ACWA POWER ELECTRICITY OPERATION AND MANAGEMENT INDUSTRY AND TRADE CO.

ACWA POWER KIRIKKALE NATURAL GAS COMBINED CYCLE POWER PLANT PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

MGS PROJECT CONSULTANCY ENGINEERING TRADE CO.

ANKARA
2014

TITLE OF THE PROJECT OWNER	**ACWA POWER ELECTRICITY OPERATION AND MANAGEMENT INDUSTRY AND TRADE CO.**
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PROJECT TITLE	ACWA POWER KIRIKKALE NATURAL GAS COMBINED CYCLE POWER PLANT PROJECT
PROJECT COST	990.000.000 **$**
MAILING ADDRESS OF THE PROJECT LOCATIN (PROVINCE, DISTRICT, LOCATION)	Kırıkkale Province, Yahşihan County, Kılıçlar Municipality
COORDINATES OF THE PROJECT, ZONE	

PROJECT SITE COORDINATES					
Order	**:**	**Right, Up**	**Order**	**:**	**Lat, Long**
Datum	**:**	**ED-50**	**Datum**	**:**	**WGS-84**
Type	**:**	**UTM**	**Type**	**:**	**Geo**
D.O.M.	**:**	**33**	**D.O.M.**	**:**	**--**
Zone	**:**	**36**	**Zone**	**:**	**--**
Scale	**:**	**6 degree**	**Scale**	**:**	**--**
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534809.7500		4415112.7801	39.88370293		33.40677306
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535267.6977		4415153.8335	39.88405390		33.41213095
535113.1935		4415056.6748	39.88318493		33.41031880
535017.1305		4415030.1936	39.88295032		33.40919394

PLACE OF THE PROJECT WITHIN EIA REGULATION (SECTOR, SUB-SECTOR)	*EIA REGULATION, ANNEX-1, 2- Thermal power plants: (a)"Thermal power plants the total thermal energy of which are 300 MWt (Megawatt thermal) and above and other firing systems"* *EIA REGULATION, ANNEX-2, 19- Ready-Mixed Concrete Plants, plants which has a production capacity 100 m3/h and over, which produces structured materials by means of compression, impact, shaking or vibration by using cement or other binding substances, plants which produce pre-stressed concrete elements, gas concrete, precast concrete panels and similar products.* *EBRD Environmental and Social Policies and Performance Requirements (2008) Projects, Category A Project: " Thermal power stations and other heat combustion facilities with a heat output of > 300 MW"*
NAME OF THE INSTITUTION/ WORKING GROUP PREPARING THE EIA APPLICATION FILE	MGS PROJECT CONSULTANCY ENGINEERING TRADE CO
ADDRESS, TELEPHONE AND FAX NUMBERS OF THE INSTITUTION/ WORKING GROUP PREPARING THE EIA APPLICATION FILE	Şehit Cevdet Özdemir Mah. 1351.Sok No:1/7 06460 Çankaya/ANKARA Phone : (0 312) 479 84 00 Fax : (0 312) 479 84 99
PRESENTATION DATE OF THE ESIA FILE (DAY, MONTH, YEAR)	26 June 2014

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ABBREVIATIONS

$	Dollar
%	Percentage
ADNKS	Address-Based Population Registration System
SS	Suspended Solid
As	Arsenic
BOD	Biological Oxygen Demand
Cr	Chrome
Cu	Copper
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ÇGDYY	Regulations on Assessment and Management of the Environmental Noise
NGCCPP	Natural Gas Combined Cycle Power Plant
DSİ	State Hydraulic Works
E	East
ETL	Energy Transmission Line
ENE	East-Northeast
EPDK	Energy Market Regulatory Authority
ETKB	Ministry of Energy and Natural Resources
Fe	İron
GDP	Gross Domestic Product
GWh	Gigavatthour
H_2O	Water
ha	Hectare
hm^3/yr	Hectometercube/year
hPa	Hectopascal
HRSG	Heat Recovery Steam Generator
KAF	North Anatolian Fault
KGM	General Directorate of Highways
km	Kilometer
COD	Chemical Oxygen Demand
kV	Kilovolt
kWh	Kilowatthour
lt/s	Liter/second
Inc. Co.	Incorporated Company
m^3/s	Metercube/second
$m^3/saat$	Metercube/hour
MKEK	The Machinery and Chemical Industry Corporation Factory
mm	milimeter
Mn	Manganese
MTA	General Directorate of Mineral Research and Exploration
MW_e	Megawatt (electric)
MW_m	Megawatt (mechanic)
MW_t	Megawatt (thermal)
NE	Northeast
NH_3	Ammonium
NOx	Nitrogen Oxides
OECD	Organisation for Economic Co-operation and Development
OHTL	Overhead Transmission Line
OIA	Organized Industrial Area
IA	Important Area
Pb	Lead
PM	Particulate Matter
PO_4	Phosphate

PTD	Project Description File
PVC	Polyvinyl Chloride
RMS	Reducing and Metering Station
RQD	Rock Quality Designation
SKHKKY	Industrial Air Pollution Control Regulation
SPT	Standard Penetration Test
TDS	Total Dissolved Solid
TEİAŞ	Turkish Electricity Distribution Inc. Co.
EÜAŞ	Electricity Generation Company
TURKAK	Turkish Accreditation Institute
TWh	Terawatthour
Etc.	Et Cetera
BOTAŞ	Petroleum Pipeline Corporation
ITÜ	Istanbul Technical University
ERP	Emergency Response Plan
UNFCCC	United Nations Framework Convention On Climate Change

INTRODUCTION

This document contains Environmental and Social Impact Assessment (ESIA) studies of Natural Gas Combined Cycle Power Plant (NGCCPP) Project, having an installed power of 927.4 MWe / 960 MWm / 1,663 MWt, planned by ACWA Power Electricity Operation and Management Industry and Trade Co. within the boundaries of Kılıçlar Municipality of Yahşihan District in Kırıkkale Province in compliance with National and International legislation-procedure and standards.

ESIA is a research study of physical, natural, cultural, social and socioeconomically impacts of the project's construction and operation phases. ESIA Report defines the Project and impacts of Project on the environmental and social conditions and informs about how the Project is designed, mitigation measures to decrease negative impacts and procedures to maximize positive impacts.

ESIA is requested by ACWA Power Electricity Operation and Management Industry and Trade Co. and implemented by MGS Project Consultancy Engineering Trade Limited Company.

International investment banks introduce the requirement of complying with standards stated below to achieve environmental and social sustainability:

- The European Bank for Reconstruction and Development (EBRD) Performance Requirements for Environmental and Social Standards,
- International Finance Corporation (IFC) Performance Standards on Social and Environmental Sustainability
- Environmental and Social Impact Assessment Standards of World Bank,
- Environmental and Social Principles and Standards of European Investment Bank,
- Equator Principles
- Korea Eximbank Common Approaches
- International Environment Conventions Applicable to Turkey

Project also needs to be in compliance with Turkish Republic environmental and social legislations. For this, Environmental Impact Assessment (EIA) Report should be prepared according to Turkish Legislations. EIA process is started by MGS Project Consultancy Engineering Trade Limited Company on 05.04.2013 by submitting EIA Application File to the Ministry of Environment and Urbanization. Moreover, since EBRD is included to the Project and Turkey is a candidate country to enter the European Union, project must comply with EU Directives about environmental and social protection.

Evaluation of NGCCPP Project is carried out in accordance with aforementioned guidelines and procedures. In the evaluation process, a systematic procedure is implemented including; physical, natural, cultural, social and socioeconomically impacts of the Project, mitigation measures, improvements and compensation of negative impacts and providence of benefits.

A Non-Technical Summary (NTS) describing the Project and a Stakeholder Engagement Plan (SEP) have also been prepared for this project as per EBRD requirements. An Environmental and Social Action Management and Monitoring Plan Plan (ESAMMP) has been prepared to describe the mitigation and monitoring measures necessary for this project. This plan includes relevant mitigations required during construction, operation and decommissioning to ensure compliance with both Turkish and International standards.

This ESIA report should be read in conjunction with the related SEP, NTS and ESAMP documents.

LEGISLATIVE FRAMEWORK

Legislations and standards which are taken in the account for construction, operation and post-operation phases of the NGCCPP Project are given in two headings.

National Legislation

ACWA Power Kırıkkale NGCCPP is contained in the list of ANNEX – I Clause 2. a. "Thermal power plants: Thermal power plants and other combustion systems with a total thermal power of 300 MWt (Megawatt thermal) or more", and ANNEX-2, Clause 19. "Ready-Mixed Concrete Plants which has a production capacity 100 m^3/h and over, which produces structured materials by means of compression, impact, shaking or vibration by using cement or other binding substances, plants which produce pre-stressed concrete elements, gas concrete, precast concrete panels and similar products" of "Environmental Impact Assessment (EIA) Regulation" which took effect upon being published in Official Gazette numbered 26939 and dated 17 July 2008 (amended by O.G. numbered 27980 and dated 30 June 2011).

- 1380 numbered Water Products Law and Related Regulations
- 2863 numbered Protection of Cultural and Natural Properties Law and Related Regulations (3386 and 5226 numbered revision)
- 2872 numbered Environmental Law and Related Regulations
- 2918 numbered Road Traffic Law and Related Regulations
- 3083 numbered Agrarian Reform Law on Regulation of Irrigation areas 4342 numbered Grassland Law and Related Regulations
- 4857 numbered Labor Law and Related Regulations,
- 5403 Soil Conservation and Land Use Law and Related Regulations
- 6831 numbered Forestry Law and Related Regulations
- "Regulation on Construction of Pits Where Sewage Channel cannot be Constructed" 13.03.1971 dated and 13783 numbered Official Gazette,
- "Solid Waste Control Regulation" 14.03.1991 dated and 20814 numbered Official Gazette),
- "Water Products Regulation" 10.03.1995 dated and 22223 numbered Official Gazette),
- "Environmental Audit Regulation" 21.11.2008 dated and 27061 numbered Official Gazette),
- "Occupational Health and Safety Regulation" 09.12.2003 dated and 25311 numbered Official Gazette),
- "Environmental Impact Assessment (EIA) Regulation" 17.07.2008 dated and 26939 numbered Official Gazette),
- "Permissions and Licenses have to be taken in regard to Environmental Law" 29.04.2009 dated and 27214 numbered Official Gazette),
- "General Principles about Waste Management Regulation" 05.07.2008 dated and 26927 numbered Official Gazette),
- "Waste Oil Control Regulation" published in 30.07.2008 dated and 26952 numbered Official Gazette (O.G.)
- "Regulation on Revision of Waste Oil Control Regulation" 30.03.2010 dated and 27537 numbered Official Gazette),
- "Excavation Soil, Construction and Demolition Wastes Control Regulation" 18.03.2004 dated and 25406 numbered Official Gazette),
- "Occupational Health and Safety Regulation on Temporary Works or Fixed Term Works" 15.05.2004 dated and 25463 numbered Official Gazette)
- "Waste Batteries and Accumulator Control Regulation" 31.08.2004 dated and 25569 numbered Official Gazette),

- "Regulation on Revision of Waste Batteries and Accumulator Control Regulation" 30.03.2010 dated and 27537 numbered Official Gazette)
- "Industrial Source Air Pollution Control Regulation" 03.07.2009 dated and 27277 numbered Official Gazette),
- "Regulation on Revision of Industrial Source Air Pollution Control Regulation" 30.03.2010 dated and 27537 numbered Official Gazette),
- "Water Pollution Control Regulation" 31.12.2004 dated and 25687 numbered Official Gazette),
- "Regulation on Revision of Water Pollution Control Regulation" 30.03.2010 dated and 27537 numbered Official Gazette),
- "Hazardous Wastes Control Regulation" 14.03.2005 dated and 25755 numbered Official Gazette)
- "Regulation on Revision of Hazardous Wastes Control Regulation" 30.03.2010 dated and 27537 numbered Official Gazette),
- "Soil Pollution Control Regulation and Regulation Regarding Areas Polluted by Point Source" 08.06.2010 dated and 27605 numbered Official Gazette),
- "Environmental Noise Assessment and Management Regulation" 04.06.2010 dated and 27601 numbered Official Gazette),
- "Medical Waste Control Regulation" 22.07.2005 dated and 25883 numbered Official Gazette),
- "Regulation on Revision of Medical Waste Control Regulation" 30.03.2010 dated and 27537 numbered Official gazette),
- "Protection of Wetlands Regulation" 17.05.2005 dated and 25818 numbered Official Gazette),
- "Regulation on Revision of Protection of Wetland Regulation" 26.08.2010 dated and 27684 numbered Official Gazette),
- "Packaging Waste Control Regulation" 24.08.2011 dated and 28035 numbered Official Gazette),
- "Vibration Regulation" 23.12.2003 dated and 25325 numbered Official Gazette),
- "Electrical Heavy Current Facilities Regulation" 30.10.2000 dated and 24246 numbered Official Gazette),
- "Exhaust Gas Emission Control Regulation" published in 04.04.2009 dated and 27190 numbered Official Gazette"
- "Air Quality Assessment and Management Regulation" published in 06.06.2008 dated and 26898 numbered Official Gazette"

In the context of the Project, Environmental Law and other laws, legislations, circulars, notices and provisions issued pursuant to this Law will be complied.

International Legislation

International directives and standards information which have been considered during the preparation of the ESIA Report are given in below:

- EBRD Environmental and Social Policies and Performance Requirements
- IFC Performance Standards
- Korea Exim Bank Common Approaches
- Equator Principles
- EU Directives
- International Environment Conventions Applicable to Turkey

The European Bank for Reconstruction and Development (EBRD) Performance Requirements for Environmental and Social Standards

The EBRD adopted its first Environmental Policy in 1991 at the initial meeting of the Board of Directors. The scope of the Policy has evolved over time and it is now an Environmental and Social Policy. In recent years the EBRD has developed related Performance Requirements that were first introduced in 2008 (For details see EBRD Environmental and Social Policy Report, 2008).

Bank-financed projects are expected to meet good international practice related to sustainable development. To help clients and/or their projects achieve this, the Bank has defined specific Performance Requirements (PR) for key areas of environmental and social issues and impacts as listed below:

- PR1 – Environmental and Social Appraisal and Management
- PR2 – Labor and Working Conditions
- PR3 – Pollution Prevention and Abatement
- PR4 – Community Health, Safety and Security
- PR5 – Land Acquisition, Involuntary Resettlement and Economic Displacement
- PR6 – Biodiversity Conservation and Sustainable Natural Resource Management
- PR7 – Indigenous Peoples*
- PR8 – Cultural Heritage
- PR9 – Financial Intermediaries*
- PR10 – Information Disclosure and Stakeholder Engagement

**Not applicable for this project.*

PRs 1 through 8 and 10 include the requirements for direct investment operations; PR 2 and PR 9 are for financial intermediary operations. Each PR defines, in its objectives, the desired outcomes, followed by specific requirements for clients to help them achieve these outcomes. Compliance with relevant national laws is an integral part of all PRs.

The following documents have been prepared in the scope of the studies:

- Nontechnical Summary (NTS)
- Stakeholder Engagement Plan (SEP)
- Environmental and Social Management and Monitoring Plan (ESMMP)
- Environmental and Social ımpact Assessment Report (ESIA)

IFC Performance Standards

Environmental and Social Impact Assessment studies contain IFC Performance Standards that listed below:

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

**Not applicable for this project.*

In addition, during ESIA studies The Environmental, Health, and Safety (EHS) Guidelines are utilized which are technical reference documents of IFC. The EHS Guidelines for thermal power plants, (Dec.19, 2008) include information relevant to combustion processes fueled by gaseous, liquid and solid fossil fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type (except for solid waste which is covered under a separate Guideline for Waste Management Facilities), with a total rated heat input capacity above 50 Megawatt thermal input (MWth) on Higher Heating Value (HHV) basis.

Also, in the area close to the project site planned capacity of 835 MW Eser Natural Gas Combined Cycle Power Plant project is located. Air quality dispersion modeling study has been done taking into consideration "Cumulative Impact Assessment and Management: Emerging Markets Private Sector Guidance for (2013) published by the IFC and cumulative impacns of both projects to the ambient air quality has been evaluated.

Korea Exim Bank Common Approaches

Korea Exim Bank is member of Organization for Economic Co-operation and Development which is an international economy organization and has adopted "Common Approaches" recommended by the organization. Common Approaches includes a control mechanism for the compliance with environmental and social requirements for officially supported export credits. (For details see Organization for Economic Co-operation and Development, Common Approaches, 2012).

Equator Principles

Another applied standard for preparation of Environmental and Social Impact Assessment Report is Equator Principles. Standards which are composed of ten main principles are the benchmark for the evaluation of social and environmental impacts of the projects over the value of $ 10 million.

Principle 1: Review and Categorization
Principle 2: Social and Environmental Assessment
Principle 3: Applicable Social and Environmental Standards
Principle 4: Action Plan and Management System
Principle 5: Consultation and Disclosure
Principle 6: Grievance Mechanism
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: EPFI (Equator Principles Financial Institutions) Reporting

EU Directives

The below EU Directives on environmental and social protections have been considered during the preparation of this report:

- World Bank Environmental Management Plan (OP 4.01 Environmental Assessment Annex-C),
- "World Bank Pollution Prevention and Abatement Handbook", "1998"
- EIA Directive, 85/337 EEC and 97/11/EC Directive revision,
- "Air Quality Framework Directive", 96/62/EC,
- "Water Framework Directive", 2000/60/EC,
- "Urban Wastewater Treatment Directive", 91/271/EEC,

- Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)", EC 1907/2006
- "Directive on Environmental Noise", 2002/49/EC,
- "Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora", 92/43/EEC,
- "Directive on the Conservation of Wild Birds", 79/409/EEC,
- "Commission Decision Concerning a Site Information Format for Proposed Natura 2000 Sites", 97/266/EC,
- CITES Convention (EEC/362/82, EEC/3418/83 and EC/338/97),
- Hazardous Waste Directive, 1991/689/EEC,
- Waste Incineration Directive, 2000/76/EC,
- Packaging Waste Directive (94/62/EC),
- Regular Storage Directive (99/31/EC),
- Waste Framework Directive (75/442/EEC (revised: 2006/12/EC)),

International Environment Conventions Applicable to Turkey

International Environment Conventions which are applicable to Turkey are listed in below;

International Environment Conventions Turkey is a Party

- European Landscape Convention (Florence).
- Convention On The Conservation Of European Wildlife And Natural Habitats (Bern Convention)
- Convention For the protection Of the marine environment And the Coastal region Of the Mediterranean (Barcelona)
- Kyoto Protocol
- Montreal Protocol on Substances that deplete ozone layer, 1987
- Stockholm Convention on Persistent Organic Pollutants
- Basel Convention on the Control of Transboundary Movements of Hazardous
- Wastes and Their Disposal.
- Convention on Biological Diversity
- Convention on Long-Range Transboundary, Air Pollution
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar)
- United Nations Framework Convention on Climate Change

ENVIRONMENTAL STANDARDS

After evaluation of National and International Legislations mentioned above the most stringent limit values are applied for the power plant Project. Each standard that is followed during ESIA studies are given in below tables.

i. Air Emissions Standards

Air Emissions for Gas Turbine:

Pollutant	Unit		Turkey[1]	IFC[2]	EU[3]
NO_x	mg / Nm^3	**Dry Gas, Excess O2 content 15 %**	50	51 (25ppm)	50 (24ppm)
CO	mg / Nm^3		100	not specified	
CO_2			not specified	not specified	
SO_2	mg / Nm^3		11,7	not specified	35 (O_2 cont. 3%)
PM			not specified	not specified	

[1] *Regulation on the Large Combustion Plants, Official Gazette dated 08.06.2010 and no 27605*
[2] *IFC EHS Guidelines on Thermal Power Plants published Dec.19,2008*
[3] *EU large Combustion Plants Directive 2001/80/EC Oct.23,2001*

Air Emissions for Auxilary Boiler:

Pollutant	Unit	Dry Gas, Excess O_2 Content (%)	Turkey[1]	IFC[2]	EU[3]
NO_x	mg / Nm3	3	100	240	200
CO	mg / Nm3		100		
CO_2					
SO_2	mg / Nm3		35		
PM	mg / Nm3		5		

[1] *Regulation on the Large Combustion Plants, Official Gazette dated 08.06.2010 and no 27605*
[2] *IFC EHS Guidelines on Thermal Power Plants published Dec.19,2008*
[3] *EU large Combustion Plants Directive 2001/80/EC Oct.23,2001*

ii. Water Pollution Control

Domestic Waste Water Standards

WATER QUALITY	IFC (mg/l)[1]	Turkish Sample 2 Hours (mg/l)[2]	Turkish Sample 24 Hours (mg/l)[2]
COD	125	180	120
BOD	30	50	45
Total Suspended Solids	50	70	45
Oil and Grease	10	NA	NA
pH	6 to 9	6 to 9	6 to 9
Total Nitrogen	10	NA	NA
Total Phosphorous	2	NA	NA
Total coliform bacteria	MPN(b)/100ml 400 (a)		

[1] *IFC EHS General Guideline puplished April 30,2007*
[2] *Water Pollution Control Regulation, Official Gazette dated 31.12.2004and no 25687*

During the evaluation of industrial wastes standards, it is seen that international standards do not assesses waste water separately bases on originated industry. Hence only Turkish Limit Values are taken into consideration.

Turkish Water Pollution Control Regulation – Table 20.7: Sector. Water softening, demineralization and regeneration, actived carbon washing and regeneration facilities.

Parameter	Unit	Composite Sample for 2 hours	Composite Sample for 24 hours
Chlorine (Cl^-)	(mg/L)	2000	1500
Sulphate (SO_4^{-2})	(mg/L)	3000	2500
Iron (Fe)	(mg/L)	10	-
Fish biotest (ZSF)	-	10	-
pH	-	6-9	6-9

Water Pollution Control Regulation – Table 9,7: Sector: Coal Preparation and Energy Production Facilities (Industrial Cooling Waters in Closed Cycle)

Parameter	Unit	Composite Sample for 2 hours	Composite Sample for 24 hours
Chemical Oxygen Demand (COD)	(mg/L)	40	-
Suspended Solids (TSS)	(mg/L)	100	-
Free Chlorine	(mg/L)	0.3	-
Total Phosphore	(mg/L)	5.0	-
Zinc (Zn)	(mg/L)	4.0	-

IFC Thermal Power Plant EHS Guideline Table 5 Effluent Guidelines

Parameter	mg/l, except pH
pH	6-9
TSS	50
Oil and Grease	10
Total Residual Chlorine	0.2
Chromium Total (Cr)	0.5
Copper (Cu)	0.5
Iron (Fe)	1.0
Zinc (Zn)	1.0
Lead (Pb)	0.5
Cadmium (Cd)	0.1
Mercury (Hg)	0.005
Arsenic (As)	0.5

iii. Noise

Turkish Standards
Regulation of Assessment and Management of the Environmental Noise (RAMEN, Annex-VII, Table 5) (During Construction)

Activity Type (construction, demolition and restoration)	$L_{daytime}$ (dBA)
Buildings	70
Roads	75
Other sources	70

**Turkish Standards say that: Noise impact should not result in a maximum increase in back ground levels of 5 dBA at the nearest receptor location off-site.*

Environmental Noise Limit Values for Industrial Plants (RAMEN, Annex-VII, Table 4) (During Operation)

Areas	Lday (dBA)	Levening (dBA)	Lnight (dBA)
Areas where houses are intensive of areas where commercial buildings and noise sensitive utilities are together	65	60	55

IFC Standards

Environmental Noise Limit Values of IFC
IFC EHS General Guideline puplished April 30,2007

NOISE	Receptor	One Hour LAeq (dBA)	
		Daytime 07.00-22.00	Night time 22.00-07.00
Environmental Noise	Residential, institutional, educational	55	45
	Industrial, commercial	70	70

**IFC recommends that: Noise impact should not result in a maximum increase in back ground levels of 3 dBA at the nearest receptor location off-site.*

SECTION 1. DEFINITION AND PURPOSE OF THE PROJECT

(Description of the project, main production of the facility in operation phase, type of the product, type and amount of fuel used in process and combustion systems, identification of units in which fuel is used by giving separately as a block or unit (thermal power plant and electric power (MWm, MWe MWt), block configuration data in schematic form and specification of efficiencies separately for natural gas turbine generator and steam turbine generator) fuel thermal power and total fuel thermal power, production capacity, technical specifications

I.1 Project Description

Within the scope of the project, the Natural Gas Combined Cycle Power Plant, having an installed power of 927.4 MWe / 960 MWm / 1,663 MWt, is planned by ACWA Power Electricity Operation and Management Industry and Trade Co. at 1/25,000 scaled Kırşehir I30-b2 within the boundaries of Kılıçlar Municipality of Yahşihan District in Kırıkkale Province.

Environmental Impact Assessment (EIA) progress started at 05.04.2013 by submitting EIA Application file to the Ministry of Environment and Urbanization and it was finalized on 30.10.2013 during Investigation and Evaluation Comission meeting. During this period, forest permit progress started for 75,663 m^2 forest area. The project owner decided to revise planned area because forest pre-permit studies at General Directorate of Forestry were unable to finilazised before EIA progress submission. According to the revision, 75,663 m^2 area (previously planned for only switchyard area) of 261,143 m2 was not considered to be part of the site and the planned project will be located on 185,480 m^2 non-forestry area totally. The forestry area (75,663 m^2) and non-forestry area area presented at Figure 1.

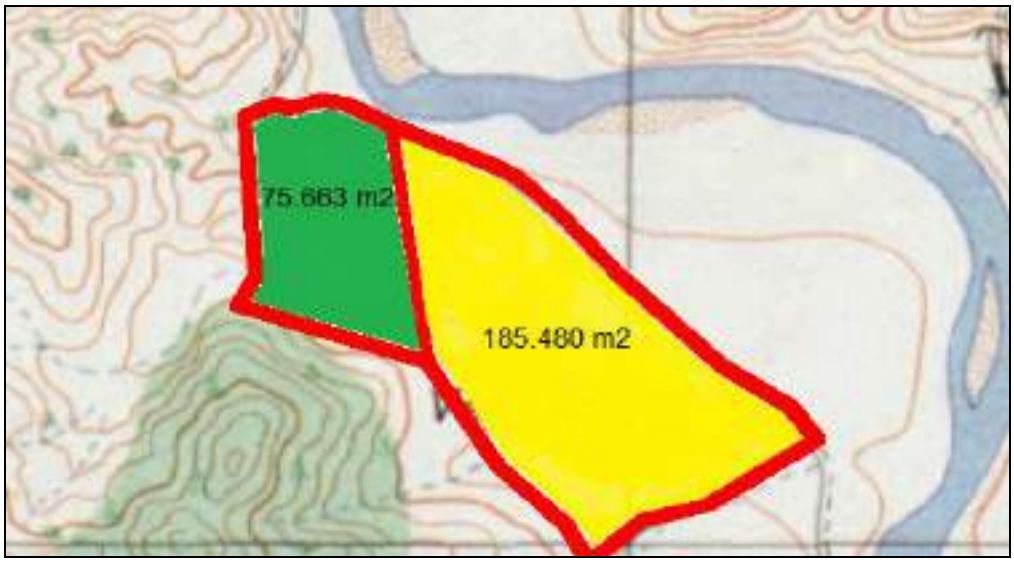


Figure 1. Old and New Areas of the Project

Necessary applications have-- already been filed to the Energy Market Regulatory Authority (EPDK) in order to obtain the Licenses to establish a Natural Gas Power Plant and to Produce Electricity within the scope of the project.

2+1 (2 gas turbines and 1 steam turbine) have been anticipated within the project scope and power of each turbine is 309,6 MW. Turbine thermal power conversion efficiency is calculated by taking the value of 37.23%. The approximate thermal output

power of gas turbine is calculated as (309,6x2)/0.3723 = 1,663 MWt and steam turbine as 328 MW.

Combine Cycle Plant's yield is around 58.6% in the referenced site conditions.

Moreover, relatedly to the project with the aim of carry out the construction works, a ready-mixed concrete plant with a capacity of 100 m^3/hour is foreseen within the scope of the project to be used at the construction phase. The aggregate material which is required for production of the mentioned ready-mixed concrete shall be purchased from the market as pre-prepared. The ready-mixed concrete plant shall be shut down following completion of the construction phase, after being utilized during the course of construction.

The project in question has been evaluated within the scope of following annexes of the Regulation on the Environmental Impact Assessment which became effective upon being published in the Official Journal dated 17.07.2008 and numbered 26939:

- ANNEX-1, Clause 2. a. Thermal power plants: Thermal power plants and other combustion systems with a total thermal power of 300 MWt (Megawatt thermal) or more,

- ANNEX-2, Clause 19. Ready-Mixed Concrete Plants which has a production capacity 100 m^3/h and over, which produces structured materials by means of compression, impact, shaking or vibration by using cement or other binding substances, plants which produce pre-stressed concrete elements, gas concrete, precast concrete panels and similar products.

In this regard the Environmental and Social Impact Assessment (ESIA) Report has been prepared for this Project mainly on the basis of the Special Format given by the Ministry of Environment Urbanization.

The construction works of the units are planned to last approximately for 18 months within the scope of activity subject to the project and procedures such as the assembly of the equipments which are the another part of the construction works, are planned to be finalized within approximately 12 months and in accordance with this total construction period has been foreseen as 30 months.

The Ready-Mixed Concrete Plant to be used at the construction phase of the project shall be constructed within the site. The Ready-Mixed Concrete Plant shall be utilized during the construction and closed after the construction works are finalized.

The project shall be transferred to the state as per the related legislations at the end of 49 years which is the period for Energy Production License or production shall be continued by renewing the production license. In order for the electricity produced by the Plant to be transmitted to the National Interconnected System, a 380 KV energy transmission line is required to be constructed and related applications will be issued to Turkish Electricity Transmission Company (TEİAŞ).

ACWA Power Kırıkkale Natural Gas Combined Cycle Power Plant switchyard is planned to be connected to Baglum Substation located at Yenimahalle/Ankara which the route is assigned by TEIAS. A separate environmental and social impact assessment study comply with IFC, EBRD, KEXIM bank and other national and international standards will be conducted for electricity transmission line.

The annual amount of natural gas used in the plant will be 1,250,000,000 m³ and 7,557 GWh of energy is planned to be produced annually.

1,250,000,000 m³ of natural gas is planned to be used in the plant annually and and energy production is estimated to be around 7,557 GWh/year.

The plant cooling system will be closed cycle system. The required amount of water during the operation will be provided from caisson wells to be located close to Kızılırmak River. The area of the land of cassion wells is 25,000 m^2. Incase land acquisition/expropriation is required for the caisson wells land, then Turkish regulations on land acquisition/expropriation will be followed and the requirement of EBRD/IFC on expropriation shall be fulfilled.

Cooling water needed in the scope of the Project will be supplied from the caisson wells to be opened near Kızılırmak River. At the studies carried out at the Project site and surrounding thereof it seems to open deep sounding well and take water wherefrom not possible due to there are no formations with aquifer property. By thinking this negative condition, it was foreseen, instead of geological surveys oriented to deep well, to make boring studies with sink shafts system.

ACWA Power Kırıkkale NGCCPP Project is involved among the facilities stated in “Regulation on Permits and Licenses Required by the Environmental Law” Annex-1. “List of Activities or Facilities Having High Contamination Impact on Environment” Clause 1.3 “Combined cycle, combined thermal power plants, internal combustion engines and gas turbines with combustion thermal power of 100 MW or above (including internal combustion engines and gas turbines used in mobile plants)” which became effective upon being published in the Official Gazette dated 29.04.2009 and numbered 27214. For this reason “Environmental Permit” shall be taken when the facility is put into operation. Moreover, environmental management unit shall be established or environmental management services shall be taken from authorized environmental consulting firms in the operation phase according to Clause 7 of “Regulation on Environmental Officer and Environmental Consulting Companies” which became effective upon being published in the Official Gazette dated 12.11.2010 and numbered 27757.

I.2 Market or service fields of the activity subject to the project and within this field importance and requirements across the country, region and/or province in economic and social terms

Energy and electrical energy consumption in this context is an important indicator of economic development and social welfare. The ease of use at any time be converted into other types of energy, and due to the prevalence of daily life in a country where the per capita energy consumption, and thus the development of the country and the level of national income is considered as an indicator of the standard of living.

In 2008, per capita annual electricity consumption of 3,000 kWh (kilowatt-hour), while the world average of 2,500 kWh and 8,900 kWh in developed countries, while the United States is about 12,322 kWh. Industrialization, economic and social development of our country is our main target for the energy demands of the industry and other users, on-site, on-time and reliable way to be met.

However, with increasing energy prices, the increase in global energy demand, which is rapidly running out of dependence on fossil fuels will continue to be in the near future, developments in the field of new energy technologies to meet the growing demand yet away from the fact that commercial development of the countries concerns about security of energy supply increases with each passing day.

2008 - 2009 during the global financial crisis on energy demand has created a temporary contraction, but the medium and long term, world population growth, industrialization and urbanization, the demand for natural resources and energy increases dramatically. The projection studies, if more current energy policies, global energy demand in 2035, the average annual 1.4% in increments of 47% compared to 2008 (12,271 Mtoe to 18,048 Mtoe) indicates that more and more.

The increase in demand of 89.7, high rates of economic growth in the period 2008-2035 (4.6% per year) with a projected rate of population growth and rapid Organization for Economic Cooperation and Development (OECD-Organization for Economic Co-operation and Development), other countries (especially China and India), the annual average of 2.2% with a value is calculated.

In the same period, the annual gross domestic product (GDP) increased by an average of 1.8% annually on average in OECD countries projected a 0.3% increase is expected.

Between the years of 2015-2035 in China, the world's largest energy consuming country will be in, in India, respectively, in 2035, China's fourth-largest energy consumer after the United States and the European Union is expected to be. The four largest consumers, by the year 2035 will consume 55% of the world's total energy supply. Sustainable conditions in the energy sector in order to meet this increase in demand of about 33 billion U.S. dollars (2009 figures) needed to invest calculated value.

The last 25 years all over the world, especially the demand for electrical energy is increasing. The fastest growing electricity by 2035 (2.5%), the end-user is a form of energy, the share of final energy consumption level of 17% in 2008 to 20% in 2020, while 2035 is expected to increase to 23%. However, the electricity sector in 2009 due to financial difficulties and severely affected by weak demand. Held close to two per cent drop in demand, the largest annual decline seen since the Second World War indicates (EÜAŞ, 2010, 2011).

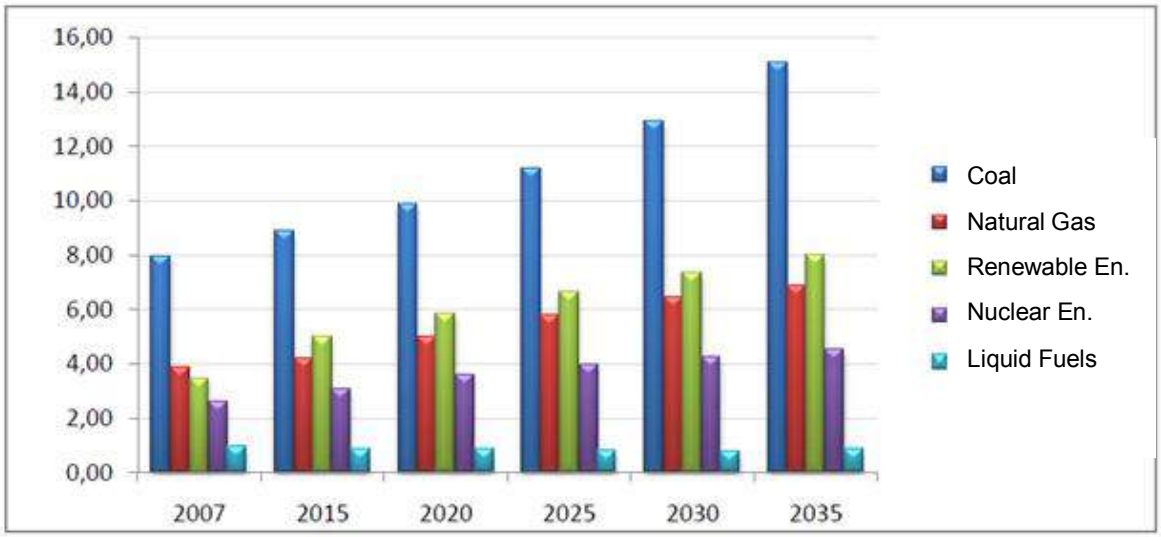
According to a study prepared by the International Energy Agency scenario (WEO, 2011) electricity generation is expected to reach 25,468 TWh and 39,368 TWh in 2035. These figures are 96.4% in the period 2009-2035 'indicate an increase in luxury. Similarly, based on Reference Scenario Study (IEO, 2011) prepared by the U.S. Energy Information Administration, electricity production in 2008 is 19.100 TWh is expected to increase in 2020 to 25.500 TWh with 84.3% increase in the period of 2008 -2035 (annual 2.3% increments) and in 2035 electricity production is estimated to rise to 35,200 TWh (EÜAŞ, 2011).

Major economic developments, especially in developing countries, leads to an increase in demand for electricity. Increase in income per capita standard of living increases, the industry, the demand for electricity for lighting and appliances increases. All over the world the gross electrical energy 4160 GW of installed power capacity is expected to increase until 2035. In this context, the electricity sector, according to the International Energy Agency prepared by the New Policies Scenario 2010-2035 period, the share of investments is expected to be 32.8 trillion dollars of energy alone 16.6 trillion dollars (2009 figures) is expected to be. The remaining 8 trillion dollars investment in the oil, natural gas and 0.7 trillion dollar’s worth of 7.1 trillion dollars of investment in the coal industry investment be made in the calculation. 64% of these investments, the rapid increase in demand and production in non-OECD countries (5.1 trillion dollars in China alone) is expected to (EÜAŞ, 2010).

Energy sources is analyzed in terms of primary energy supply, oil, natural gas and coal, fossil fuels, mainly consisting of the position and the energy demand is expected to continue to increase in the coming years (2008-2035 period) and 75.7% of energy demand will be meet by these resources. This ratio is 8.5% for biomass and waste, 6.6% for other renewables, nuclear for 6.4% and 2.8% for hydropower. The largest share of primary energy supply in 2020 (29.8%) have calculated that the oil, coal, first place in 2030 and 2035 (29.1% and 29.3%, respectively) is thought to leave. Protection of the share of natural gas in electricity generation (about 21.4%) is expected.

During 2008-2035 period, gas and coal will continue to be the most important sources of power in the production, the amount of coal usage will increase from 41% to 42.8%, natural gas usage will increase 21.3% to 21.7% to rise, the share of oil will decrease from 5.5% to 1.6%, the share of hydraulics will decrease from 15.9% to 13.3%, the share of nuclear power will decrease from 13.5% to 10.8%. The largest percentage increase is expected in the wind energy. In the same period, 1.1% share of the wind is expected to rise to 5% (EÜAŞ, 2010).

According to sources specified by the International Energy Agency, the distribution of the world's electricity production is given in **Figure 2**.



Reference: EIA,2010

Figure 2. Distribution of World Energy Sources in Energy Production (TWh)

According to the Annual Report 2011 released by TEİAŞ, production of electricity in Turkey in 2011, increase over the previous year to 8.6% with a corresponding to 18,187.4 million kWh increase to 22,9395.1 million kWh. Electricity consumption increase by 9.4% corresponding to 19,872.4 million kWh increase and reach to 230,306.3 million kWh. According to the same report, 74.8% of the electricity produced in 2011 based on thermal (coal, lignite, fuel oil, natural gas, LPG, naphtha, and others) and 22.8% based on hydraulic power and 2.40% based on geothermal and wind power plants. For the year 2010-2011 the amount of electrical energy production and electricity generation sources are given in **Table 1** and **Table 2**.

Table 1. 2010 - 2011 Electricity Generation in Turkey

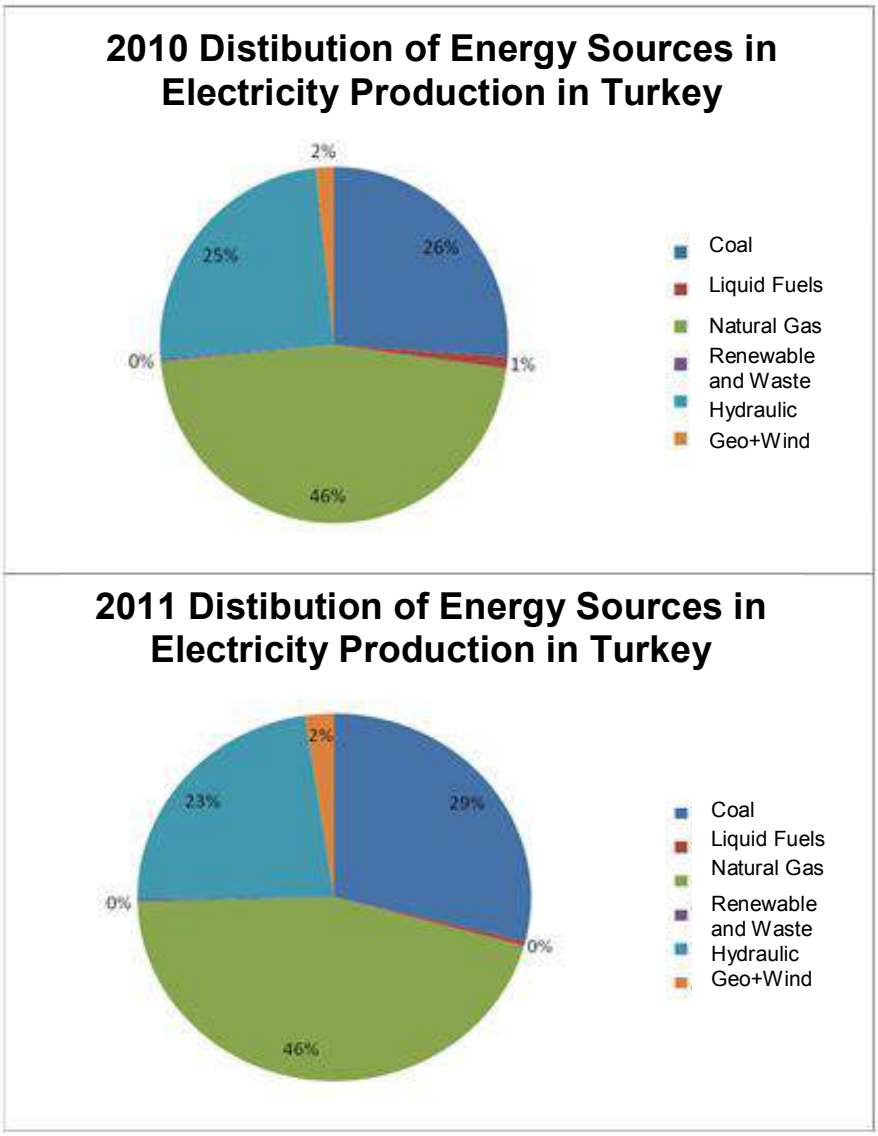
Energy Sources	2010		2011		İncrease
	GWHour	%	GWHour	%	%
Thermal	155,827.6	73.8	171,638.3	74.8	10.1
Hydraulic	51,795.5	24.5	52,338.6	22.8	1.0
Geo+Wind	3,584.6	1.7	5,418.2	2.4	51.2
Total	211,207.7	100.0	229,395.1	100	8.6
Import	1,143.8		4,555.8		
Export	1,917.6		3,644.6		
Gross Consumption	210,433.9		230,306.3		9.4

In our country, as can be seen from **Table 1**, the share of coal in electricity generation was 26.1% in 2010 and 28.9% in 2011.

Table 2. 2010-2011 Distribution of Turkey's Electricity Generation by Primary Energy Sources

Energy Sources	2010		2011		Increase
	GWHour	%	GWHour	%	%
Coal	55,046.4	26.1	66,217.9	28.9	20.3
Liquid Fuels	2,180.0	1.0	903.6	0.4	-58.6
Natural Gas	98,143.7	46.5	104,047.6	45.49	6.0
Renewable and Waste	457.5	0.2	469.2	0.2	2.6
Hydraulic	51,795.5	24.5	52,338.6	22.8	1
Geo+Wind	3,584.6	1.7	5,418.2	2.4	**51.2**
Total	**211,207.7**	**100.**	**229,395.1**	**100.0**	**8.6**

Referance: TEİAŞ 2011 Annual Report



Referance: TEİAŞ 2011 Annual Report

Figure 3. 2010-2011 Distribution of Turkey's Electricity Generation by Primary Energy Sources

The effect of the economic crisis to energy demand by the end of 2008 and the revised demand series were used in the calculations for Capacity Projection for 2011-2020 by TEİAŞ.

In the calculations for Generation Capacity Projection study 2011 - 2020, realizations in the first five months, taking into account the macro-economic objectives in accordance with the work resulting from the June 2011, High and Low Demand forecasting models were used in series by the Ministry

Determining the demand series, in 2011 for a series of both demand growth in demand occurred in the first 5 months of this year, in line with the revised estimates of consumption in subsequent years are in high demand in the range 7.5% on average, 6.5% in the developing series of low demand calculated demand series used by Ministry. Also considering the load curve with peak load characteristics remain unchanged allowed sequences were obtained (See Table 3, Figure 4, and Figure 5).

Daily peak demand is the highest consumption in 2010 amounted to 32,688 MW. According to TEİAŞ, 799 million kWh electricity consumption in Turkey was reached on 27 July 2012. During this period, the highest 11-hour peak load was 39,645 MW.

Table 3. Energy and Peak Demands in 2011-2020 Period

High Demand	PEAK DEMAND		ENERGY DEMAND	
YEAR	MW	Increase (%)	GWh	Increase (%)
2011	36000	7.8	227000	7.9
2012	38400	6.7	243430	7.2
2013	41000	6.8	262010	7.6
2014	43800	6.8	281850	7.6
2015	46800	6.8	303140	7.6
2016	50210	7.3	325920	7.5
2017	53965	7.5	350300	7.5
2018	57980	7.4	376350	7.4
2019	62265	7.4	404160	7.4
2020	66845	7.4	433900	7.4
Low Demand				
2011	36000	7.8	227000	7.9
2012	38000	5.6	241130	6.2
2013	40130	5.6	257060	6.6
2014	42360	5.6	273900	6.6
2015	44955	6.1	291790	6.5
2016	47870	6.5	310730	6.5
2017	50965	6.5	330800	6.5
2018	54230	6.4	352010	6.4
2019	57685	6.4	374430	6.4
2020	61340	6.3	398160	6.3

Referance: TEİAŞ 2011 Annual Report

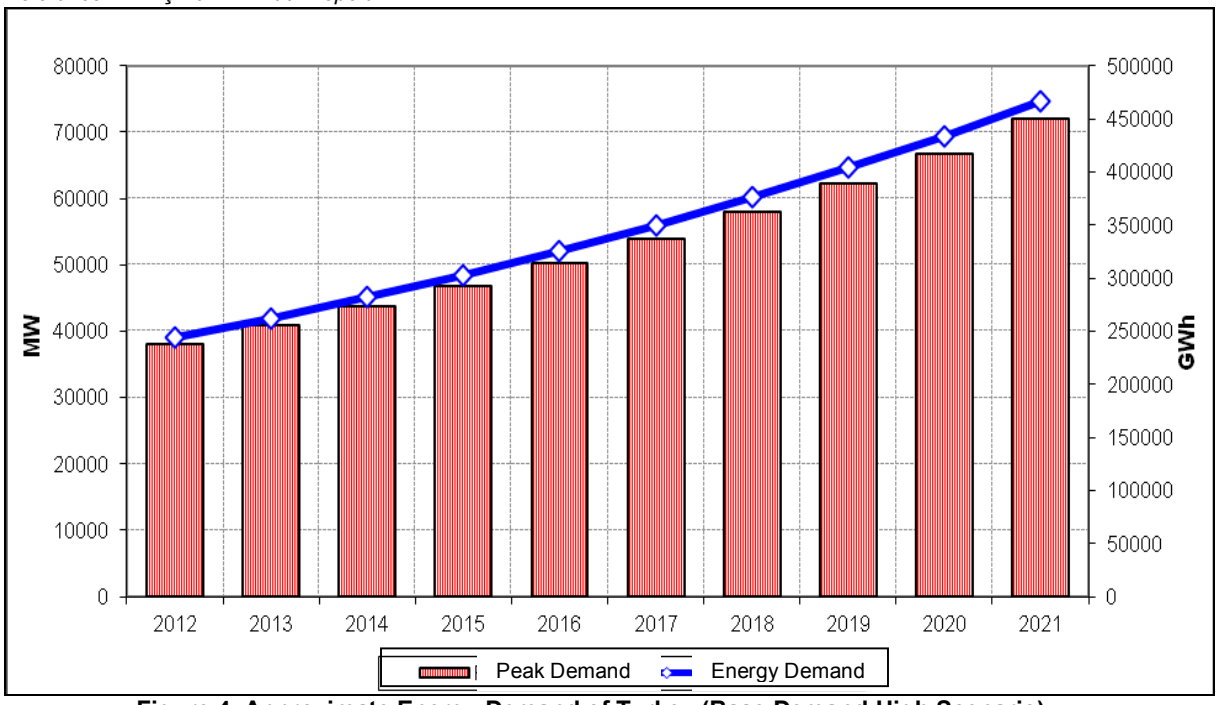


Figure 4. Approximate Energy Demand of Turkey (Base Demand-High Scenario)

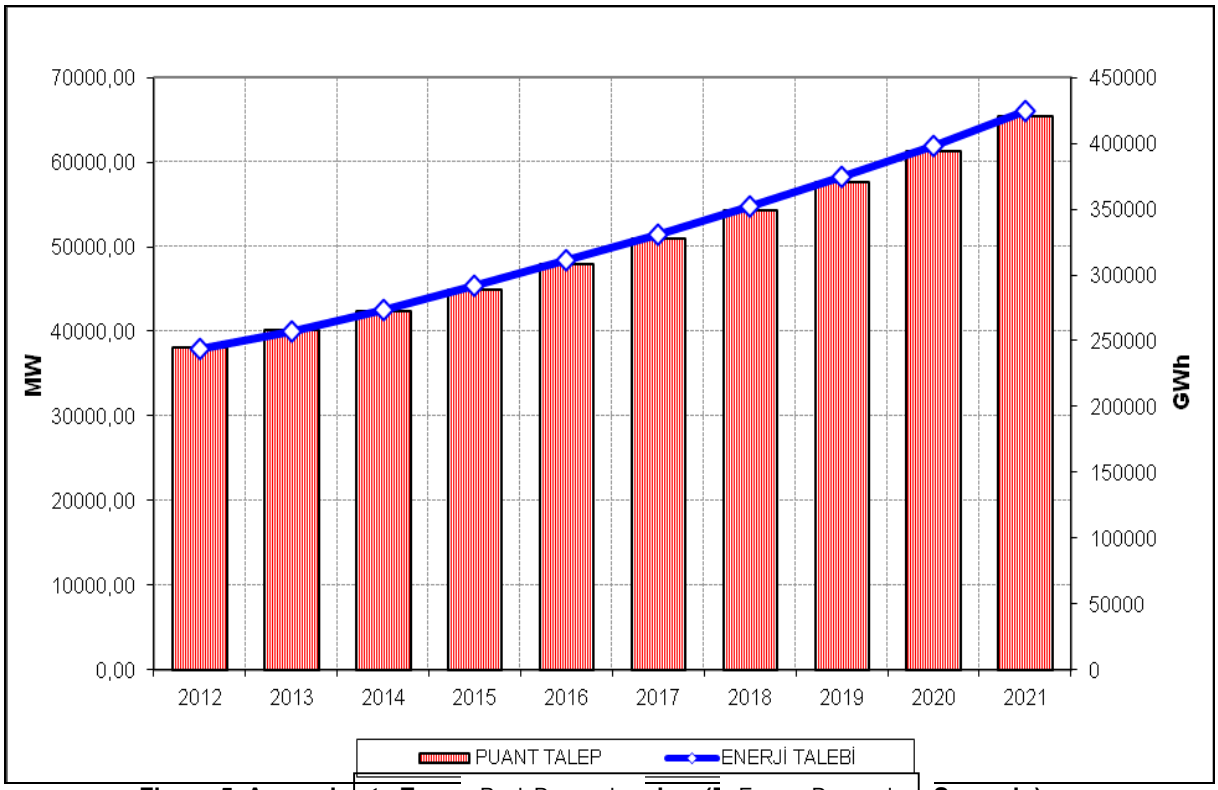


Figure 5. Approximate Energ… …rkey (E… …Scenario)

Beside capacity projection according to statistics from the official websites of TEİAŞ, as well as the estimated growth in demand and peak values in 2010 compared to 2009, reaching a highly rated values, estimates on the results (see **Table 4**). Estimated growth rate reached a value above estimates.

Both can be seen in the reports of the World Bank, as well as reports of TEİAŞ 2012 up to now, but it will decrease the impact of the crisis is completely the passage of these growth rates is expected to return to normal again.

Table 4. 2009 -2010 Consumption Rates (GWh)

MONTHS	2009	2010	Increase by Percentage
JANUARY	16,851.4	17,343.9	2.92%
FEBRUARY	15,010.0	15,720.5	4.73%
MARCH	15,983.7	17,041.1	6.62%
APRIL	14,849.1	16,262.0	9.52%
MAY	15,297.7	16,573.6	8.34%
JUNE	15,899.6	17,118.0	7.66%
JULY	17,743.5	19,343.5	9.02%
AUGUST	17,704.6	20,368.2	15.04%
SEPTEMBER	15,379.3	17,116.6	11.30%
OCTOBER	15,989.9	17,161.1	7.32%
NOVEMBER	15,779.3	16,318.4	3.42%
DECEMBER	17,590.9	19,127.0	8.73%
TOTAL	194,079.1	209,493.8	7.94%

Reference: TEİAŞ 2011 Annual Report

According to Development Plan (2007-2013), which was published in the Official Gazette No. 26215 dated 01.07.2006, during VIII. Plan period, in line with economic growth and population growth has been a significant increase in the consumption of primary energy and electricity. During VIII. Development Plan period, the average annual primary energy consumption increased by 2.8% at the end of 2005, 92.5 million tons of oil equivalent, while the average annual electricity consumption increased by 4.6% and reached 160.8 billion kWh. During IX. development plan; primary energy demand, proportion to economic and social development an increase in the average annual rate of 6.2% is foreseen. Natural gas share in Energy consumption in 2005, which was 28% rise to 34%, the share of oil products is expected to decline 37% to 31%. On the other hand the demand for electricity in the same plan, by weight, in line with developments in industrial production and services sector, is expected to increase by 8.1% per year (see Table 5).

Table 5. IX. Development Plan Targets

Energy Targets	2006	2013	2007-2013
Primary Energy Demand	96,560	147,400	6.2
Secondary Energy Demand	171,450	295,500	8.1

Reference: Development Plan (2007-2013), Official Gazette No. 26215 dated 01.07.2006

Turkey's growing energy needs in accordance with each passing day, the current account deficit in 2011 reached 77.1 billion dollars, and energy imports in 2011 amounted to 54.1 billion dollars. The current account deficit of 70.2 is energy imports. Turkey's foreign trade deficit reached $ 106 billion, 51 per cent is due to energy imports (CBT, TCEB). Reduce Turkey's dependence on foreign sources, the project, reducing the current account deficit, the discovery of the development potential of the region, the region and the increasing number of industrial plants in the country ensuring a healthy and sustained energy, electricity production more economically, Turkey's energy needs are met and energy market in accordance with the laws and regulations within the framework of free competition in the energy market is aimed to electric power consumers. Furthermore, the project is a new source of employment, up to 1000 people during the construction phase of the project, while the operational phase will provide direct employment to 60 people.

ACWA Power Kırıkkale NGCCPP Project aims to meet the energy demand of Turkey and transfer of cheap and good quality energy to consumers in accordance with the laws and regulations in the energy market within the framework of free competition in the energy market.

Project owner has designed ACWA Power Kırıkkale Natural Gas Combined Cycle Power Plant to install a plant that is;

- Highly efficient,
- Main load (base load) carriers, reliable production source,
- Low-carbon emissions (clean energy),
- Low cooling water consumption,
- meet the needs of National Grid (flexible working capacity).

SECTION 2. LOCATION OF THE PROJECT AREA

II.1 Project Location (1/25,000 scaled environmental master plan verified by the relevant Governorship or Municipality and which includes the legend and plan notes of the activity field, (plan notes and conditions), approved land use plan and application construction plan (with plan notes and legends on otherwise display on the current land use map), (detailed information about industrial facilities and settlements in the vicinity of the project area)

II.1.1 Project Site Location

Within the scope of the project, the Natural Gas Combined Cycle Power Plant, having an installed power of 927.4 MWe / 960 MWm / 1,663MWt, is planned by ACWA Power Electricity Operation and Management Industry and Trade Co in 1/25,000 scaled Kırşehir I30-b2 map within the boundaries of Kılıçlar Municipality of Yahşihan District in Kırıkkale Province (**See Annex 2**).

ACWA Power Kırıkkale NGCCPP is located 4.5 km northwest to Yahşihan District, 3.7 km east to Kiliçlar Municipality and 4 km northwest to Yenisehir Village. The project area is located 200 m from the Kızılırmak River. In the context of Regulation on the Conservation of Wetlands, opinion of Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks will be taken regarding the project area. In addition opinion of State Hydraulic Works is taken regarding the Project in which it is demanded not do build any permanent structure within 200 m from the shore of the Kızılırmak River because the mentioned area is defined as “Area Covered by Flood Waters Law” (See **Annex-1**).

The nearest residential areas to the Project area are given in **Table 6**.

Table 6. Residential Area Centers In the Vicinity of Project Area

Residential Area	Distance	Direction (location as to plant)
Kılıçlar Municipality	3.7 km	West
Yahşihan	4.5 km	Southeast
Hacibaba	4.2 km	Northeast
Irmak	5 km	North
Mahmutlar	7 km	Northeast
Yenişehir	4 km	Southeast
Central Kırıkkale	7.5 km	Southeast

1/25,000 scaled topographic map of the Project area is given in **Annex-2**, Site location map in **Figure 6**, satellite images in **Figure 7** and **Figure 8**, photographs of the Project area in **Figure 9** and **Figure 10** and coordinates in **Table 7**.

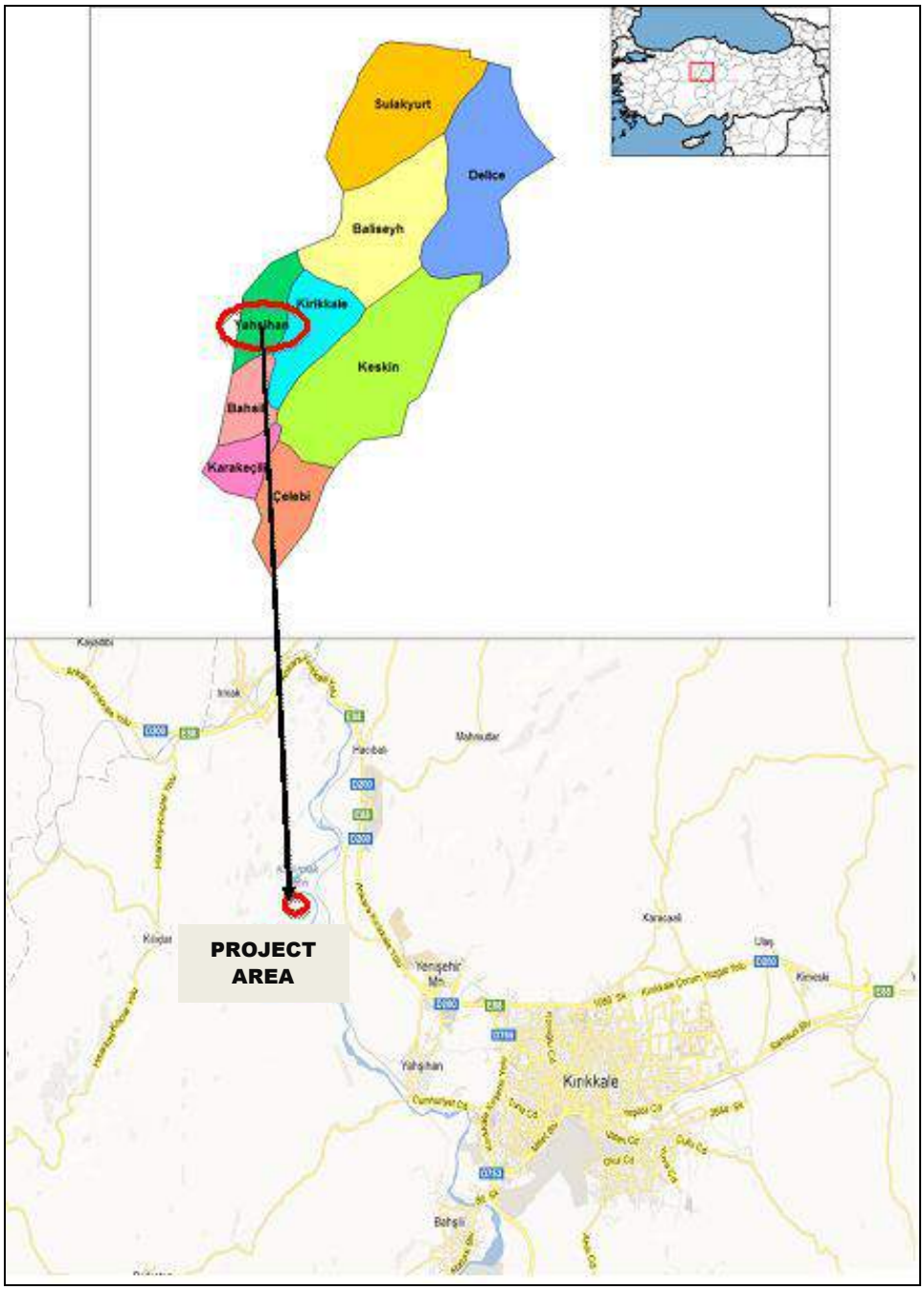


Figure 6. Site Location Map

Figure 7. Project Area Satellite İmages-1

Figure 8. Project Area Satellite İmages -2

Figure 9. Project Area Photographs (Spring Session)

Figure 10. Project Area Photographs (Summer Session)

Table 7. Project Area Coordinates

	PROJECT AREA COORDİNATES						
	Coor. Line	**:**	**Rightward, Up**		**Coor. Line**	**:**	**Latitude, Longitude**
	Datum	**:**	**ED-50**		**Datum**	**:**	**WGS-84**
	Type	**:**	**UTM**		**Type**	**:**	**GEOGRAPHIC**
	D.O.M.	**:**	**33**		**D.O.M.**	**:**	**--**
	Zone	**:**	**36**		**Zone**	**:**	**--**
	Scale Factor	**:**	**6 degrees**		**Scale Factor**	**:**	**--**
NGCCPP AREA							
1	534940.4006		4414966.4266		39.88237896		33.40829319
2	534907.2866		4415025.0895		39.88290885		33.40790906
3	534809.7500		4415112.7801		39.88370293		33.40677306
4	534708.2989		4415269.4198		39.88511836		33.40559491
5	534653.9904		4415627.2205		39.88834426		33.40497872
6	534791.0356		4415570.9585		39.88783175		33.40657857
7	534840.3455		4415546.3036		39.88760759		33.40715397
8	534992.4756		4415391.6167		39.88620765		33.40892495
9	535129.4474		4415265.2373		39.88506335		33.41052009
10	535229.3456		4415201.4997		39.88448495		33.41168499
11	535267.6977		4415153.8335		39.88405390		33.41213095
12	535113.1935		4415056.6748		39.88318493		33.41031880
13	535017.1305		4415030.1936		39.88295032		33.40919394

II.1.2 Industrial Facilities in the Vicinity of Project Site

ESER NGCCPP is located 1.5 km northeast of the ACWA Power Project area in which investor company is partner of the ESER NGCCPP. In addition to that, GAP Kırıkkale NGCCPP which belongs to GAP Oil Gas Import and Export Marketing Industry and Trade Inc. is situated 8 km northeast of the project site and İç Anadolu NGCCPP Project owned by İç Anadolu Natural Gas Electricity Generation and Trade Inc. is situated 14.5 km southeast of the project area. Facilities in question are shown in **Figure 11**.

Figure 11. Map Showing Other Projects İn the Vicinity of the Project Area

II.1.3 Transportation Routes

Ankara-Kırıkkale road will be used to reach the facility. Other than service roads to reach units in the Project area, no any acess roads will be built in the scope of the Project. The access road to the project site may be upgraded to meet construction and operation requirements. As a result landowners adjacent to the route were invited to participate in the consultation process. In case of any land acquisition/expropriation needed, Turkish regulations, IFC and EBRD requirements will be followed.

II.1.4 Location of the Project area in 1/100.000 scaled Environmental Master Plan

ACWA Power Kırıkkale NGCCPP Project area is situated in "*forest area"* according to Kırıkkale 1/100.000 Scaled Environmental Master Plan given in **Annex-2**. Project in question is planned for energy generation, thus implementation shall be made in accordance with Kırıkkale 1/100.000 Scaled Environmental Master Plan Provision No:8.26 (Energy Generation Area and Energy Transportation Facilities).

Energy (wind, solar, geothermal, hydro) production areas, the permits and related institutions and organizations under license from the Energy Market Regulatory and Supervisory Board will be given, provided that the assent of the Ministry 1/100.000 without the need to change the environment plan, relevant agencies approval of the relevant authorities and organizations following the practice of development plans prepared in accordance with the opinion begins. For information sent to the Ministry a digital environment ".

In Plan Provision 8.26.1, the following statement takes place:*" In energy (wind, solar, geothermal, hydraulic) production areas, implementation initiates when the development plans prepared according to relevant institutions and organizations' opinions are approved by the relevant authorities without the need to change the 1/100.000 scaled environmental master plan provided that the assent of the Ministry is taken in the context*

of the permits taken from relevant institutions and organizations and license from the Energy Market Regulatory and Supervisory Board. For digital information it is sent to the Ministry." Plan Provisions of Kırıkkale 1/100.000 Scaled Environmental Master Plan shall be complied in the scope of the Project. Accordingly, in opinion letter of Kırıkkale Province Special Administration, it is stated that provisions in question must be complied. **(See Annex-1)**

II.1.5 Location of the Project Area in 1/5.000 Scaled Land Use Plan (Draft)

According to microscaled 1/5,000 Scaled Draft Land Use Map, Project area takes place in *"Energy Plant Area"* (**See Annex-2**).

II.1.6 Location of the Project Area in 1/1,000 Scaled Application Construction Plan (Draft)

According to 1/1,000 Scaled Draft Application Construction Plan, Project area takes place in *"Energy Plant Area"* (**See Annex-2**).

II.2 Location of the activity units within the scope of the project (settlement plans of the all administrative and social units, technical infrastructure units and if available other units, sizes of the indoor and outdoor fields determined for these, layer numbers and heights of the buildings, simulated picture)

The units such as Gas Turbine, Steam Turbine, Cooling Towers, Switchyard, Water Treatment Plant and Wastewater Treatment Plant, Administrative Building, Warehouse-Maintenance Room shall be constructed in the Project site.

The Layout Plan anticipated for AWCA Power Kırıkkale Natural Gas Combined Cycle Plant is given in the **Annex-2**. Seating charts of the units which shall be installed in the scope of project shall become definite after detailed projects. A Representative Picture of the Facility is shown in the following **Figure 12**.

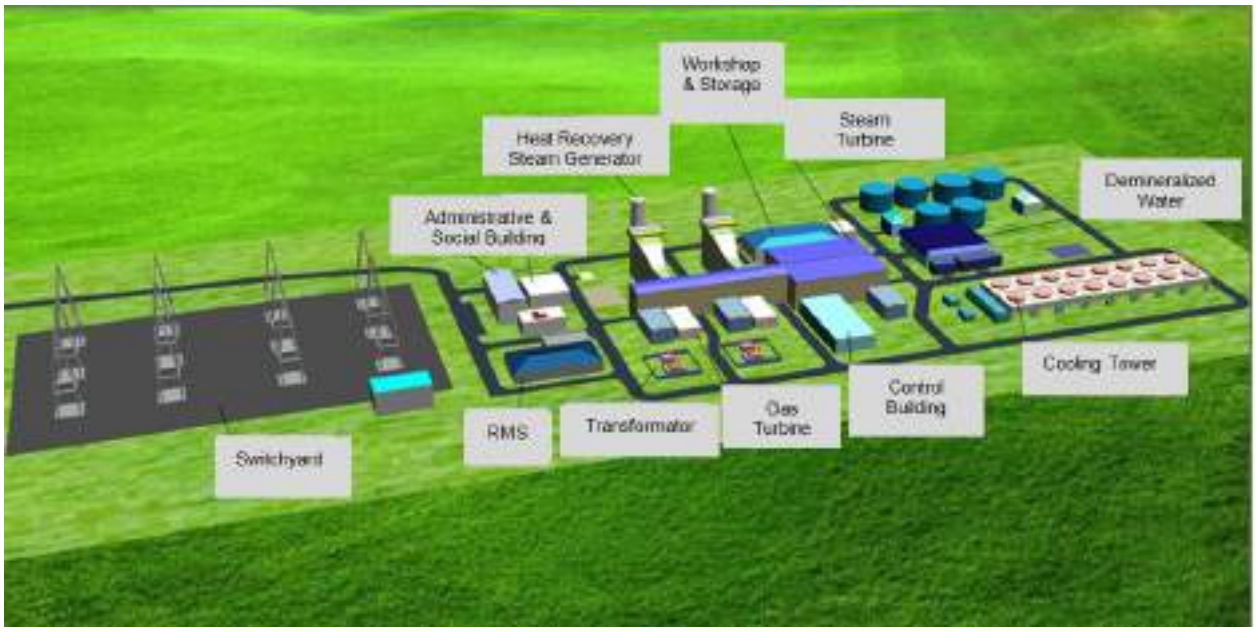


Figure 12. Representative Picture of ACWA Power Kırıkkale NGCCPP

SECTION 3. ECONOMICAL AND SOCIAL DIMENSIONS OF THE PROJECT

III.1 Investment program and financial resources regarding the realization of the project

The investment cost of ACWA Power Kırıkkale Natural Gas Combined Cycle Plant has been estimated as $ 990.000.000. Some of the investment cost shall be provided from the equity and most of it shall be covered by means of bank credit.

The cost distribution of $ 990.000.000 by the procedures are given below and time distribution are given in the **Table 9**.

Table 8. Cost Distribution of the Project

Item	Cost ($)
Engineering, Provision, Construction Costs	639,000,000
Unexpected Expenses of the Owner	60,000,000
Primary Inventory & Operating Capital	57,000,000
Project Development Expenses & Payments	39,000,000
Expenses of the Owner & Other Expenses	43,000,000
Energy Transmission Line Expenses	29,000,000
VAT	35,000,000
Financing Cost	84,000,000
Stamp Duty	1,000,000
BSMV(Banking and Insurance Transaction Tax)	3,000,000
Total	***990,000,000***

III.2 Flow process chart or time table regarding the realization of the project

Within the scope of the investment subject to the project, the feasibility studies have been carried out in the first place and then attention was focused on the project studies. After the required permissions are received during this period, the construction period shall ensue. The Process is given in the **Figure 13** in the below Flow Process Chart.

Following the completion of EIA Process within the project and receiving the required permissions, the construction period shall commence.

Within the scope of the activity subject to the project, the landscape studies shall be commenced and the construction phase and the construction of the units are planned to be completed in 30 months. During the construction phase, various disciplines such as construction, electricity and mechanics shall work together. Within this period of time, the Concrete Plant shall also be operated. A maximum of 1000 personnel is planned to be employed at the construction phase at the same time. Different numbers of personnel shall work at the site at different times and average number of the personnel to work at the same time has been foreseen as 500 personnel.

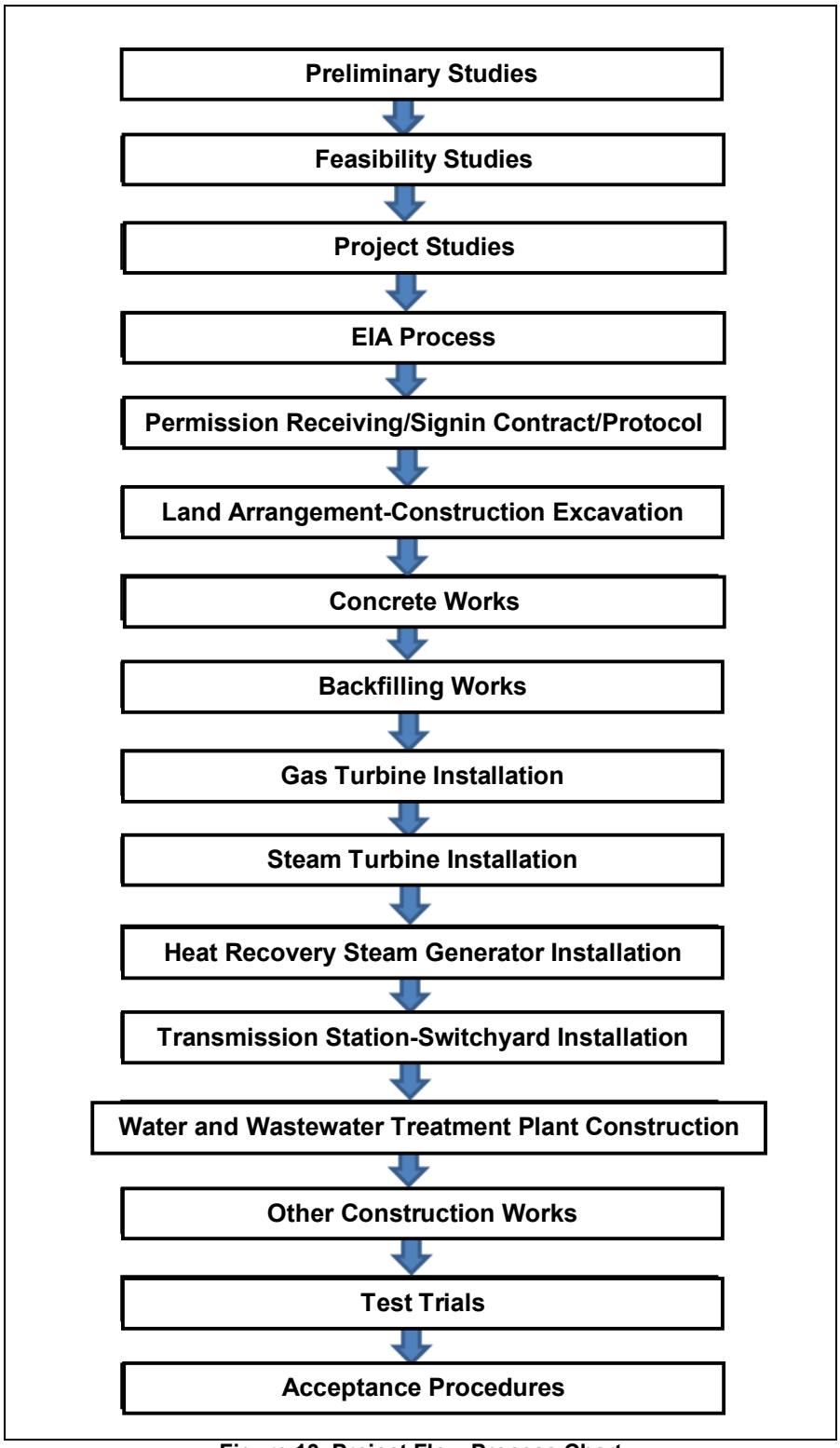


Figure 13. Project Flow Process Chart

A temporary construction camp shall be set up to be used during the construction activities in the project site and dining hall, kitchen, changing room, shower, toilet, washroom, warehouse, administrative and technical offices shall be located within the site in question.

The personnel to be employed within the scope of the project will be tried to be chosen from the close settlements.

Table 9. Schedule Table

Activity	Months																																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Preliminary Studies																																													
Feasibility Studies																																													
Project Studies																																												
EIA Process																																												
Required Permissions– Signing the Contract/Protocol																																												
Land Arrangements- Excavations																																												
Concrete Works																																												
Backfilling Works																																												
Gas Turbine Installation																																												
Steam Turbine Installation																																												
Heat Recovery Steam Generator Installation																																												
Transmission Station- Switchyard Installation																																												
Water and Waste Water Treatment Plant Construction																																												
Other Construction Works																																												
Test-Trial Studies																																												
Acceptance Procedures																																												

III.3 Cost-benefit analysis of the project

The project in question is of 927.4 MWe installed power and 7,557 GWh of energy production is planned annually.

The electricity planned to be produced within the scope of the project, which is aimed for public interest, shall be transmitted to the national interconnected system and contribute to the electricity production.

Below are given the investment costs and information regarding its return and the return on project has been calculated.

Table 10. Project Cost Analysis

Construction Cost of NGCCPP Units	639,000.000 $
Other Expenses	351,000.000 $
Total Investment Cost	990,000.000 $
Unit Sale Price for Electricity	9.6 cent/KWh =0.096 $/ KWh

By realizing the project in question, a great contribution to the local community shall be provided both at the construction and operation phases. Also the equipment to be used at the construction and operation phases, fuel, food requirements, and repair and maintenance works of small scale, spare parts etc. are anticipated to be provided from the region and in this way trade in the region shall be developed.

People living in the region in which the project is planned to be realized generally immigrate and the region shall be enhanced in terms of employment and economy with the construction and operation phases and in this way the immigration shall also be decreased.

III.4 Other economic, social and infrastructure activities which are not within the scope of the project but planned to be realized by the investor company or other firms in connection with the project realization

Project, which is not within the scope of the project but planned to be realized by the investor company or other firms in connection with the project realization, is the Energy Transmission Line (ETL) Project which will transmit the electricity generated in the plant to National Interconnected System.

In order for the Electricity Energy to be produced at ACWA Power Kırıkkale Natural Gas Combined Cycle Plant to be transmitted to the National Interconnected System, a 380-kV Energy Transmission Line is required to be constructed.

The electricity energy to be produced within the project shall be transmitted to the system in the switchyard to be constructed by the electricity energy plant. The necessary applications will be issued to Turkish Electricity Transmission Company (TEİAŞ) for the construction of the 380-kV Energy Transmission Line (ETL) and the connection.

III.5 Other economic, social and infrastructure activities which are not within the scope of the project but required to be realized by the investor company or other firms and required for the realization of the project

a) Construction Phase

A temporary construction camp shall be set up to be used during the construction activities in the project site and dining hall, kitchen, changing room, shower, toilet, washroom, warehouse, administrative and technical offices shall be located within the site in question.

After the completion of facility construction activities, construction camp will be removed from the Project site. Land reclamation works will be carried out considering topography and land use of surrounding plots.

b) Operation Phase

Within the scope of the Project, the fuel to be used shall be provided from BOTAŞ (Petroleum Pipeline Corporation) Natural Gas Pipe Line and there will be no natural gas storage. 1,250,000,000 m^3 of natural gas shall be used annually for as fuel including the losses.

Applications shall be made to BOTAŞ Ankara Branch Office for the RMS-A (reducing and metering station) station that will be established for ACWA Power Kırıkkale NGCCPP to supply natural gas and land route survey shall be carried out.

During the construction of the pipeline route, the Safety and Environment Regulation on the Construction and Operation of Crude Oil and Natural Gas Pipeline Facilities of BOTAŞ shall be abided by. In addition for the safety of Samsun-Ankara natural gas pipeline necessary precaution shall be taken for pipeline and surrounding areas safety.

Natural gas transmission lines shall be equipped with necessary protection systems and necessary measures shall be taken for gas line unites not to contain pressure when not engaged. Moreover, in the event of any failure, emergency shut-off valves will be resent to cut the gas flow. Therefore, it is possible for that amount of gas to spread from the facility to environment that may have negative impact to the environment.

III.6 Other Points

There is no other issue to be disclosed in this section.

SECTION 4. DETERMINING THE AREA THAT WILL BE AFFECTED WITHIN THE SCOPE OF THE PROJECT AND STATING THE ENVIRONMENTAL CHARACTERISTICS IN THIS AREA

IV.1 Determination of the area to be effected by the project, (method of the determination of the impact area will be stated and shown on a map)

Environmental impacts arising from the project are; potential impacts on physical and biological environment, natural geography and geology, water resources, ecosystem, land resources, land use, air quality, noise and vibration and the infrastructure services as well as the socio-economic environment.

Construction Phase Impact Area

For the construction phase of the project, taking into account the above effects, we can classify the areas that are in impact area.

a) Areas that will be continuously affected from the construction activities of the Project (areas that will lose their natural features),

b) Areas that will be temporarily affected from the construction activities of the Project (the effects will diminish after the completion of activities.)

a) Areas that will be continuously affected from the construction activities of the Project (areas that will lose their natural features)

Natural ecosystem of the construction area will be removed due to excavation works. However this impact will take place in an area of 185,480 m^2.

b) Areas that will be temporarily affected from the construction activities of the Project (the effects will diminish after the completion of activities)

Impact area is calculated as 100 m considering environmental effects (dust-noise-vibration) due to construction works of the Project (**See Figure 14**).

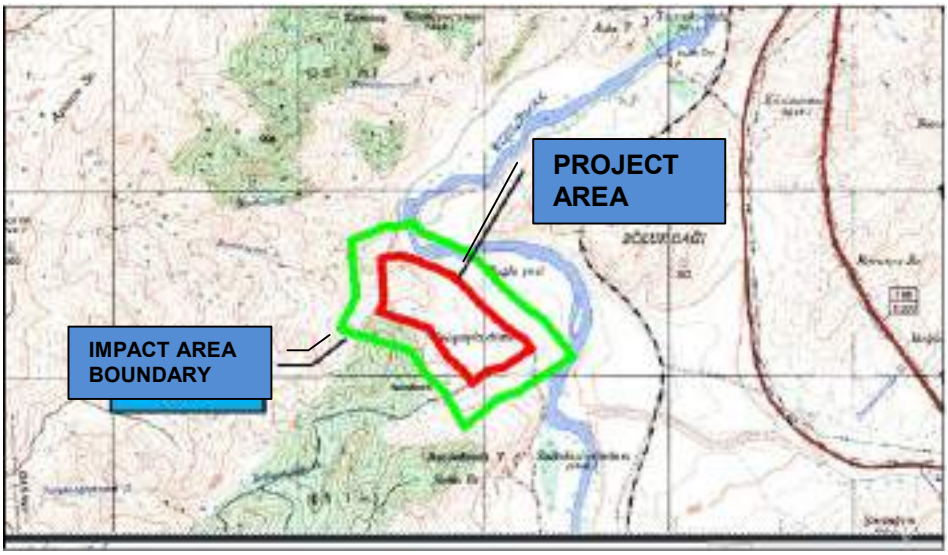


Figure 14. Project Impact Area Map (Construction Phase)

Operation Phase Impact Area

Project domain is determined according to Regulation of Industrial Source Air Pollution Control as using 50 (fifty) times of stack height which is calculated basis stated in **Annex-4**. Therefore, radius of 3,750 m area should be selected as project domain since stack height is calculated as 75 m.

However, in order to be at the safe site, 16 km x 16 km of project domain is determined considering project sire, topography and distance of closest settlements. The project domain is presented at **Figure 15**.

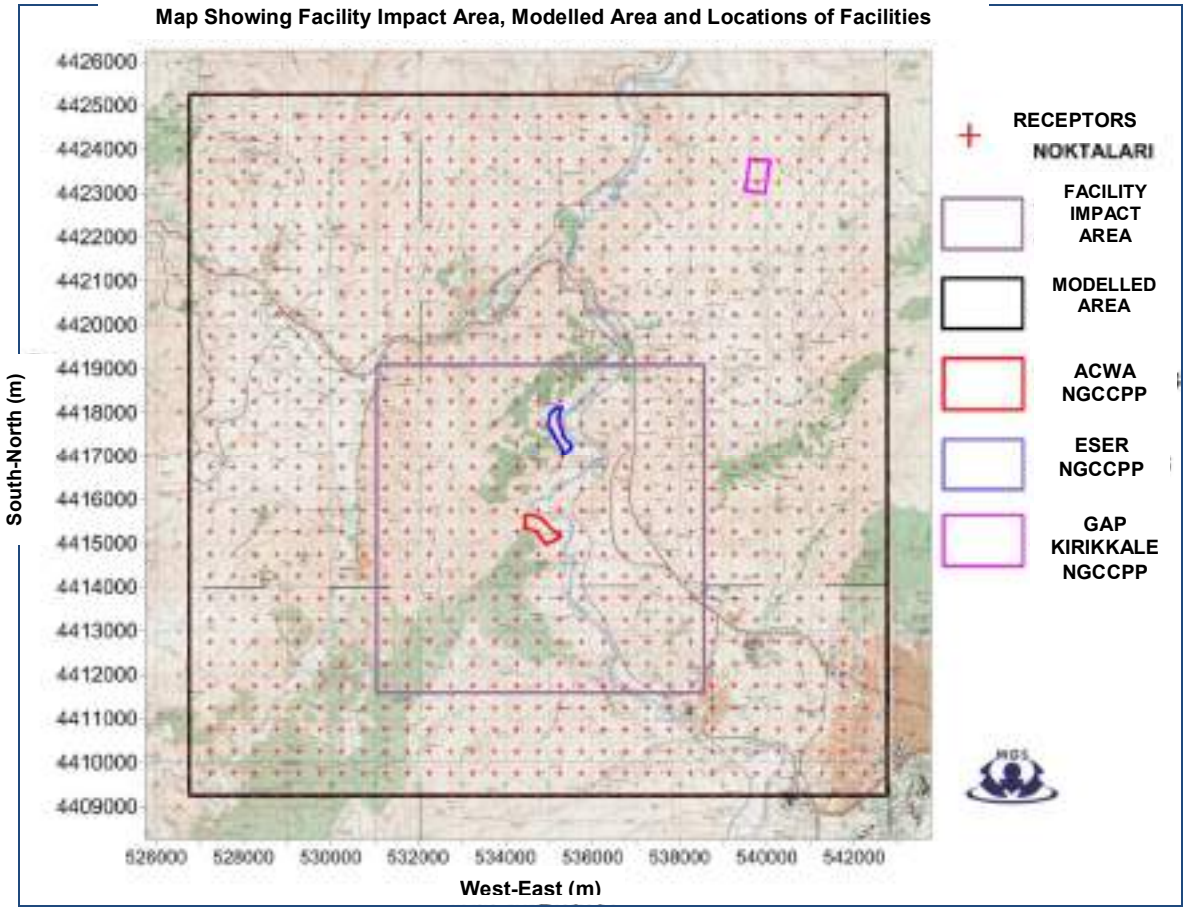


Figure 15. Project Impact Area Map (Operation Phase)

IV.2 Characteristics of the Physical and Biological Environment in the Project and Impact Area and Use of the Natural Sources

IV.2.1 Meteorological and climatic features (general climatic features of the project location, temperature distribution, precipitation distribution, relative humidity distribution, evaporation condition, numbered days distribution (foggy, snowy, snow-covered days, highest snow cover thickness etc.), wind distribution, wind speed distribution, stormy days, strong windy days) this title should contain monthly-seasonal annual distributions and meteorological data set should cover long years data including recent years (1975-2012)

a) General meteorological features of the region:

Height of Kırıkkale province from sea level changes between 570– 1744 m. province center has a height of 720 m. Project area is in the mild temperature zone. However, the climate become continental with reasons such as being far apart of the area from the sea, daily temperature difference changes because of being steppe.

Following sections have been prepared by taking into consideration of the Long Years Meteorological Data Bulletin of Kırıkkale Meteorology Station belonging to years 1975-2010 which is the nearest meteorology station to the activity area. Meteorological Data Bulletin is given in Annex-4.

b) Pressure:

b-1) Average Pressure: According to pressure records of the Kırıkkale Meteorology Station, annual average pressure is 929.68 hPa.

b-2) Maximum Pressure: According to pressure records of the Kırıkkale Meteorology Station, maximum pressure is measured in January as 950.7 hPa.

b-3) Minimum Pressure: According to pressure records of the Kırıkkale Meteorology Station, minimum pressure is measured in January as 898.7 hPa.

Table 11. Kırıkkale Meteorology Station Pressure Data

Pressure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Pressure (hPa)	932	930.3	928.8	927.4	928.2	927.5	926.4	927.2	930	932.4	933.3	932.6	929.68
Maximum Pressure (hPa)	950.7	947.3	949	944.4	941.7	938.3	937.8	937.9	941.2	944.1	947.7	949.2	950.7
Minimum Pressure (hPa)	898.7	909.8	907.9	912.5	917.1	915.3	915.4	917.6	917.9	919.8	914.9	912.2	898.7

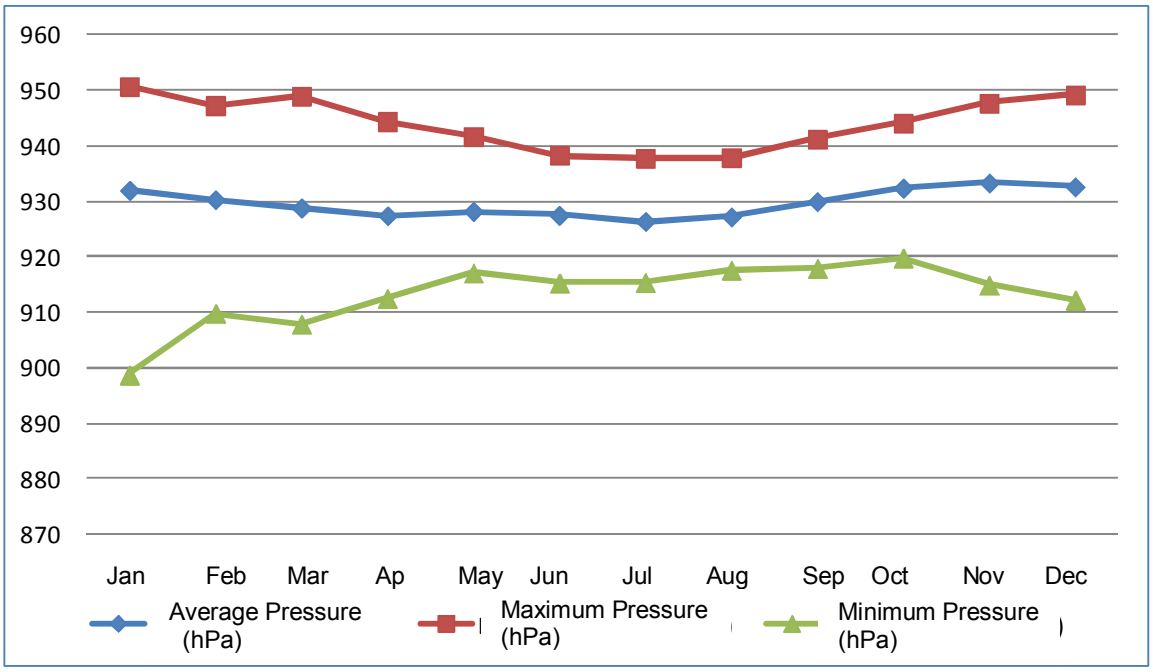


Figure 16. Kırıkkale Meteorology Station Pressure Data Graph

c) Temperature

c-1) Average Temperature: According to temperature records of the Kırıkkale Meteorology Station, annual average temperature is 12.57^{0}C.

c-2) Maximum Temperature: According to temperature records of the Kırıkkale Meteorology Station, maximum temperature is measured in July 2012 as 41.8^{0}C.

c-3) Minimum Temperature: According to temperature records of the Kırıkkale Meteorology Station, minimum temperature is measured in January 1980 as -22.4^{0}C.

Table 12. Kırıkkale Meteorology Station Temperature Data

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Temperature (°C)	0.4	2.1	6.8	12.2	16.9	21.2	24.6	24.1	19.5	13.6	6.9	2.5	12.6
Maximum Temperature (°C)	17.0	20.8	30.4	32.0	34.4	37.6	41.8	40.3	37.0	33.0	24.8	19.0	41.8
Maximum Temperature Day	29	28	24	22	23	27	26	1	10	2	2	1	26
Maximum Temperature Year	2005	2004	2008	2008	1995	1996	2012	2010	1963	1999	2004	1990	2012
Minimum Temperature (°C)	-22.4	-21.6	-19.8	-6.8	0.4	4.6	7.4	7.2	2.7	-5.0	-9.7	-18.0	-22.4
Minimum Temperature Day	16	6	3	4	6	5	5	31	29	30	26	31	16
Minimum Temperature Year	1980	1972	1985	1965	1990	1967	1985	1965	1974	1973	1995	1972	1980

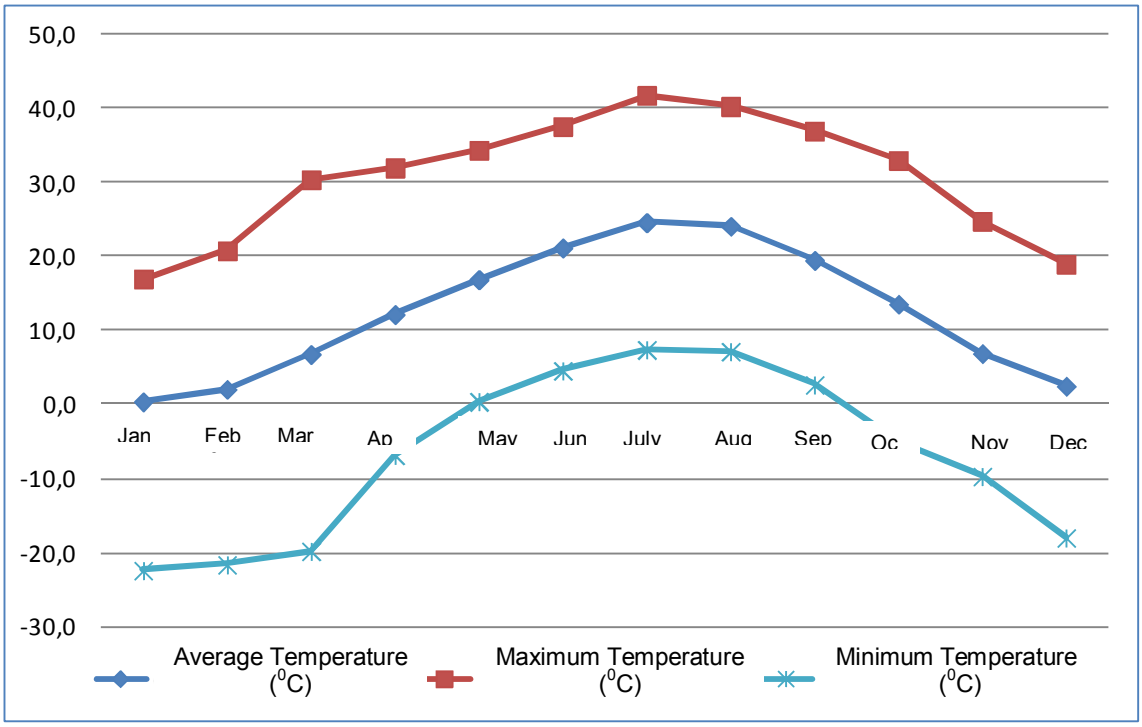


Figure 17. Kırıkkale Meteorology Station Temperature Data Graph

d) Precipitation:

d-1) Average Total Precipitation: According to precipitation records of the Kırıkkale Meteorology Station, average total precipitation amount as annually is 373.5 mm.

d-2) Maximum Daily Precipitation: According to precipitation records of the Kırıkkale Meteorology Station, maximum precipitation is measured in June as 100.6 mm.

Table 13. Kırıkkale Meteorology Station Precipitation Data

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Total Precipitation (mm)	41.6	31.4	34	45.8	49.2	34.8	10.9	8.2	13.4	27.9	30.5	45.8	373.5
Maximum Precipitation (mm)	36.5	36	30.2	33	35.8	101	52.7	26.1	29.4	39.2	40	34.6	100.6

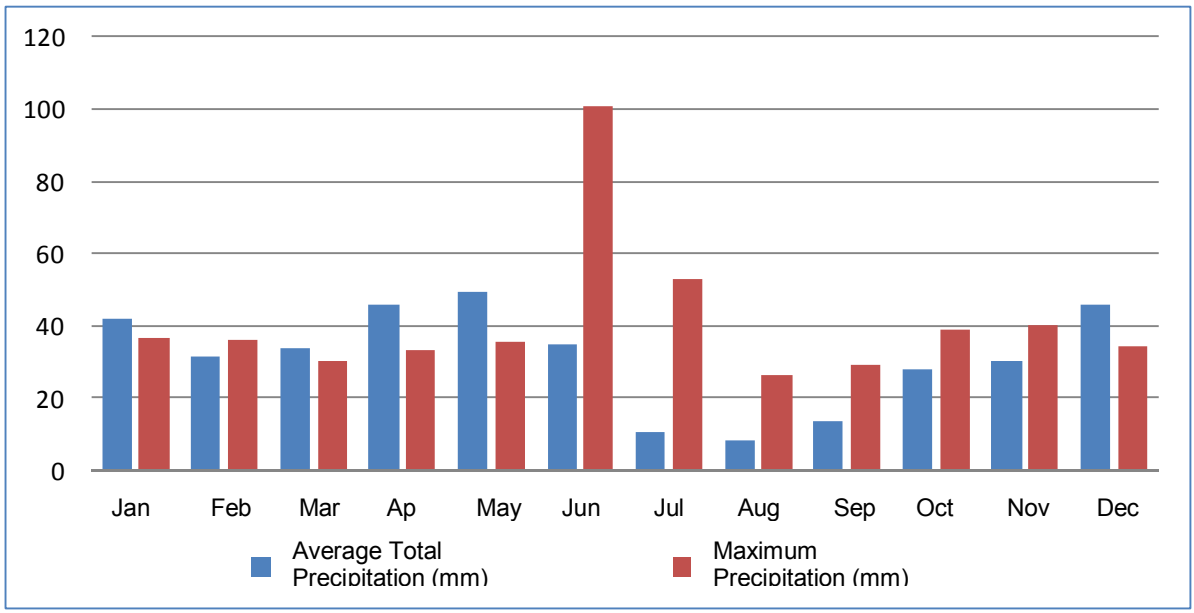


Figure 18. Kırıkkale Meteorology Station Precipitation Data Graph

d-3) The Highest Precipitation Values Observed at Standard Times, Recurrence Graphs:

The highest precipitation values observed at standard times and rainfall intensity-duration-recurrence curves observed in Kırıkkale Meteorology Station is given in **Annex-4**.

Necessary drainage systems within the scope of the Project shall be designed according to highest precipitation values observed at standard times recorded in Kırıkkale Meteorology Station.

In addition, highest precipitation values observed at standard times shall be taken into consideration during construction and operation phases.

e) Average Relative Humidity: According to precipitation records of the Kırıkkale Meteorology Station, average relative humidity as annually is %62.01.

Table 14. Kırıkkale Meteorology Station Average Humidity Values

Relative Humidity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Relative Humidity (%)	77.5	73.1	65.1	61.2	58.9	52.4	47	46.9	51.1	61	71.8	78.1	62.01

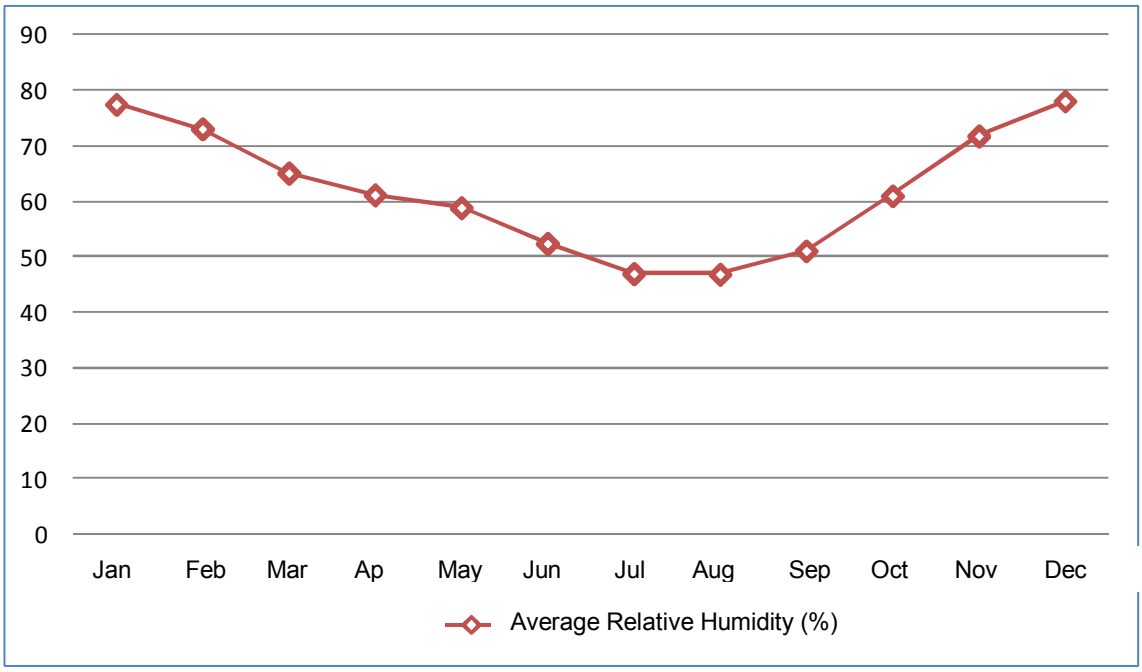


Figure 19. Kırıkkale Meteorology Station Relative Humidity Data Graph

f) Numbered Days:

f-1) Number of Snowy Days: According to records of the Kırıkkale Meteorology Station, number of snowy days as annually is 18.1.

f-2) Number of Days Covered With Snow: According to records of the Kırıkkale Meteorology Station, number of days covered with snow as annually is 16.8.

f-3) Number of Foggy Days: According to records of the Kırıkkale Meteorology Station, number of foggy days as annually is 13.1.

f-4) Number of Haily Days: According to records of the Kırıkkale Meteorology Station, number of haily days as annually is 1.6.

f-5) Average Number of Frosty Days: According to records of the Kırıkkale Meteorology Station, average number of frosty days as annually is 31.6.

f-6) Average Number of Thunderstormed Days: According to records of the Kırıkkale Meteorology Station, average number of thunderstormed days as annually is 20.5.

Table 15. Kırıkkale Meteorology Station Numbered Days Data

Numbered Days	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Number Snowy Days	5.8	4.5	2.8	0.5	-	-	-	-	-	-	1	3.5	18.1
Number of Days Covered With Snow	7.7	4.8	1.4	0.1	-	-	-	-	-	-	0.2	2.6	16.8
Number of Foggy Days	3.9	1.9	0.5	0.2	-	-	-	-	0	0.2	2	4.4	13.1
Number of Haily Days	0.1	0.2	0.2	0.4	0.4	0.2	0	-	0	0.1	0	0	1.6
Average Number of Frosty Days	6.6	5.9	3.8	0.5	-	-	-	-	-	0.8	6.9	7.1	31.6
Average Number of Thunderstormed Days	0	0.1	0.4	2.5	5.8	4.9	2	1.8	2	0.9	0.1	0	20.5

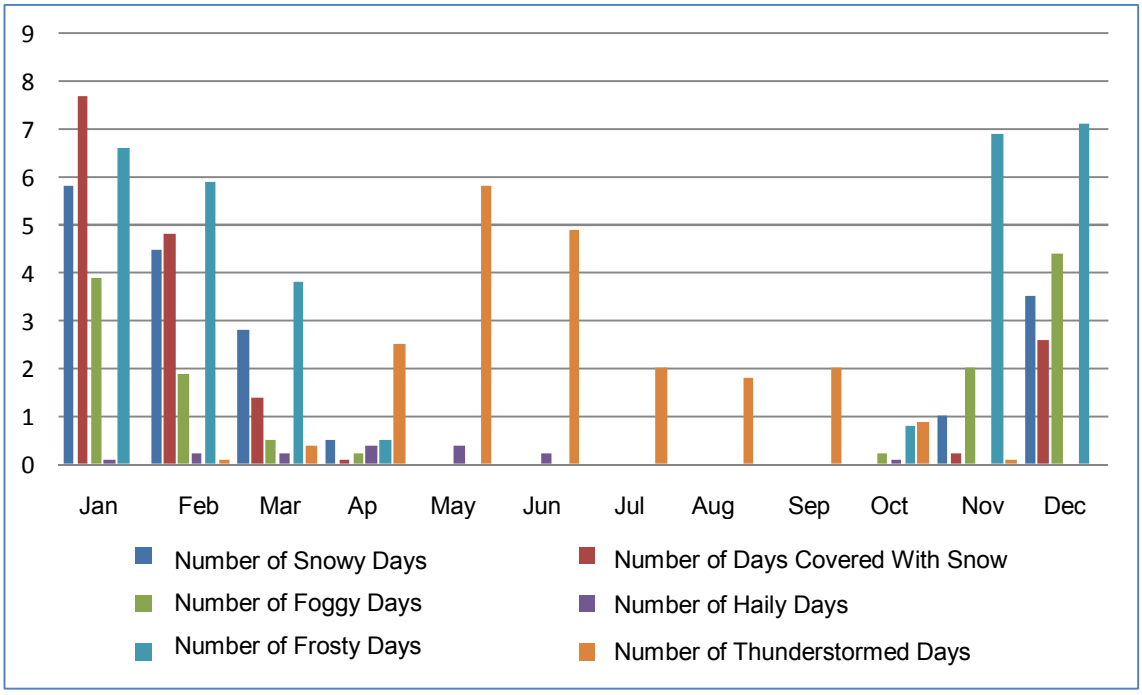


Figure 20. Kırıkkale Meteorology Station Numbered Days Data Graph

g)Maximum Snow Height:

According to records of the Kırıkkale Meteorology Station, maximum snow height is measured in January as 48 cm.

Table 16. Kırıkkale Meteorology Station Snow Height Data

Snow Height	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Snow Height (cm)	48	40	25	6	-	-	-	-	-	-	5	31	48

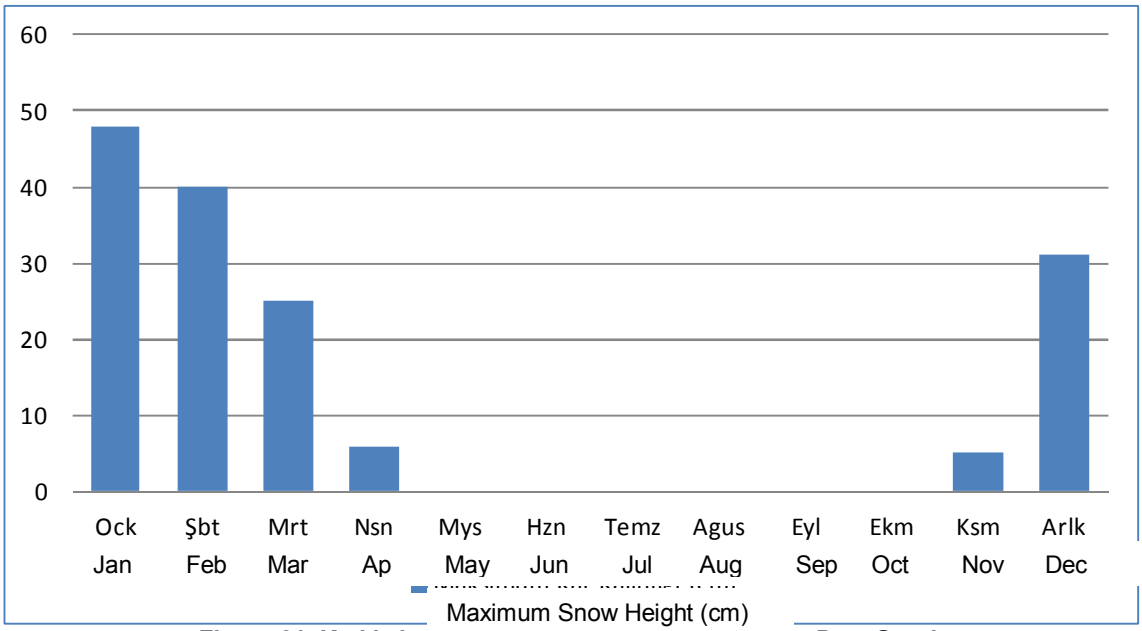


Figure 21. Kırıkkale Meteorology Station Snow Height Data Graph

h) Evaporation:

h-1) Average Open Surface Evaporation: According to records of the Kırıkkale Meteorology Station, average open surface evaporation amount as annually is 1001.7 mm'dir. The highest average open surface evaporation is measured in August as 266 mm.

h-2) Maximum Open Surface Evaporation: According to records of the Kırıkkale Meteorology Station, maximum open surface evaporation is measured in June as 17 mm.

Table 17. Kırıkkale Meteorology Station Evaporation Amount Data

Evaporation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Open Surface Evaporation (mm)	-	-	-	52.6	174.2	229.6	-	266.0	176.2	96.7	6.4	-	1001.7
Maximum Open Surface Evaporation (mm)	-	-	-	11.0	14.4	17.0	-	15.7	11.7	9.7	4.7	-	17.0

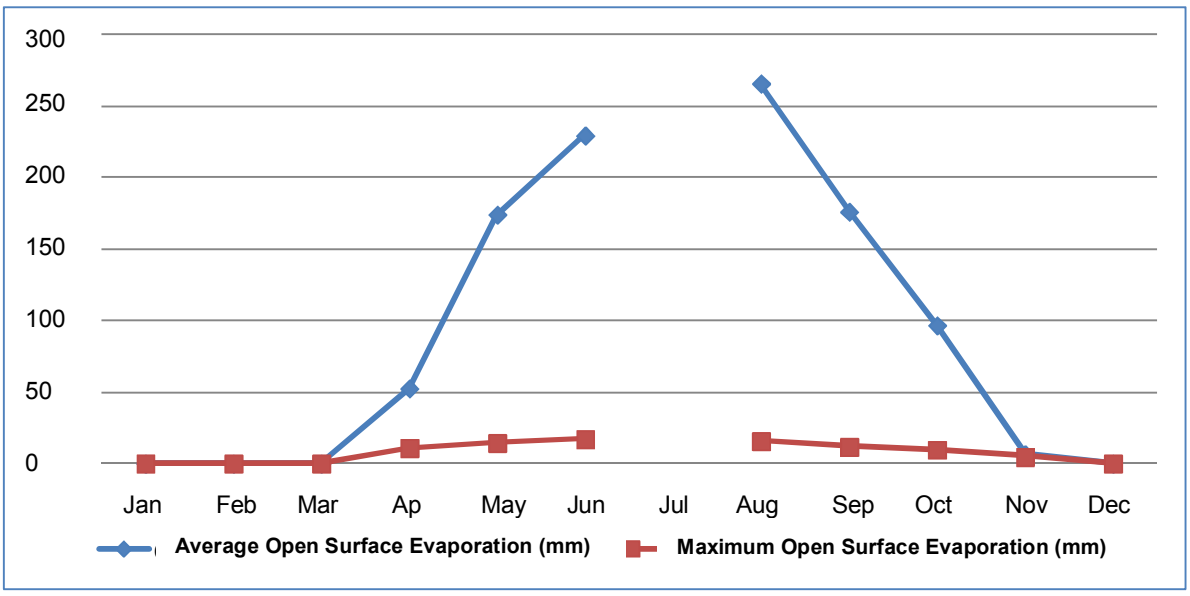


Figure 22. Kırıkkale Meteorology Station Evaporation Amount Data Graph

i) Wind:

i-1) Annual, Seasonal, Monthly Wind Direction:

Blowing Numbers of Wind According to Directions: According to records of the Kırıkkale Meteorology Station, blowing numbers of wind according to directions are given in **Table 18**.

Table 18. Kırıkkale Meteorology Station Blowing Numbers of Wind According to Directions

Direction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
N	1148	1095	1399	989	1542	2073	2340	2243	1662	1413	1169	1189	18262
NNE	1049	932	1146	1166	1330	1944	2947	2487	1679	1513	1163	985	18341
NE	3636	3464	4467	3943	5096	6260	9170	8514	6459	5532	4146	3503	**64190**
ENE	3435	3309	3691	3540	4658	4890	6170	6692	5541	5499	3952	3652	**55029**
E	3422	3497	3698	3309	3823	3739	4031	4424	4641	4220	4000	3285	**46089**
ESE	895	835	752	753	809	923	839	881	988	757	796	798	10026
SE	1129	901	936	823	1073	896	762	750	1017	1191	1119	1262	11859
SSE	741	582	445	524	506	359	269	260	437	420	495	682	5720
S	2207	1845	1850	1699	1481	1106	697	564	953	1250	2095	2035	17782
SSW	3501	3258	2983	2897	2014	1019	626	600	1092	1811	2562	3450	25813
SW	5695	4798	5004	4829	3689	2263	1566	1337	1889	2545	3641	5589	42845
WSW	1683	1721	2214	2422	1983	1520	739	819	1394	1693	1709	1865	19762
W	1871	1960	2272	2726	2533	2315	1538	1311	1592	1725	1709	1758	23310
WNW	498	513	796	837	928	1040	691	657	961	723	556	695	8895
NW	518	716	858	813	891	1200	1189	1029	830	627	531	714	9916
NNW	414	528	631	518	623	970	859	700	621	415	548	506	7333

According to records of the Kırıkkale Meteorology Station, the first degree prevailing wind direction is (NE) Northeast, second degree prevailing wind direction is (ENE) South-Southeast, 3rd degree prevailing wind direction is (E) East.

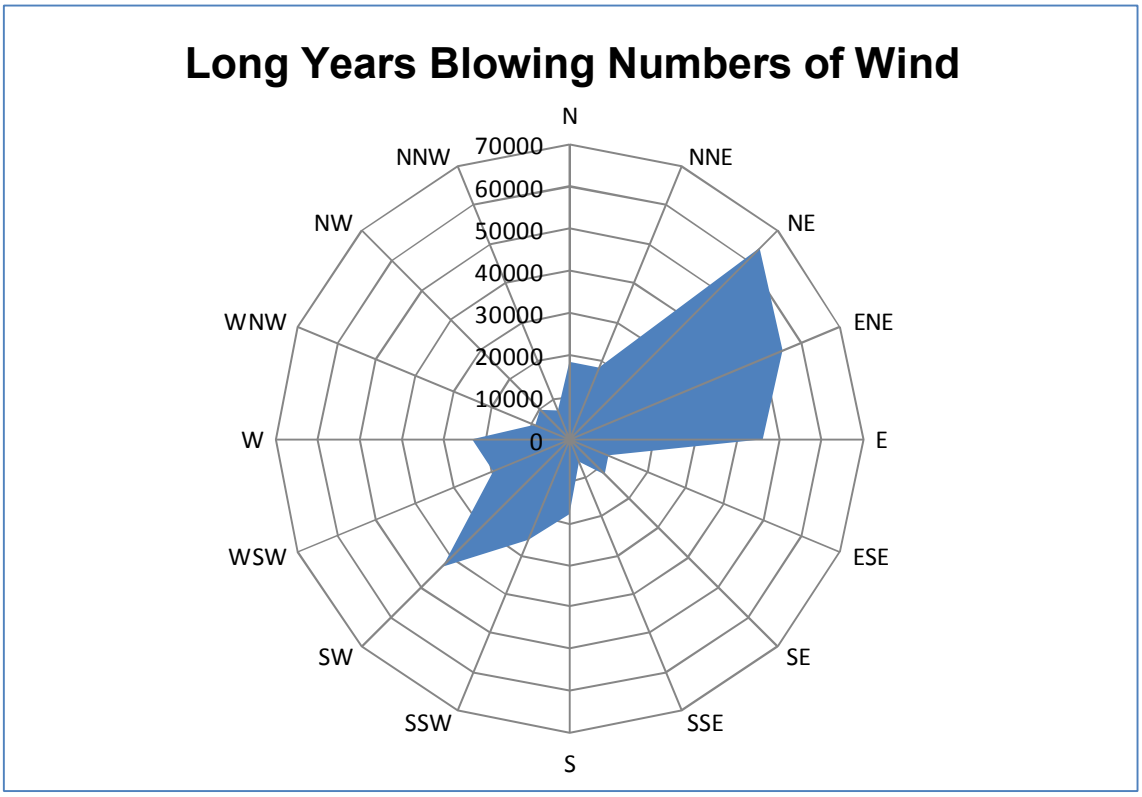


Figure 23. Kırıkkale Meteorology Station Blowing Numbers of Wind According to Directions Graph

Table 19. Kırıkkale Meteorology Station Blowing Numbers of Wind in Spring and Summer Seasons

Spring	Sep	Oct	Nov	Seasonal	Summer	Jun	Jul	Aug	Seasonal
N	1399	989	1542	3930	**N**	2073	2340	2243	6656
NNE	1146	1166	1330	3642	**NNE**	1944	2947	2487	7378
NE	4467	3943	5096	13506	**NE**	6260	9170	8514	23944
ENE	3691	3540	4658	11889	**ENE**	4890	6170	6692	17752
E	3698	3309	3823	10830	**E**	3739	4031	4424	12194
ESE	752	753	809	2314	**ESE**	923	839	881	2643
SE	936	823	1073	2832	**SE**	896	762	750	2408
SSE	445	524	506	1475	**SSE**	359	269	260	888
S	1850	1699	1481	5030	**S**	1106	697	564	2367
SSW	2983	2897	2014	7894	**SSW**	1019	626	600	2245
SW	5004	4829	3689	13522	**SW**	2263	1566	1337	5166
WSW	2214	2422	1983	6619	**WSW**	1520	739	819	3078
W	2272	2726	2533	7531	**W**	2315	1538	1311	5164
WNW	796	837	928	2561	**WNW**	1040	691	657	2388
NW	858	813	891	2562	**NW**	1200	1189	1029	3418
NNW	631	518	623	1772	**NNW**	970	859	700	2529

Table 20. Kırıkkale Meteorology Station Blowing Numbers of Wind in Autumn and Winter Seasons

Autumn	Sep	Oct	Nov	Seasonal	Winter	Dec	Jan	Feb	Seasonal
N	1662	1413	1169	4244	**N**	1189	1148	1095	3432
NNE	1679	1513	1163	4355	**NNE**	985	1049	932	2966
NE	6459	5532	4146	16137	**NE**	3503	3636	3464	10603
ENE	5541	5499	3952	14992	**ENE**	3652	3435	3309	10396
E	4641	4220	4000	12861	**E**	3285	3422	3497	10204
ESE	988	757	796	2541	**ESE**	798	895	835	2528
SE	1017	1191	1119	3327	**SE**	1262	1129	901	3292
SSE	437	420	495	1352	**SSE**	682	741	582	2005
S	953	1250	2095	4298	**S**	2035	2207	1845	6087
SSW	1092	1811	2562	5465	**SSW**	3450	3501	3258	10209
SW	1889	2545	3641	8075	**SW**	5589	5695	4798	16082
WSW	1394	1693	1709	4796	**WSW**	1865	1683	1721	5269
W	1592	1725	1709	5026	**W**	1758	1871	1960	5589
WNW	961	723	556	2240	**WNW**	695	498	513	1706
NW	830	627	531	1988	**NW**	714	518	716	1948
NNW	621	415	548	1584	**NNW**	506	414	528	1448

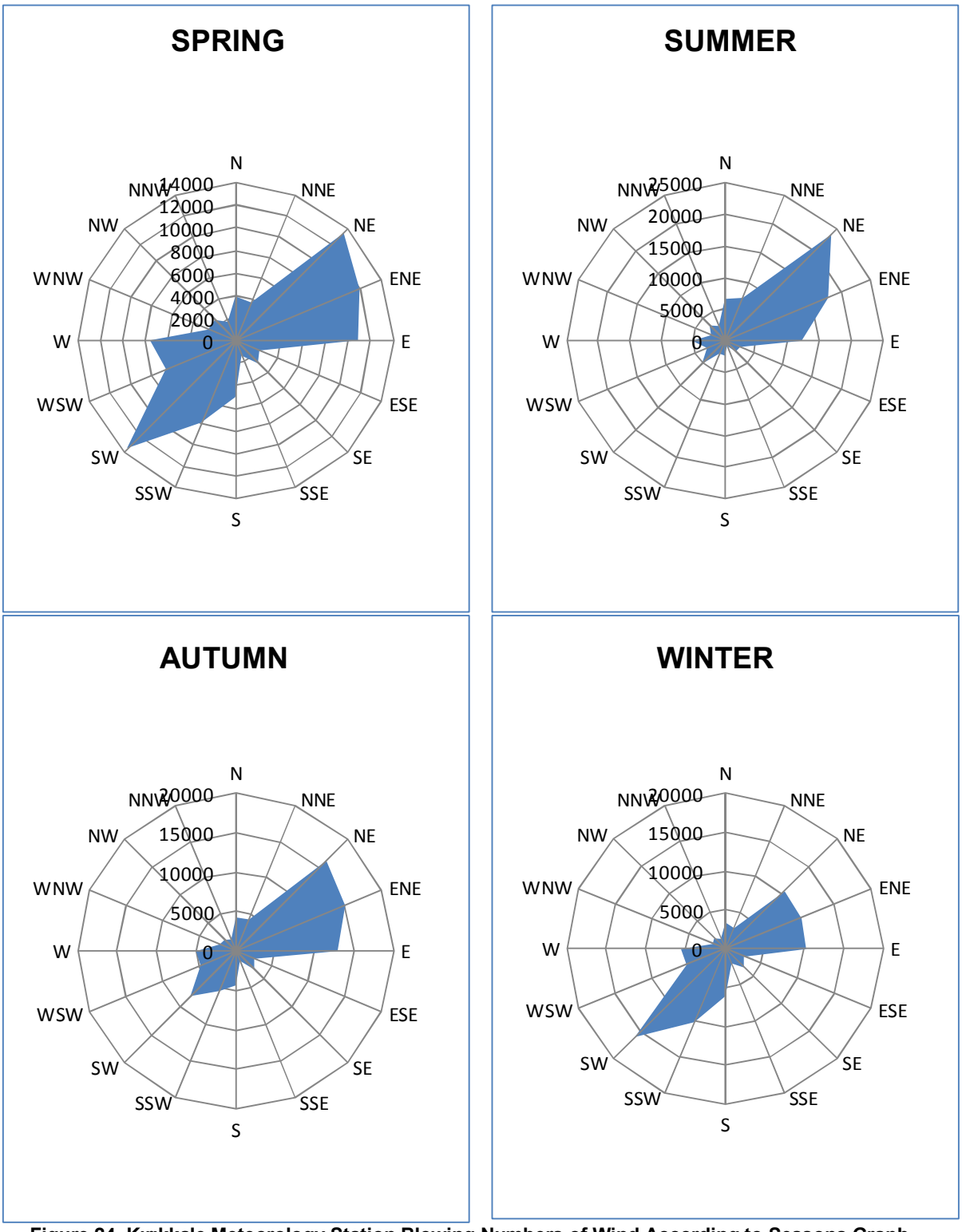


Figure 24. Kırıkkale Meteorology Station Blowing Numbers of Wind According to Seasons Graph

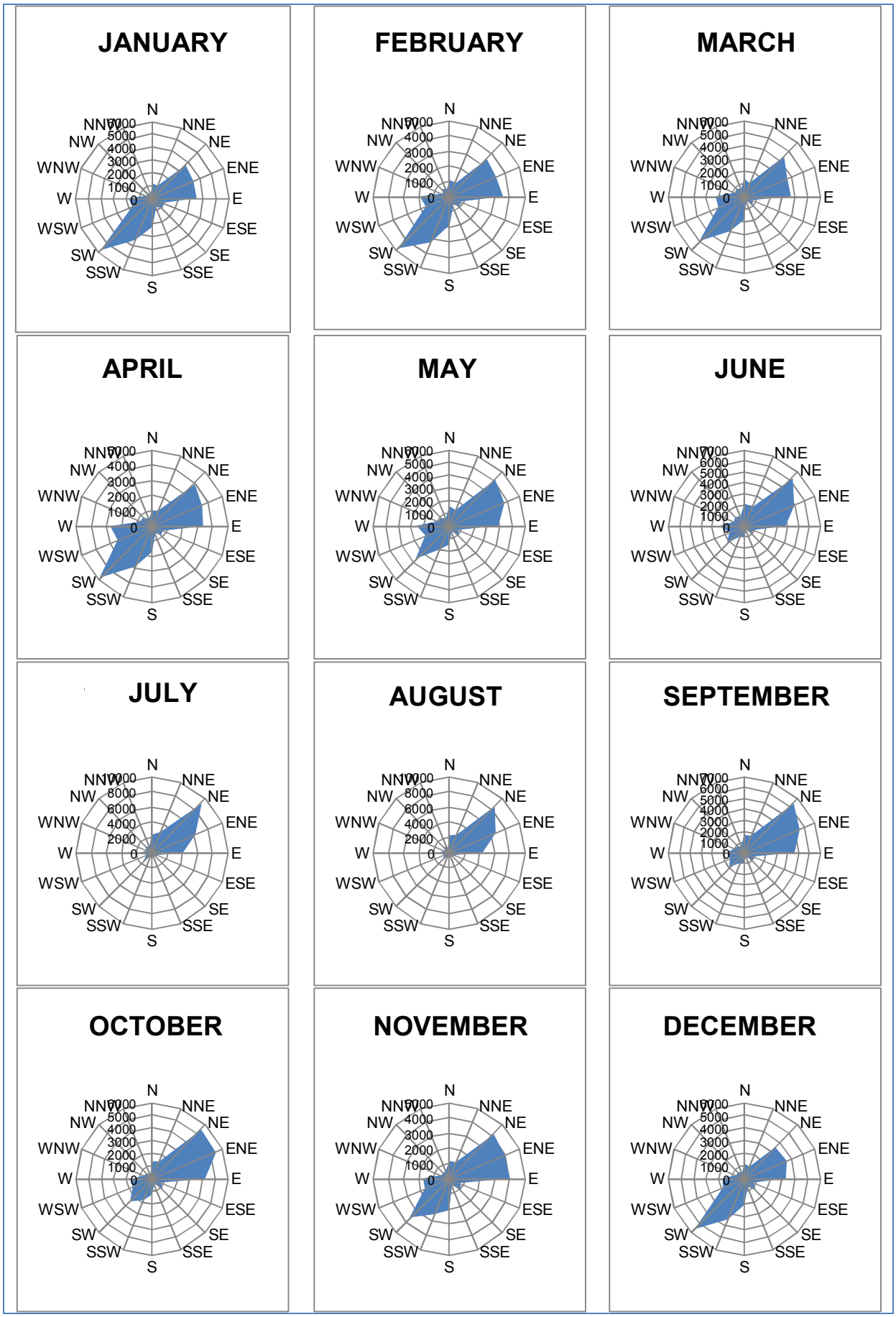


Figure 25. Kırıkkale Meteorology Station Blowing Numbers of Wind According to Months Graph

i-2) Wind Speed According to Directions:

According to records of the Kırıkkale Meteorology Station, average wind speed according to directions is given in the following table.

Table 21. Long Years Wind Speed According to Directions

Direction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
N	2.1	2.4	2.8	2.3	2.6	3	3.7	3.2	2.6	1.9	1.8	2.1	2.5
NNE	2.1	2.3	2.5	2.3	2.3	2.8	3.2	3.2	2.5	2.1	1.9	1.9	2.4
NE	1.7	1.8	2.1	2.1	2.1	2.4	3.1	2.7	2.1	1.8	1.5	1.6	2.1
ENE	1.6	1.8	2	1.9	2	2.2	2.7	2.7	2	1.7	1.5	1.5	2.0
E	1.3	1.4	1.5	1.4	1.5	1.5	1.8	1.7	1.4	1.2	1.1	1.2	1.4
ESE	1.1	1.2	1.3	1.3	1.4	1.4	1.6	1.6	1.4	1.2	1	1.1	1.3
SE	1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.2	1	1	1	1.2
SSE	1	1.2	1.3	1.4	1.3	1.3	1.5	1.4	1.3	1.1	1	1.1	1.2
S	1.5	1.8	1.9	2	1.7	1.6	1.4	1.5	1.5	1.5	1.5	1.4	1.6
SSW	2	2.4	2.5	2.4	2.1	1.9	1.7	1.7	1.7	1.9	1.9	2.1	2.0
SW	1.9	2	2.1	2.1	1.9	1.9	1.8	1.6	1.6	1.6	1.6	1.8	1.8
WSW	1.7	1.9	2.2	2.3	2.2	2.1	1.9	1.9	1.9	1.6	1.5	1.6	1.9
W	1.7	1.9	2.2	2.3	2.4	2.4	2.2	2.1	2	1.7	1.6	1.6	2.0
WNW	1.6	1.9	2.2	2.3	2.4	2.4	2.5	2.3	2.1	1.8	1.5	1.5	2.0
NW	1.6	1.7	1.8	1.9	2	2.2	2.5	2.2	1.8	1.4	1.7	1.5	1.9
NNW	2.2	2.7	2.4	2.4	2.5	2.8	3	3	2.5	2	2.1	2	2.5

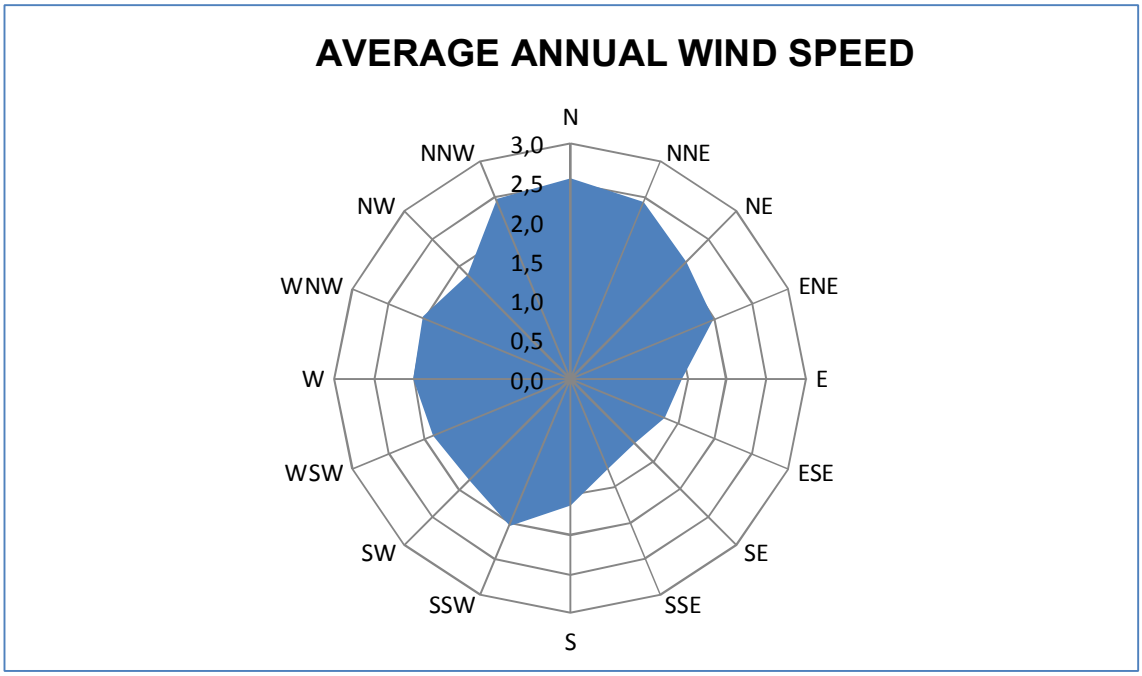


Figure 26. Long Years Wind Speed According to Directions Graph

i-3) Average Wind Speed: According to records of the Kırıkkale Meteorology Station, average wind speed is 1.92 m/sec.

i-4) Maximum Wind Speed and Direction: According to records of the Kırıkkale Meteorology Station, maximum wind speed direction is measured in March as W (West) and speed as 28.1 m/sec.

Table 22. Kırıkkale Meteorology Station Average Wind Speed, Maximum Wind Speed and Direction Data

Wind Speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Wind Speed (m/sec)	1.7	1.9	2.1	2.1	1.9	2.1	2.6	2.3	1.8	1.5	1.4	1.6	1.92
Maximum Wind Speed (m/sec) and Direction	22.6 SW	25.9 SSW	28.1 W	27.7 SSW	24.3 WSW	28.0 W	24.4 W	23.0 WNW	23.9 S	22.0 WSW	22.6 NNW	22.6 N	28.1 W

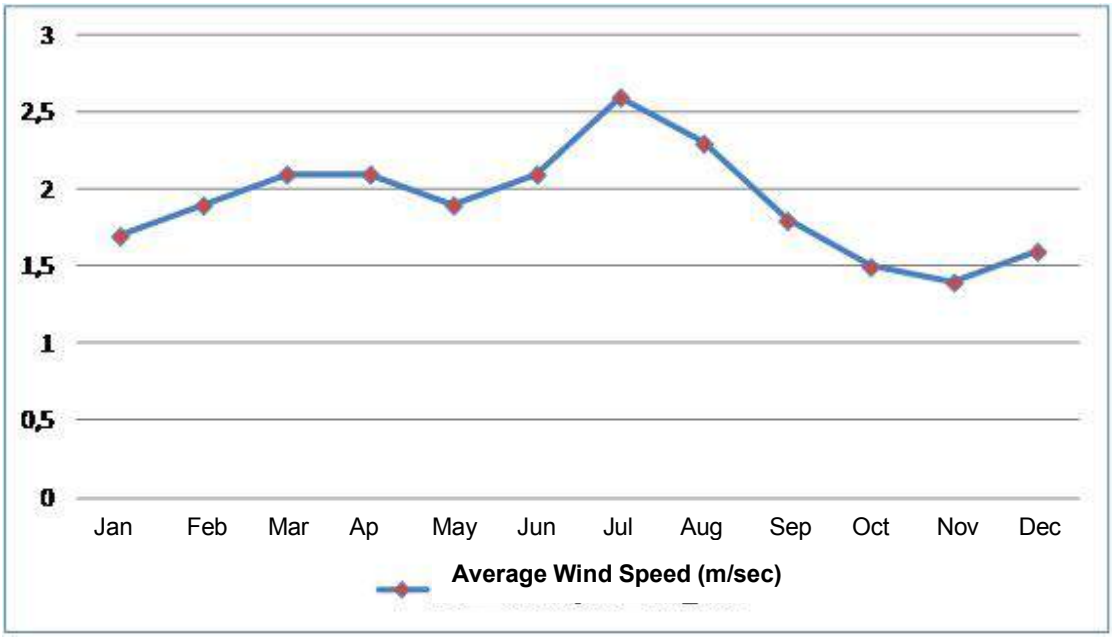


Figure 27. Kırıkkale Meteorology Station Average Wind Speed Graph

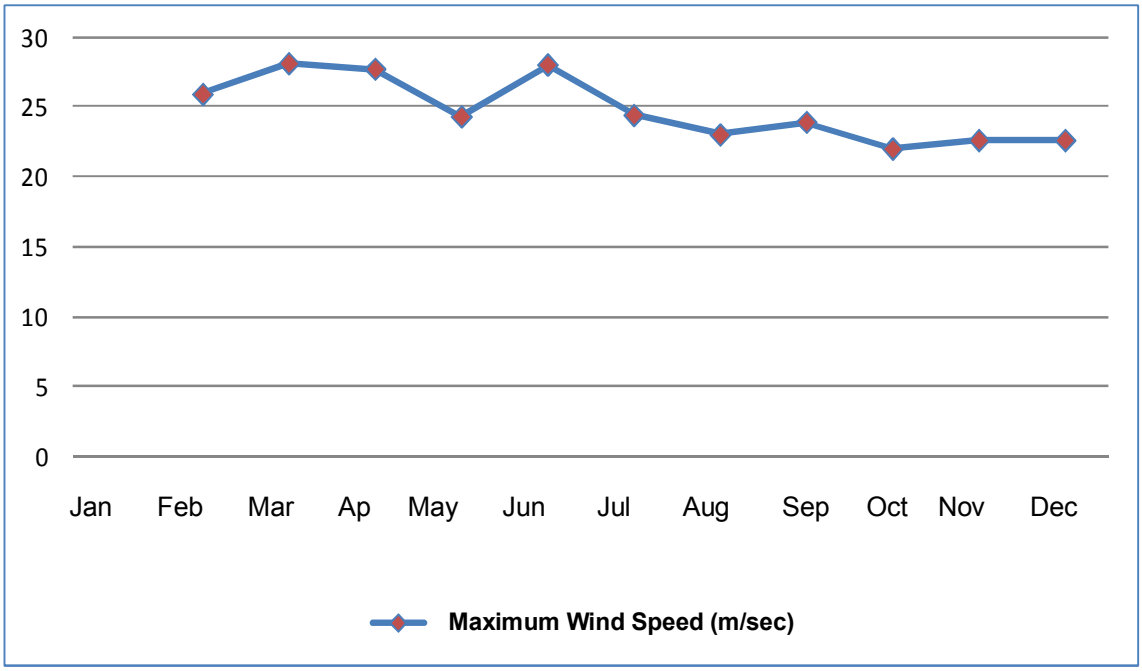


Figure 28. Kırıkkale Meteorology Station Maximum Wind Speed Graph

i-5) Average Number of Stormy Days: According to records of the Kırıkkale Meteorology Station, average number of story days as annually is 7.4.

i-6) Average Number of Strong Windy Days: According to records of the Kırıkkale Meteorology Station, average number of strong windy days as annually is 49.4.

Table 23. Average Number of Stormy and Strong Windy Days

Days	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Number of Stormy Days	0.4	0.8	0.9	1.1	0.7	0.9	0.8	0.5	0.5	0.2	0.3	0.3	7.4
Average Number of Strong Windy Days	2.5	2.8	4.5	5	5.5	6.2	7	5.8	3.3	2.4	2.2	2.2	49.4

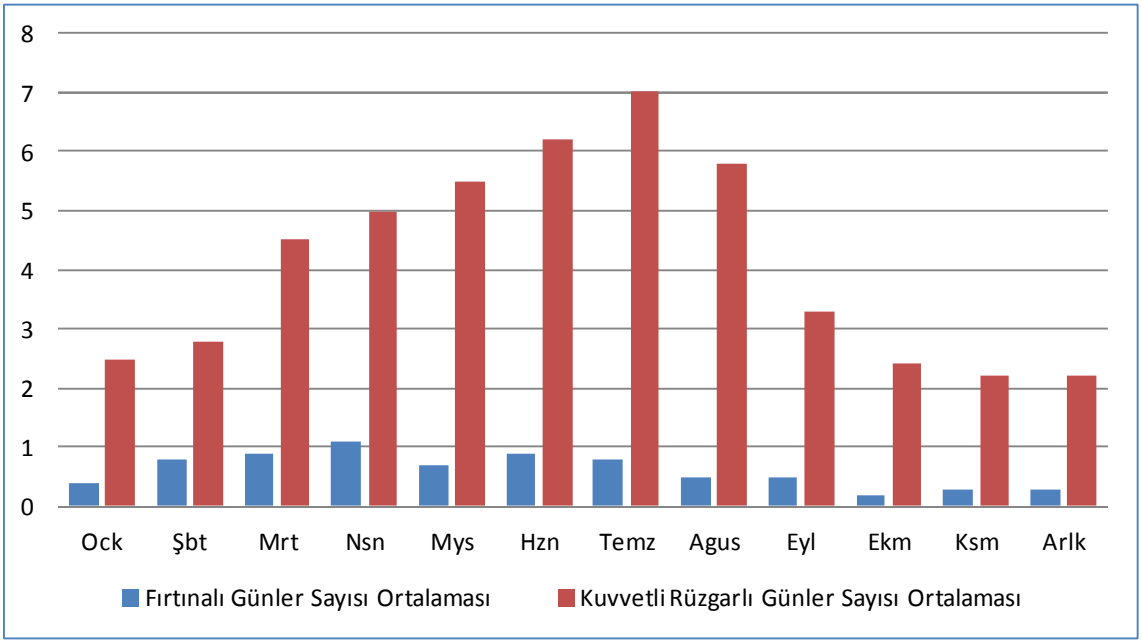


Figure 29. Kırıkkale Meteorology Station Average Number of Stormy and Strong Windy Days Graph

h) Extreme Events:

Extreme events that have occurred in Kırıkkale Province is given in **Table 24**.

Table 24. Extreme Events

YEAR	EVENT	NOTES
1977	Rainfall and flood	Agricultural products, the environment and settlements are damaged due to the flood
1978	Drought	Actual conditions needs rainfall
1979	Storm	Agricultural products, the environment and settlements are damaged due to the storm
1980	Storm	Agricultural products, the environment and settlements are damaged due to the storm
1981	Snow Frost	Agricultural products, the environment and settlements are damaged due to the snow
1981	Storm	Agricultural products, the environment and settlements are damaged due to the storm

YEAR	EVENT	NOTES
1982	Hail Storm	Agricultural products, the environment and settlements are damaged due to the hail storm
1983	Snow	Traffic was disrupted due to snow
1983	Rainfall and flood	Agricultural products, the environment and settlements are damaged due to the flood
1986	Hail	Agricultural products are damaged due to the hail
1987	Storm	Agricultural products, the environment and settlements are damaged due to the hail storm
1999	Rainfall and flood	Settlements are damaged due to the flood
2004	Storm	Branches of trees are broken
2007	Storm	Settlements are damaged
2008	Storm	Human, animal, transportation and settlements are damaged
2008	Storm	Human, animal, transportation and settlements are damaged
2009	Storm	Branches of trees are broken
2009	Storm	Branches of trees are broken
2009	Storm	Branches of trees are broken
2009	Storm	Branches of trees are broken
2009	Storm	Branches of trees are broken
2009	Storm	Branches of trees are broken
2009	Storm	Branches of trees are broken
2010	Storm	Branches of trees are broken
2010	Storm	Trees are damaged
2010	Storm	Trees are damaged
2010	Storm	Trees are damaged
2010	Storm	Branches of trees are broken
2010	Rainfall and flood	Human, animal, transportation and settlements are damaged
2010	Storm	Branches of trees are broken
2011	Storm	Branches of trees are broken
2011	Hail	Flowers of trees are damaged
2011	Hail	Flowers of trees are damaged
2011	Hail	Fruits of trees are damaged
2012	Snow	Traffic is disrupted
2012	Frost	Greenhouse agricultural products are damaged

IV.2.2 Geological properties (study of the geologic structure under the topics of physical-chemical properties of tectonic movements, mineral resources, landslide, unique formations, presentation of geological units on 1/25000 or 1/5000 scale geologic map according to litological properties, geological and geotechnical reports of the project area, stratigraphic cross-section), information about seismicity

a) General geology

1/100 000 scaled Geological Map of the region whit in Kırşehir I30 map section has been published by MTA (Mineral Investigation and Research General Directories). In this map section (Kırşehir İ30), Four different environment rocks type exist which are; rocks from Sakarya Block, rocks from İzmir-Ankara suture zone, rocks from Kırşehir Block and blanket deposits cover the base rocks.

The stratigraphical column section of the geological units situated on the map section Kırşehir – İ30 are given in **Figure 30.** The oldest geological unites which are out cropped in the project area are; Upper Cretaceous aged Samanlık Formation (Ks) and Ilıca Formation (Ki). These unites are belong to İzmir –Ankara-Erzincan Suture Zone. Due to the effect of tectonically movements, the older geological unite, Ilıca Formation sits on the Samanlık Formations (Ks) which is younger than Ilıca Formation (Ki) in the project site.

As Quaternary aged deposits, Holocene aged alluvial fan deposits, debris flows, and flood plain deposits are observed. Study area situates on the İzmir-Ankara-Erzincan Suture Zone. The relation between the geological unites which exist along this Suture Zone is tectono-stratigraphical. These rocks from oldest to youngest are; Late Cretaceous aged Artova Ophiyolitic mélanges, Kocatepe Formation, Karadağ Formation, Ilıcapınar Formation, Samanlık Formation, Haymana Formation, Paleocene-Eocene aged Dizilitaş Formation and Sakarya Formation.

All the deposit types which exist along the İzmir-Ankara-Erzincan Suture Zone represent the deposits settles in closing basin (converging basin edges) during Upper Cretaceous – Lower Eocene ages. Especially, the relation between turbiditic flyche deposits in the basin show the closing basin features like under trust movements.

Geological Map of the study area and shows the close vicinity is given in **Annex 2**, **Figure 30** is a generalized stratigraphic column is presented in the section.

The Geotechnical Survey Report for the Project Development Plan presented in **Annex 5**. It comes to matters mentioned in the report, the project will be carried out by the owner.

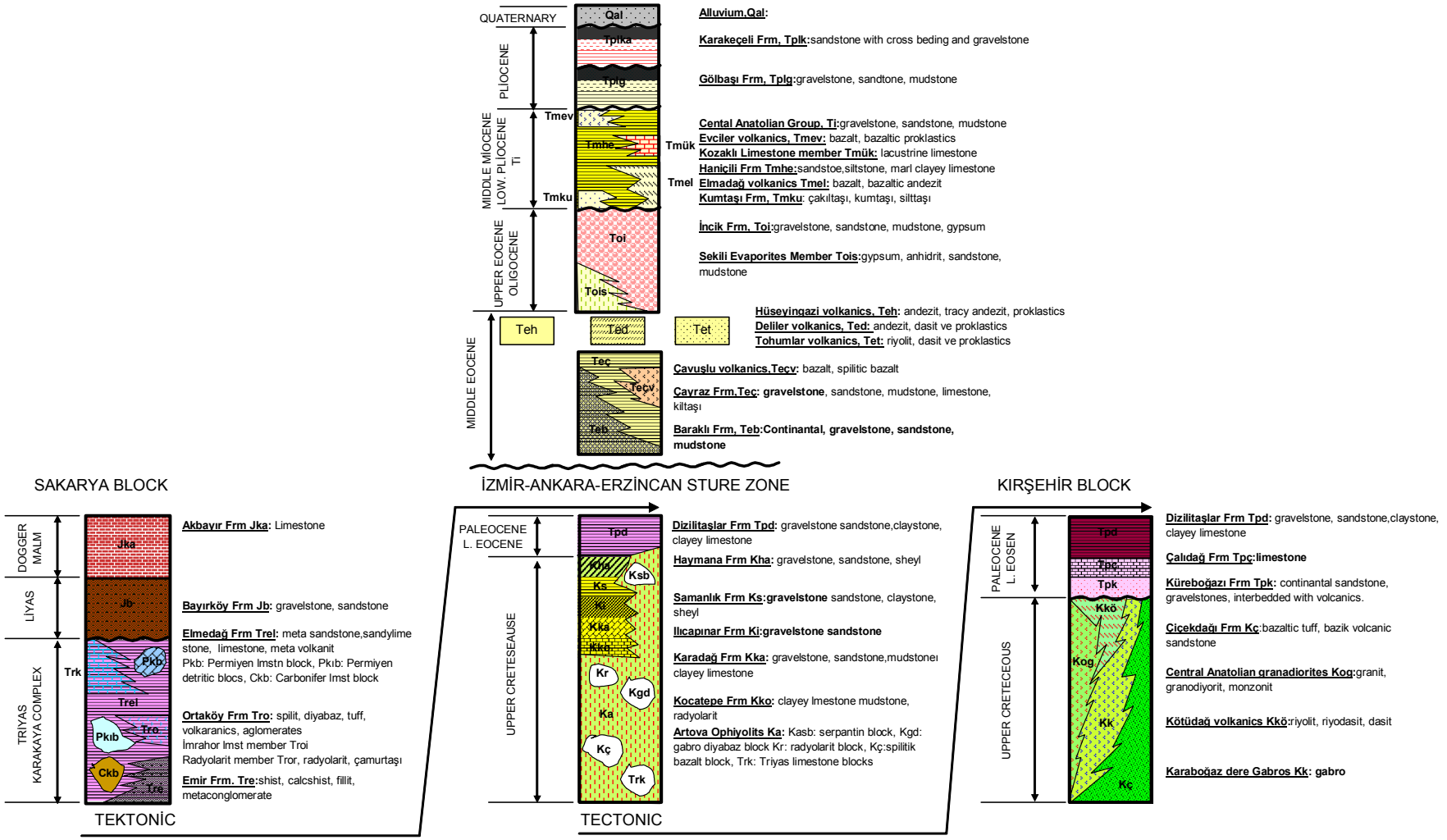


Figure 30. Geological columnar section of the project area and close vicinity (Dönmez, M. 2008)

All geological deposits settled along the İzmir-Ankara-Erzincan Suture Zone are explained at the below from the oldest to youngest.

Artova Ophiolitic Mélange (Ka): Artova ophiolitic mélange (Özcan and others, 1980), in generally, this complex composes of basic-ultra basic, volcanic blocks, sedimentary rocks and ophiolitic fragments (Dönmez and others, 2008). This unites spreads expansively along the region between Bala and Çankırı and it outcrops at the northwest side of study area. Therefore, at the north of study area serpentines outcrops are seen. Artova ophiolites consist of pelagic clays, limestone, radyolarite, mudstone, gabbros, diabas, andezit, basalt, tuff, and agglomeratic blocks. The settlement age of the mélange is known as Late Cretaceous – Early Eocene. Karadağ Formation through lower angled Çankırı Fault over trusts this mélange (Artova Ophiolites).

Kocatepe Formation (Kko): It consists of pelagic clayey limestone, which has budinage structure, radiolarite-mudstone, and alternation of calsiturbidites. This sequence was named as Kocatepe Formation by Dönmez et.al, 2008. Limestones are red and grey colored and they have thin-middle thick bedding structures. Its fractured surfaces show seashell texture. Calsiturbidites contain shallow sea or reef limestone and few volcanic rock fragments. Radyolarite-mudstones are red colored and they have thin bedding surfaces (Akyürek and others, 1977).

Karadağ Formation (Kka): According to Akyürek and others 1997, Karadağ Formation generally contains volcanic gravels, sandstone, mudstone, pelagic clayey limestone and claystone (Dönmez and others, 2008). This formation's layers were reversed towards east and stratigraphicly, upper part of the formation composes of pelagic clayey limestone, sandstone, claystone layers. In the places where the formation is over lapped by serpentines levels, the sequence is 20-30 meters thick. Based on the paleontological data, the age of the formation is Cenomanien - Campanien (Akyürek and others 1997). The relation between Karadağ Formation and Ilıcıpınar Formation is transitive. Quaternary aged deposits covers the Karadağ Formation levels with an unconformity

Ilıca Formation (Kı): Ilıca Formation composes of green, brown and red colored turbiditic sequence, which is mainly gravelstone and sandstone alternation (Dönmez and et, al., 2008). Formation starts with a massif basaltic conglomerate at the bottom. This conglomerate composes of angular and semi-angular basalt, andesite, radiolorite, chert, limestone and serpentines gravels. At the top of basaltic conglomerate, 50 meter thick sequence exists, which is alternation of sandstone and limestone. Limestones are gray and pink colored. At the upper part of this reversed sequence, thick-bedded sandstone and massif gravelstone layers are observed. Sandstone layers show poor gradation. Gravels are mainly originated from volcanic rocks and matrix composes of calcite, limonite, chlorite, and glauconite (Norman 1972). Total thickness of the formation is 1250 meters and depending on its stratigraphical position, the age of the formation is accepted as Maastrichtien. (Akyürek and others, 1979) (Dönmez et.al, 2008).

Samanlık Formation (Ks): The geological unite, which is yellow, green and brown, gray colored and alternation of gravelstone, sandstone and shale is named as Samanlık Formation (Akyürek and others, 1984). This formation occurred in flych environment and in the study area; Samanlık Formation spreads in parallel position with Ilıcapınar Formation's layers. Gravelstone layers of the formation are greenish, yellowish and brown colored and well cemented. Gravelstone layers gradually pass to sandstones. In the gravelstones, synchronously transported rudites and carol grains exist (Akyürek and others, 1984). Sandstones are green, yellow and brown colored and well cemented and fractured, the bedding thickness is fine and middle. Shales are dark gray colored and weakly cemented. Bedding thicknesses are fine and laminated (Akyürek and others,

1984). Considering the previous position, Formation is underlined by Ilıcapınar Formation and over lined by Dizilitaş Formation. However, due to tectonic movements, the sequence is observed in reverse position in the field.

Haymana Formation (Kha): Haymana Formation is represented by Turbiditic deposits, which consist of gravelstone, sandstone, and shale. Rigo and Cortesini (1959) named these turbidities as Haymana Formation. Gravelstones are greenish yellow and brown colored and well cemented with middle and thick bedding planes (Akyürek and others, 1997). In the unite, place to place, poorly sorted, coarse-grained gravelstone layers exist. In the gravelstones, synchronously transported rudites and carol fragments are observed. Sandstones are green, yellow and brown colored and well cemented. Bedding layers show thin and middle thicknesses. Shale layers are dark gray brownish cream colored and thin bedded. According to Akyürek and others, 1997, the age of Haymana Formation is Maastrichtien

Dizilitaşlar Formation (Tpd): The geological unites which composes of gravelstone, sandstone, claystone, with in gypsum and reef limestone blocks are named as Diziltaş Formation by Norman 1972. Unite has thin-middle-thick bedding layers. Apart from the coarse gravels, roundness, sorting and grading are well developed. In the sections where fine-grained gravels exist, matrix is clay and these sections are good to well cemented. Sandstones are dark-light brown, gray and yellowish colored. It shows cross bedding structures. Matrix is clay and carbonates. In the sections where the carbonate is abundant as matrix, sandstones could be named as sandy carbonates. The characteristic features of the sandstones are; showing diamond macro texture. Claystones are light and dark green and dark gray colored. These claystone layers are slightly interbeded with sandstone and gravelstone layers. In some places, the claystones show massif appearance. Dizilitaş Formation is also includes olistostromes, which proves that formation deposited in deep-sea environment with turbididic flows (Bilgin and others 1986). According to Dönmez and others 2008, the age of the formation is Paleocene-Lower Eocene.

Alluvium (Qal, Qym, Qay): The youngest depositions in the region represent Quaternary aged geological unites which are Debris Flows (Qym), alluvial fans (Qay) and flood plain deposits (Qal).Flood plain deposits mostly spreads on the banks of Kızılırmak River. These deposits are reddish cream colored and composed of incremented clay, silt, sand, gravel and block mixtures.

b) Structural Geology

Study area situates at the Anatolian tectonic belt, which prolongs at the southern side of the North Anatolian Fault Zone (NAFZ). This belt gained its structural features during the Alpine Oregenesis. Study area sits on the İzmir-Ankara-Erzincan suture zone. This zone was occurred by the collision of Torit Anatolian belt and Sakarya Block, during the closing of Neothetis. As the result of this, suture zone consists of oceanic crust and deep-sea basin deposits. Depending on the closing movements of Thetis, over trust fault lines prolong from northeast to southwest were occurred. Among these faults, Çankırı Fault line passes close to the north-west boundary of the project area. At the northwest side of the project area (outside of the project area), Artova Ophiolits and serpentine blocks over trusted to younger deposits, which are Ilıca and Samanlık Formations, through Çankırı Fault Line. On the project site Ilıca formation is also over trusted to Samanlık Formation, which is younger than Ilıca Formation. Therefore bedding layers of Ilıca and Samanlık formations are observed as overturned bedding planes in the study area.

c) Project Site Geology

Based on the Geotechnical Survey Report obtained from the field works and existing technical literature, it is determined that flat plain area spreads towards Kızılırmak River bed, at the southeast part of the study area is covered by Quaternary aged alluvial fan deposits (Qay) and flood plain deposits (Qal). During the drilling works, it was seen that the thickness of the alluvial fan deposits varies between 8,00 and 20,00 meters. The average thickness of the fan deposits is 15,00 meters. These blanket layers overlay the base rock, which is Upper Cretaceous aged Samanlık Formation (Ks). Mostly, sandstone and gravelstone layers of Samanlık Formation were drilled on the project site.

Alluvium fan deposits (Qal) and Flood plain deposits (Qal) are represented by medium dense to dense gravely silty sand and very stiff to hard gravely sandy silt layers. Samanlık Formation (Ks) composes of sandstone gravelstones in the study area.

On the other hand, at hilly side at northwest of the area where the altitude is about 750 meters yellowish brown colored sandstone and gravelstones of Ilıca Formation outcrops are observed. Older Ilıca Formation overturns to younger Samanlık Formation, because of tectonic movements.

Geological maps is given at **Figure 31** and geological map sections are presented at **Annex -5** of Geotechnical Survey Report.

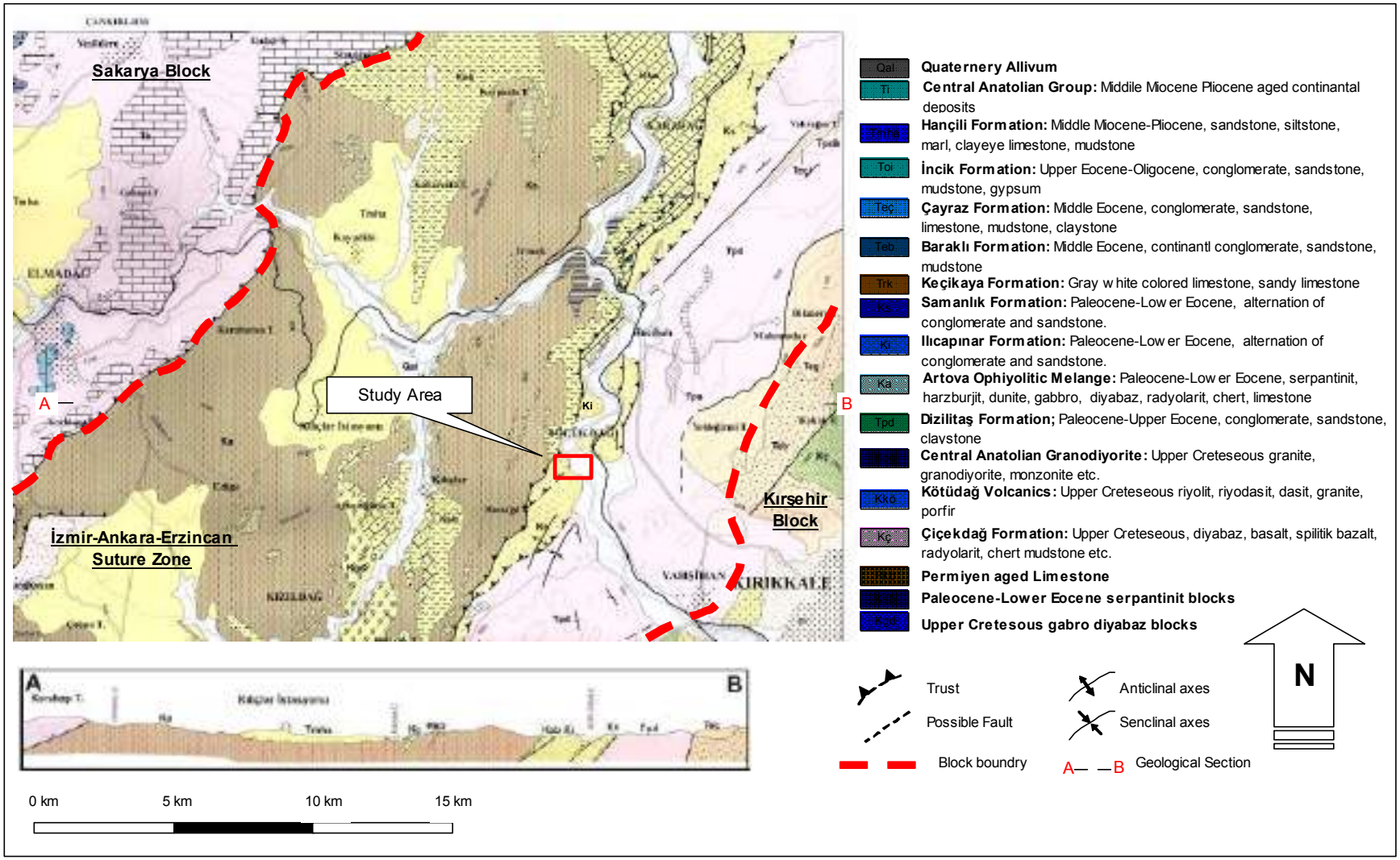


Figure 31. Geological Map of the study are and its close vicinity (1/100 000 scaled geological map of Kırşehir I30 map section, MTA)

GEOTECHNİCAL DRILLING AND TEST PIT WORKS AND IN-SITU TESTS

i. Drilling Studies

10 numbers of boreholes, which the depths vary between 20 and 50 meters, were drilled, to investigate the thickness of the soil and rock layers, their lithological, structural and physical properties and the depth of ground water level. The total depth of boreholes completed is 320 meters. The data obtained from the boreholes is summarized in **Table 25**.

Table 25. The list of depths, lithology and formations determined from boreholes

Borehole No	Coordinates		Depth (m)	Lithology	Formation
SK-1	534753	4415444	20,00	0,00 – 8,00 m: silty gravely sand with blocks (Qay) 8,00 – 20,00 m: alternation of sandstone, siltstone and conglomerate (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-2	534765	4415342	20,50	0,00-20,00 m: gravely clayey silt, silty sand, sand and clayey silt, clayey silt with few gravel, gravely sandy silt. (Qay) 20,00-20,50 m: sandstone (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-3	534870	4415309	50,00	0,00-17,50 m: gravely silty clayey sand, silty gravely sand, gravely fine sand-silt. (Qay) 17,50-50,00 m: alternation of sandstone claystone (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks))
SK-4	534892	4415283	50,00	0,00-15,00 m: gravelly silty clayey sand, silty gravely sand, gravely silty sand. (Qay) 15,00-50,00 m: alternation of claystone, siltstone, sandstone (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks))
SK-5	534909	4415240	50,50	0,00-15,00 m: gravely silty clayey sand, silty gravely clayey sand, clay with fine sand. (Qay) 15,00-50,50 m: alternation of marl siltstone sandstone, (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-6	534955	4415353	20,00	0,00-15,00 m: silty gravely sand, gravely silty sand (Qay) 15,00-20,00 m: alternation of sandstone siltstone (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-7	534922	4415142	50,00	0,00-16,00 m: gravely silty clay, sandy clay with few gravel, gravely silty sandy clay. (Qay) 16,00-50,00 m: alternation of siltstone marl (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-8	535013	4415189	20,00	0,00-13,00 m: silty fine sand with few gravel and few clay. (Qay) 13,00-20,00 m: alternation of conglomerate, sandstone and siltstone. (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-9	535471	4415244	21,00	0,00-15,00 m: gravely silty sand, fine sand with few gravel, silty sand with few clay. (Qal) 15,00-21,00 m: claystone inter bedded with sandstone. (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)
SK-10	535483	4415370	20,50	0,00-12,80 m: gravely silty sand, clayey silty sand with few gravel, sandy silty clay with few gravel.(Qal) 12,80-20,50 m: siltstone inter bedded with sandstone (Ks)	Alluvial Fan (Qay) Samanlık Formation (Ks)

During the drilling works, D-500 type rotary drilling machine, which is fixed on the truck, was used. Rotary techniques with circulation water and without circulation water are used in drilling works (**Figure 32**). At the different soil levels, Standard Penetration Tests (SPT) were carried out. In the rock sections, the progress of boreholes was fulfilled by core drill method. These works were completed between the dates of 04.06.2013 – 03.07.2013. Drill locations are shown at **Figure 33**.

Figure 32. SK-10 Drilling Works

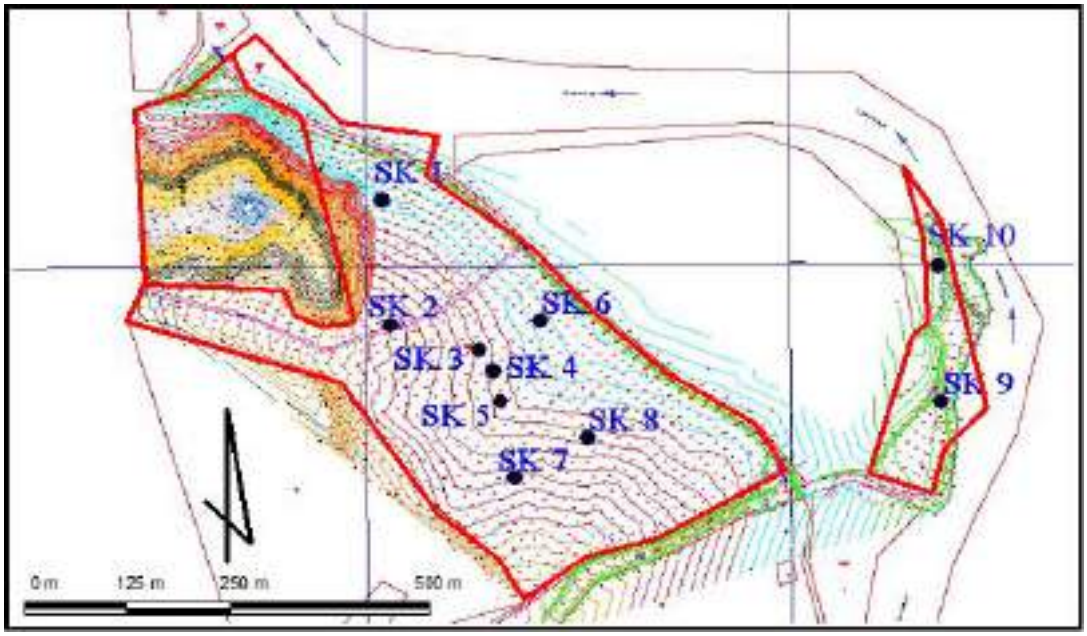


Figure 33. Parcel Lines and Drill Locations ve Drill Locations

The data obtained from boreholes is summarized at the below and borehole logs are presented at Geotechnical Report givens as Annex 5.

SK-1; Drilling SK-1's total depth is 20, 00 meters. Deposits belonging to alluvial fan; infrequent blocked, silt and gravelly sand, have been cut in between 0,00 – 8,00 meters. Gravels, grit, magnetite pieces are half round and angular, coarse material rate is approximately 40%. Levels that have been cut are in dense to very dense structure. In between 8.00 and 20.00 meters, levels consisting of sandstone, siltstone, and conglomerate belonging to Samanlık Formation (Ks) have been cut. Mentioned levels are in less to moderately weathered conditions. The rock quality (RQD) is mostly poor and in small amounts is medium. Ground water was not encountered after drilling operations.

SK-2; Total depth of SK-2 is 20,50 meters. At the depths of 0,00 – 20,00 meters, alluvial fan deposits (Qay) have been cut; These deposits show loose, medium dense character and they are gravely clayey sand and gravely silty sand between the depths of 3,00 – 8,00 meters. At the depths, between 8,00 – 20,00 meters, these deposits are mainly very stiff and hard clayey silt, gravely silt and sandy silts. After the depth of 20,00 meters, the levels of Samanlık Formation (Ks) have been cut. These levels are sandstone beds and their weathering degree moderately and mostly weathered. RQD degree is very poor. Ground water level is at 14,00 meters.

SK-3; Total depth of SK-3 is 50,00 meters. The deposits which have been cut between the depths of 0,00 – 17,00 meters, belong to Alluval fan (Qal) deposits. Material class is mostly medium dense and dense gravely silty sand at the depths, between 0,00 – 17,00 meters. Between the depts. Of 17,00 – 50,00 meters, Samanlık Formation (Ks) levels exist. These levels are alternation of sandstone and claystone. Rock Quality (RQD) is very poor upper layers but at the deep it becomes medium and weathering degree is moderately to less weathered. The depth of Ground water level was measured as 14,30 meters.

SK-4; The depth of this borehole is 50,00 meters. Alluvial fan (Qay) deposits have been cut between 0,00 – 15,00 meters. The material from these levels are medium dense to dense gravely clayey silty sand and gravely sand. After the depth of 15,00 meters, the alternation of claystone, siltstone and sandstone levels have been cut. These levels belong to Sarımsaklı Formation (Ks). Weathering degree is moderately to less weathered between the depths of 15,00 – 33,00 meters and deeper than 33,00 meters it becomes fresh and less weathered. Rock Quality is poor-medium to fine. After 43,00 meters very fine rock quality was encountered. Ground water depth is 13,50 meters.

SK-5; Total drilling depth is 50,50 meters. Alluvial fan (Qay) deposits have been cut between the depths of 0,00 – 15,00 meters. In this interval down to 6,50 meters, material is medium dense gravely clayey silty sand and silty gravely clayey sand. Deeper than 6,50 meters, material is clay with fine sand and few gravel. After 15,00 meters Sarımsaklı Formation's (Ks) levels have been cut in the drill hole. These levels are; alternation of marl, siltstone and sandstone at the depths, between 15,00 – 40,00 meters. The rock quality is poor to very poor and weathering degree is less-moderate and mostly weathered. Between 40,00 – 50,00 meters, the rock type is sandstone which is less and moderate weathered. The rock quality is medium to poor at these depths. The depth of Ground water level is 9,80 meters

SK-6; The depth of SK-6 is 20,00 meters. Alluvial fan deposits (Qay) which are medium dense and dense gravely sand, silty sand and clayey sand, have been cut at the depths of 0,00-15,00 meters. After 15,00 meters depth alternation of sandstone, claystone levels of Samanlık formation (Ks) have been cut. The rock qualities of these

levels are very poor and poor. The weathering degree of these levels varies between less weathered and completely weathered. In this borehole ground water level was measured as 12,00 meters.

SK-7; Total drilling length is 50,00 meters. Between 0,00 – 16,00 meters, alluvial fan (Qay) deposits exist; material is stiff to very stiff sandy clay. After 16,00 meters depth, the alternation of sandstone, marl and siltstone levels have been cut which belong to Samanlık Formation (Ks). The rock quality of these levels is very poor to poor but towards the end of borehole rock quality changes to fine. Weathering degree is fresh, less weathered at the deep, and moderately weathered through the surface. Ground water level is at the 12,00 meters.

SK-8; Depth of the borehole is 20,00 meters. Alluvial fan (Qay) deposits are at the depth of between 0,00-13,00 meters. These deposits are dense at the deep and medium dense towards the surface and they are gravely clayey and silty fine sand. Clay content increases towards the bottom of the borehole and soil type becomes low plastic very stiff clay at the bottom. At the depth of 13,00 meters, the level of Samanlık Formation (Ks) starts. These levels are alternation of conglomerate, claystone, sandstone and siltstones. Rock quality of these levels is very poor at the surface and through the bottom of the borehole, it becomes fine. Weathering degree of the rocks is moderately and less weathered. Ground water level is at 12,50 meters.

SK-9; Total depth of SK-9 is 20,00 meters. Between the depths of 0,00 and 14,50 meters, flood plain deposits (Qal) have been cut. The soil type of these levels is very dense gravely sand and silty sand. After the depth of 14,50 meters, bed rock has been cut during the drilling operation. These rock levels belong to Sarımsaklı Formation (Ks) and composes of sandstones, which inter bedded with claystones. Rock quality (RQD) of these levels varies from very poor to medium. Weathering degree is moderate. The depth of the ground level was measured as 2,20 meters.

SK-10; Total depth of this borehole is 20,50 meters. Alluvial deposits (Qal) which were deposited at the flood plain surfaces of Kızılırmak River banks have been cut between the depths of 0,00 – 12,80 meters. These deposits are medium dense gravely silty sand down to 10,00 meters. After 10,00 meters deposits become very stiff silty clay. Between the depth of 12,80 and 20,50 meters levels belong to Samanlık Formation (Ks) have been cut. These level are sand stones which inter bedded with clay stones and siltstones. Rock quality is medium and weathering degree is less weathered. The depth of the ground water is 2,10 meters.

ii. Test Pit Works

During the site works 10 numbers of test pits were excavated and their depths vary between the depth of 3,60 – 3,20 meters. Test pits were opened by using JSB model tractor excavator and test pit works were completed on the date of 02.07.2013. 13 no of bulk samples collected for laboratory works during this test pit works. The data has collected from test pit works are summarized at below. The location maps of test pits are shown at **Figure 33**.

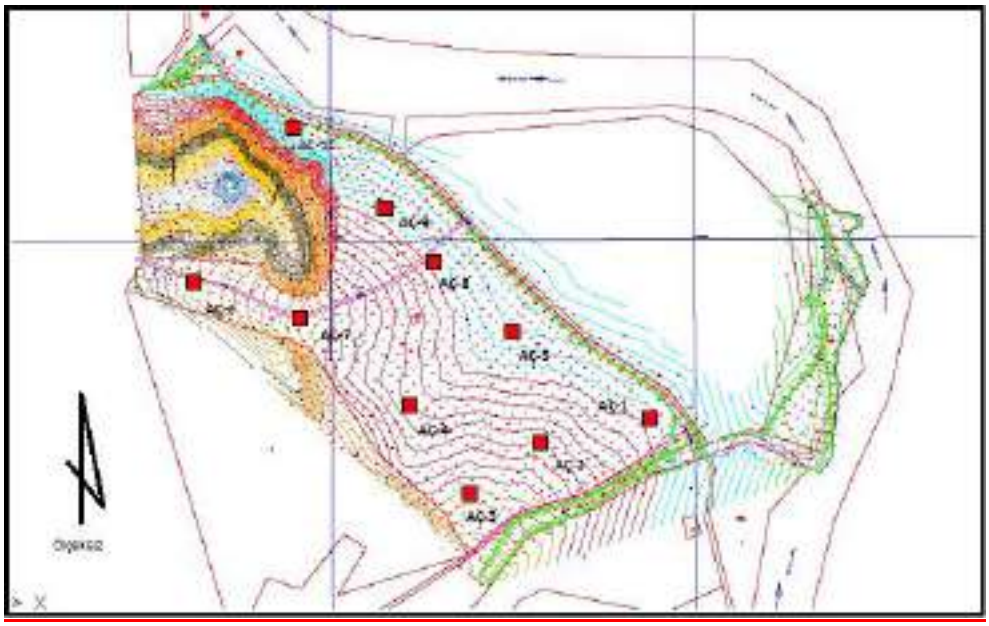


Figure 34. Location Map of Test Pits

AC-1: Total depth of borehole is 3.50m. Vegetable soil are encountered between the depth of , 0.00-0.30 m. and alluvial fan sediments(Qay) cut between the depth of 0.30-3.50m. These sediments are sands with rare clay, gravel and silt between the depth of 0.30-2.40m. Clay with silt which are classified as medium plasticity soil class are encountered between the depth of 2.40-3.50m.

AC-2: Total depth of borehole is 3,30m. Vegetable soil are encountered between the depth of 0.00-0.40 meters. And alluvial fan sediments (Qay) cut between the depth of 0,40-3,30m. The soil class is encountered between the depth of 0.40 -1.00m. is Sand with gravel. Clayey sand encountered between the depth of 1.00 -3.00m. There is no discovering of ground water.

AC-3: Total depth of borehole is 3.40 m. Top soil is encountered between the depth of 0.00-0.30 meters and alluvial fan sediments (Qay) were cut between the depths of 0.30-3.40m. The soil class is encountered between the depth of 0.30 -1.80 m is sand with few gravel. Clay which is classified as low plasticity soil is encountered between the depth of 1.80 -3.40m. There is no ground water in this test pit.

AC-4: Total depth of borehole is 3,60 m. Vegetable soil are encountered between the depth of 0.00-0.30 meters and alluvial fan sediments (Qay) were cut between the depth of 0.30-3.60m. The sediments was cut between the depth of 0.30 -1.50m. are represented with clayey sand with few gravels. Low plastic clay levels are encountered between the depths of 1.50-3.60m. The ground water level is not observed in this pit.

AC-5: Total depth of borehole is 3.40m. Top soil is encountered between the depth of 0.00-0.30 meters and alluvial fan sediments(Qay) cut between the depth of 0.30-3.40m. The sediments are composed of silty clayey sands with few blocks and gravels. There is no any ground water level in this test pit.

AC-6: Total depth of borehole is 3.50 m. Top soil is encountered between the depth of 0.00-0.30 meters and alluvial fan sediments (Qay) were cut between the depth of 0,30-3,50m. The soil class is described as gravely clayey sands. There is no any observed ground water level in the pit.

AC-7: Total depth of borehole is 3.20 m. Top soil is encountered between the depth of 0.00-0.40 meters and alluvial fan sediments (Qay) were cut between the depth of 0.40-3.20 m. The sediments are sandy materials, which are rare complex. There is no discovering of ground water in this open pit. The sediments are gravely clayey sand with few blocks. There is no observed ground water in this pit.

AC-8: Total depth of borehole is 3.20 m. Top soil is encountered between the depth of 0.00-0.40 meters. Alluvial fan sediments (Qay) were cut between the depth of 0.40-3.20 m. The sediments are clayey sand with few gravels and they contain rarely blocks. The ground water level does not exist in the pit.

AC-9: Total depth of borehole is 3.50m. Top soil is encountered between the depth of 0.00-0.40 meters. Alluvial fan sediments (Qay) were cut between the depth of 0,40-3,50m. The soil class is described as gravely clayey sand with rare blocks. There is no ground water level in the test pit.

AC-10: Total depth of borehole is 3.60 m. Top soil is encountered between the depth of 0.00-0.30 meters. Alluvial fan deposits (Qay) were cut between the depth of 0.30-3.20 m. The soil class is described as gravely silty clayey sand with rare blocks. There is no ground water level in the pit.

iii. Liquefaction Analysis's and Assessments

In the drilling works, there is no evidence encountered for the existence of poorly graded and saturated loose sands, which could carry liquefaction risks in the area. Nevertheless poorly graded silty sands (SM; SPT:8) were cut at the depth of 3.5 meter in the borehole SK-2 Liquefaction Analysis was carried out on the mentioned sand layer to have a numerical approach to situation. The Analysis was done according to the method explained by Seed et.al, 1985.

The data obtained Borehole SK-2 was used In the model analysis, It is considered that the groundwater seasonally arises up to 1m to ground surface and the layer which could show liquefaction risk is between 3,00 – 7,50 meters depths. The outcome of the analysis for this particular condition shows that Safety Factor of Liquefaction (FL) is "F = 1,5" for the earthquake magnitude is 7,5 (M = 7,5). This calculated Safety Factor, F = 1,5 provides the condition of FL> 1,2. Based on this result, one could say that there is no any liquefaction risk on the project site. The detail calculations of analysis and Liquefaction Charts used during the analysis are given at Geotechnical Report.

d) EARTHQUAKE POSSIBILITY

City of Kırıkkale generally takes place in first-degree seismic zone on "The Earthquake Map of Turkey" prepared by "Cancelled Ministry of Public Works and Settlement" and put in action by the number of 18.04.1996-96/8109 date value of council of ministers. Since the project area locates at the west side of Kırıkkale city, the study area locates at the second-degree seismic zone (**Figure 35**).

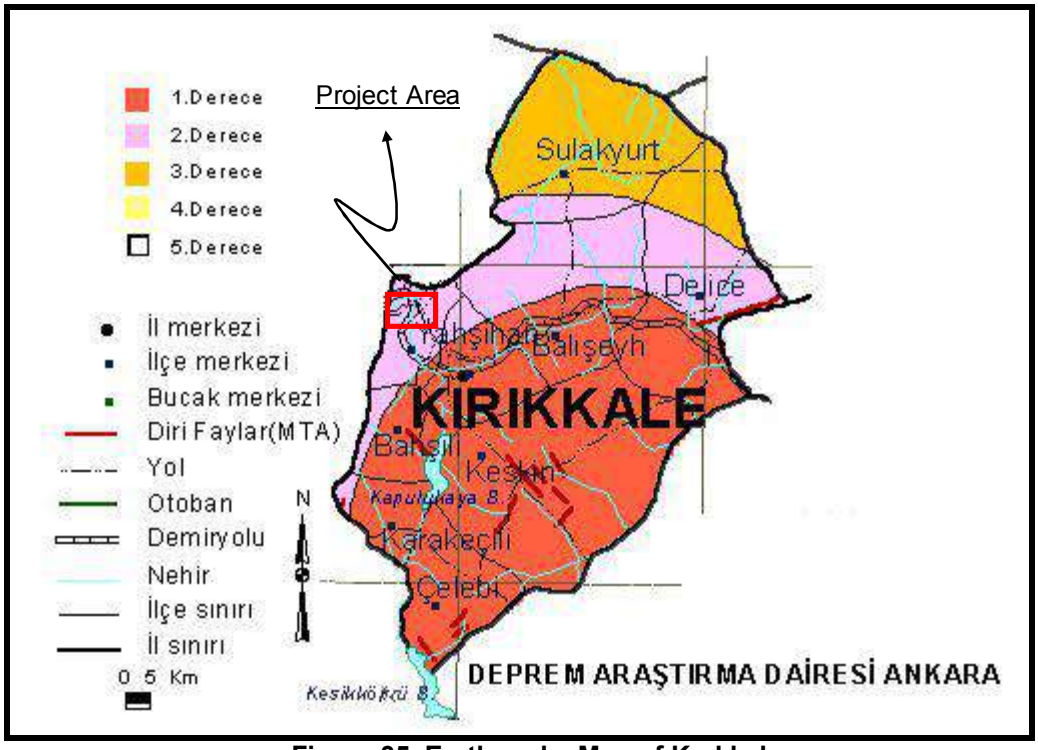


Figure 35. Earthquake Map of Kırıkkale

The project site is not included within the boundaries of the region exposed to disaster, all kinds of buildings under construction and 23,098 on 09/02/1997 (amendment: Official Gazette No. 26582 dated 14.07.2007) which was published in the Official Gazette "of Construction in Disaster Areas "Regulation, which was published in the Official Gazette dated 06.03.2007 and literal 26454 Building Code and the 7269 Earthquake" No. The active Disasters Therefore, Precautions and Aids in public Life "law provisions shall be complied with.

The Earthquake Risk of the Region

Kırıkkale never been in the center of major earthquakes but the Kırşehir Massive composed of magmatic and plutonic rocks takes place in the large arch of Kızılırmak river divided by multiple blocks by faults. The basins among these blocks were filled with Neogene aged deposits. Apart from the North Anatolian Fault Zone (KAF), these basins are the other belts, which could cause earthquakes in Central Anatolia. The Kırsehir Earthquake on 1938 was occurred along the one of these belts. Based on the Neotectonical system of Turkey, the south block of North Anatolian Fault Zone (KAF) is forced to move towards west. However Kırıkkale Province locates on the south block of KAF, right hand side Sungurlu Strike Slip fault comes close to the southern part of Kırıkkale Province which releases the pressure on the region **(Figure 36).**

The blue arrows on the map given in **Figure 36** show the possible pressure directions. The middle arrow towards North East represents the pressure releases around Kırıkklae District. This modeling could be the reason why Kırıkkale Province did not have large magnitude earthquakes in the history.

For units intended to be established under the project "Construction in Disaster Areas" and "Regulation Buildings Earthquake" Regulation on the principles to be obeyed.

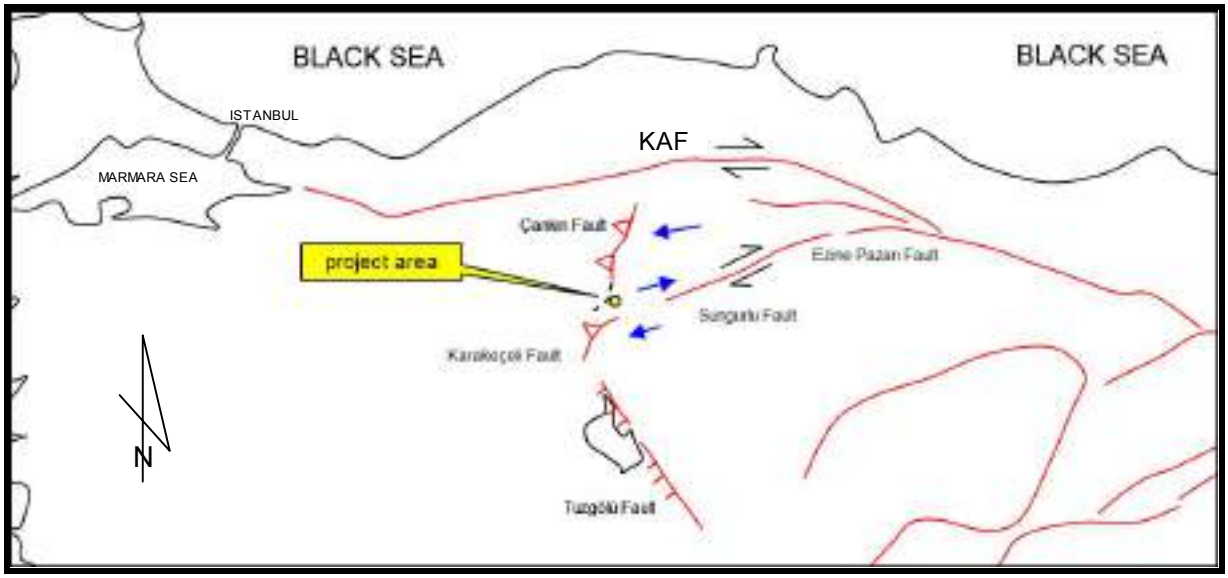


Figure 36. Movement directions of the active faults around Kırıkkale

Mass Movements (Slope Stabilities)

In the project area, there are no any restricted lands under the coverage of the law 7269 due to not having previous affection of any hazards. On the other hand, any mass movements in the area (like land slides, rock falls etc.) were not observed during the site study. However, the artificial and natural slopes would be designed during the construction periods in the areas classified as ÖA – 2.2 (Land need precautions for settlement). Necessary precautions will be applied in these particular areas, like proper retaining walls against potential slope stability problems.

IV.2.3 Hydrogeological properties (groundwater level, presently available caisson, deep artesian well etc. location and elevation of wells, litological characteristics, conductivity mass and geomechanics features, safe draw quantities, physical and chemical specifications of water; present and planned usage of groundwater, their distances and flow rates thereof)

Kırıkkale total water potential is 3,257.5 hm^3 / year as 3,250 hm^3 / year surface water plus 7.5 hm^3 / year groundwater.

There is no well at the project site.

Cooling water needed in the scope of the Project will be supplied from from the caisson wells to be opened near Kızılırmak River. At the studies carried out at the Project site and surrounding thereof it seems to open deep sounding well and take water wherefrom not possible due to there are no formations with aquifer property. By thinking this negative condition, it was foreseen, instead of geological surveys oriented to deep well, to make boring studies with sink shafts system.

Groundwater levels in the borehole SK-9 and SK-10 drilled inland section108 are measured as 2,00 m. The necessary cooling water for Natural Gas Combined Cycle Power Plant could be provided from caisson wells, which would be located in the map section 108. For this purpose, non - pressured water tests (permeability tests) were carried out in SK-9 and SK-10 boreholes, to determine the permeability coefficient and

the “k” values of Alluvial (Qal) sediments. The results of permeability tests are given in Table 26.

Table 26. Alluvium (Qal) Permeability Properties of Sediments

Drill No	Depth (m)	Permeability Coefficient K (cm/s)	Permeability Class
SK-9	1,50	$4,74 \times 10^{-2}$	Very Permeable
	4,00	$3,71 \times 10^{-2}$	Very Permeable
	6,00	$3,94 \times 10^{-2}$	Very Permeable
	8,00	$3,77 \times 10^{-4}$	Permeable
	12,00	$4,05 \times 10^{-5}$	Semi Permeable
	13,50	$3,12 \times 10^{-4}$	Permeable
SK-10	2,00	$2,90 \times 10^{-3}$	Very Permeable
	3,50	$1,64 \times 10^{-3}$	Very Permeable
	8,00	$2,78 \times 10^{-4}$	Permeable
	12,00	$1,26 \times 10^{-4}$	Permeable

The number and the capacity of the caisson wells could be estimated by using the data available and Darcy’s law.

$$Q = k \times i \times A$$

“Q” is flow rate, “k” is permeability coefficient, and “I” is hydraulic gradient in the equation above. A caisson well with 5-meter diameter and 10 meter deep is schematically shown in the drawings given in **Figure 37**. In addition, the geological data obtained from SK-9 borehole is shown on the same drawing (**Figure 37**).

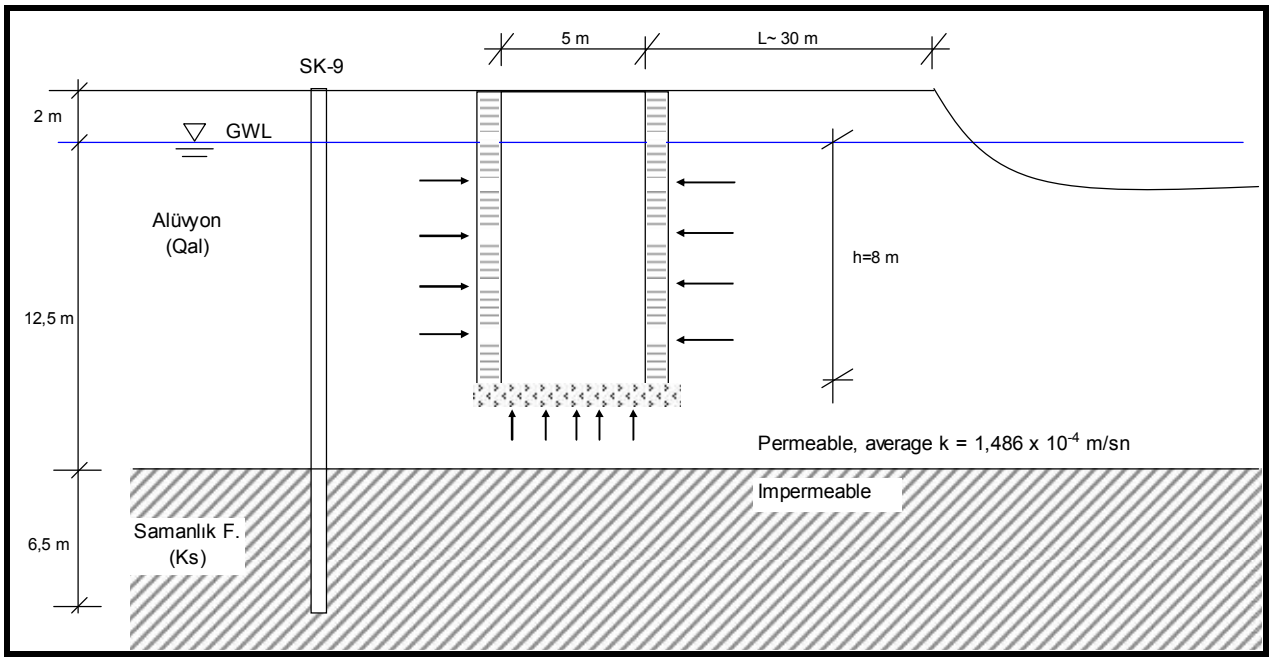


Figure 37. Approximate dimensions and position of a well, which could be excavated near to borehole SK-9.

Darcy equation could be written as it shown blow.

- $i = h/L$
- $A = \pi r^2 + 2 \pi r h$

$Q = \pi r^2 + 2 \pi r h \times (L/h) \times k$

$Q = 3.14 \times 6.25 + 2 \times 3.14 \times 2.5 \times 8 \times (8/30) \times 1.486 \times 10^{-4}$

$Q = 0.0976\ m^3/s = 97.6\ lt/s$

The flow rate capacity of the model-caisson well shown was calculated as 97.6 lt/s. Four or five caisson wells, located with safe distance between each other will prevent the wells from influenced drawdown curves by others. In this case, total well efficiency could be 400 lt/s. This much water will be sufficient for the power plant.

Opinion of General Directorate of State Hydroulic Works about the caisson wells are taken and presented at **Annex -1** as there is no drawback in using cassion wells.

Grondwater Levels at Drills

Apart from the one borehole, the groundwater is found at the different levels in 10 boreholes. The measured groundwater levels are listed below;

SK-1 :none
SK-2 :14.00 m
SK-3 :14.30 m
SK-4 :13.50 m
SK-5 : 9.80 m
SK-6 :12.00 m
SK-7 :12.00 m
SK-8 :12.50 m
SK-9 : 2.20 m
SK-10 : 2.10 m

The above distribution of groundwater depths on the land, the land elevation decreases and moves towards the east the Kızılırmak River bed, the water table approached the surface.

Groundwater Quality

In order to determine existing environmental conditions, samples from 2 different points were taken and analyzed by SEGAL Environment Measurement and Analysis Laboratory which is certified and authorized by TURKAK (Turkish Accreditation Institute) and Ministry of Environment and Urbanization. According to results, water quality of groundwater is classified as II. Class water in terms of conductivity, Nitrite Nitrogen, Fecal Coliform and Total Coliform. In terms of other parameters, quality is classified as I. Class Groundwater sample analysis results are presented in **Annex-6** and Section **IV.2.18**.

IV.2.4 Hydrological properties, (physical, chemical, bacteriological and ecological specifications of lakes, fishpond, stream and other wetlands, seasonal changes in this context, the coastal ecosystems)

Kızılırmak, that rises and flows into the sea within the boundaries of Turkey, as the biggest river, rises from the southern of Kızıldağ, at Sivas Province at the eastern of Central Anatolia, while that reaches to The Black Sea from Bafra cape passes through the Kırıkkale province as well. It is 1.355 km long. The stream of river that is fed from rain and snow water is irregular.

Towards the end of July, drop starts on the water surface continue until February and start to increase rapidly as of march. Some brooks and rivulets are added to the Kızılırmak delta where there are a lot of large and small lakes.

8 Dams are constructed on river. These are Sarıoğlan in the province of Kayseri, the Yamula Dam established at the Yemliha Town, the dams of Kesikköprü, Hirfanlı ve Kapulukaya near to Ankara, The Altınkaya and Derbent dams established at the Bafra plain and the Obruk Dam established last.

The other important water source of the Kırıkkale Province is the Delice River as one of the Kızılırmak branches. The most important water sources feeding the Delice River are Kanak, Kılıçözü and Budaközü. Their length through the Province is 50 km. Out of that; there is Çoruh Özü Brook that gives some help for Irrigation of agricultural areas along the route. That's length is 48 Km. According to the "Water Quality Research Report 2004 of the Kızılırmak Basin" that has been prepared by the Department of DSİ Drinking and Sewerage; the Çoruh Özü Brook has a quality class of IV, in terms of pollution elements causes spoiling of the quality of the Kızılırmak River at the boundaries of Kırıkkale

Further, the Balaban and Sarılıöz Brooks are connected near the Kılıçlar Town and forms the Orkun rivulet that is 13 km long flows into the Kızılırmak near the Irmak Town. Out of these streams, at the some brooks and rivulets are within the Kırıkkale Province. As an example to those the Ahılı Rivulet, Kuruçay Rivulet and Yeni Çıkan Rivulet may be given.

The Flow rates of the Kırıkkale Province take part in the following **Table 27**:

Table 27. The Flow Rates of Important Rivers and Areas in Kırıkkale Province

Name	Flow rate (hm^3/year)	Total (hm^3/year)	Area (ha)	Total (ha)
Kızılırmak River	2,500	3,250	595	669.7
Delice Creek	750		74.7	

Reference: Kırıkkale Province Environment Status Report

The Kapulukaya Dam pond is the biggest artificial pond in the Kırıkkale Province. That's distance to the Project Area is approximately 23 km. The lake volume of the Dam, which is earth fill dam type, at normal water level is 282.00 hm^3, and the lake area is 20.70 km^2. That meets the drinking and service water of the Kırıkkale Province. Beside, the Çipi and Danacı Bonds are the other ponds of the province.

According to the "Water Quality Research Report 2004 of the Kızılırmak Basin" that has been prepared by the Department of DSİ Drinking and Sewerage, according to 58 years long observation period, the current value is 75.7 m^3/sec at Kızılırmak Yahşihan, between 1938 and 1996. When it is reviewed in the terms of the variation of the NH_3-N polluter parameter; at the Kapulukaya dam outlet, the quality of water is 1st class while the same at the Çoruh Özü Rivulet taking domestic and industrial waste waters is quality IV.

At the Kızılırmak River - Yahşihan bridge that quality is II. Class Water.

In point of NO_2-N, the Kızılırmak River, at the generality of basin that has IV. Class quality.

In point of the PO_4 pollution; quality of the water at the Kapulukaya dam outlet is II. Class

And the water quality of the Kızılırmak River does not changed after The Çoruh Özü Rivulet, of which water quality is IV. Class, flows into the River, in terms of this parameter.

TDS change; at the Kapulukaya dam outlet, the water quality is quality is II. Class. Although the water of the Çoruh Özü Rivulet that receives the sewerage wastes of Kırıkkale is II. Class, that is saltier than the Kızılırmak River. The water of River, after Çoruh Özü and Balaban water sources have been flowed hereinto protects its II. Class water quality as well. One of the saltier branches of the River is the Delice River.

The most evident peculiarity of the Kızılırmak River is having salty water. In spite of River's water is soft and drinkable at its source, especially after Zara District, when the water bedding enters into the land with gypsum and salt, and flowing into of southern branches, and as a consequences thereof the composition varies on a large scale.

BOD5 change; at the Kapulukaya dam outlet in terms of this parameter, the quality of water is I. Class.

The closest surface water resource to the Project area is Kızılırmak River which takes place in 200 m distance.

In order to determine existing environmental conditions, samples from Kızılırmak River were taken and analyzed by SEGAL Environment Measurement and Analysis Laboratory which is certified and authorized by TURKAK (Turkish Accreditation Institute) and Ministry of Environment and Urbanization. According to results, Sample-1 is classified as II. Class water in terms of Nitrite Nitrogen, Mercury, Fecal Coliform and Total Kjeldahl Nitrogen. In terms of other parameters, Sample-1 is classified as I. Class water. Sample-2 is classified as II. Class water in terms of Conductivity, Dissolved Oxygen, Nitrate Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus Mercury, Fecal Coliform and Total Coliform. In terms of Nitrite Nitrogen, it is III. Class water and in terms of other parameters, Sample-2 is classified as I. Class water. Water sample analysis results are presented in **Annex-6** and Section **IV.2.18**.

IV.2.5 The living species in the watercourses in which cooling water will be supplied from and other features (natural characteristics of these species, species taken under protection with national and international legislation; reproduction, feeding, sheltering and living environments of these; the decisions for protection made related to these environments, wave movements, temperature, depth, salinity, etc.)

Cooling water will by no means be provided from any surface water in the scope of the Project. The closest wetland, Kızılırmak River, takes place 200 m east of the Project Area.

Detailed ecological studies, which are given in Ecosystem Assessment Report (See **Annex-7**) and in **Section IV.2.12**, have been carried out covering the profect field and its surroundings.

IV.2.6 Thermal and geothermal water resources (physical and chemical properties, flow rates, present and planned usages of these)

There are no thermal and geothermal water sources within Kırıkkale Provincial boundaries.

IV.2.7 Present and planned usage of surface water resources (river, stream, dam, lake, pond potable and irrigation water, electricity generation, types and amohnts of water products, tourism, sports and similar purposes of water and / or coastal uses, other uses)

The closest wetland, Kızılırmak River, takes place 200 m east of the Project Area. Kızılırmak River is used for power generation, drinking and industrial water supply.

Cooling water needed in the scope of the Project will be supplied from from the caisson wells to be opened near Kızılırmak River.

At the Region, there is “Köprükale Regulator and Hydroelectric Power Plant (HPP)” belonging to ALASAR HES Energy Construction Industry and Trade Electrical Manufacturing Company Limited. The Köprükale Regulator and HPP is located at the northeast of the said ACWA Power NGCCPP Project Site at approximately 1 km distance (**See Figure 38**). As it can be seen from **Figure 38,** the project area is located upstream of the dam and the projects does not have any conflict. For this reason said projects do not affect each other in a negative way.

Besides, at the end of the EIA Process, during the project construction or operation phases, in the event of the commencement of the construction of the Köprükale HEPP Project, by making things easier for the construction works mutual assistance would be ensured. Similarly, at the operation phase of the Köprükale HEPP Project, no adverse effect is experienced.

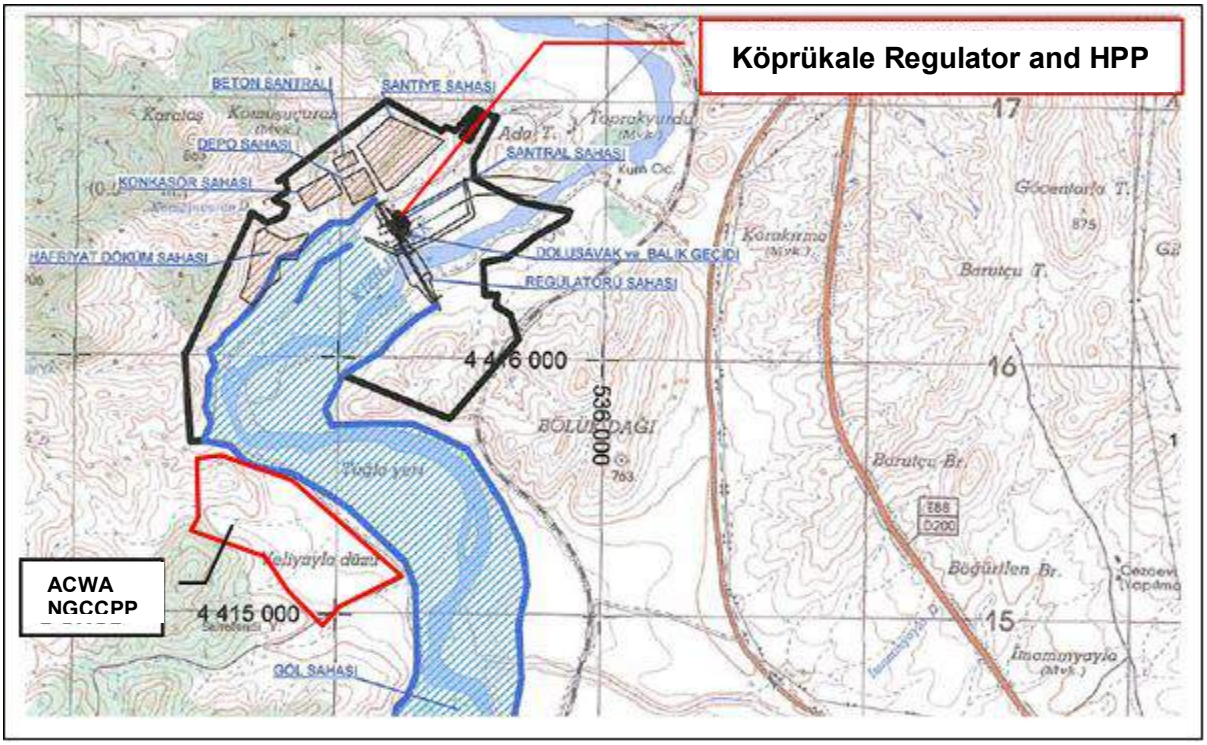


Figure 38. Position of Köprükale Regulator Project and Acwa Power Kırıkkale NGCCPP Project With Each Other

IV.2.8 Soil characteristics and usage (soil structure, classification of land usage, carrying capacity, hillside stability, lubricity, erosion, usage status of pasture, meadow and agriculture etc. used as the natural vegetation)

Soil of Kırıkkale Province consists of brown soils in general. These soils, which are brown or grayish on the surface are fine grained and disperse easily. Lime ratio is rather high. These are soils rich in minerals. Alluvial soils are found in the southern parts of the province on the riversides, and these constitute thick covers in places. Inclinations are very small. They are suitable for cropland agriculture and irrigated farming. The small amounts of precipitation in the area and dryness is an important factor in the formation of the soil.

According to the data of the Ministry of Agriculture and Village Affairs, the total area of Kırıkkale Province is 463.000 ha. Of this, 306.506 hectares are used for agricultural production. In other words, proportion of the land used for agricultural purposes to the total land is 66.2%. Among the land actively used for agriculture, the croplands have the biggest share. Classification and distribution of the lands of the province according to use are given in the table below.

Table 28. Class Distribution of the Agricultural areas in the Kırıkkale Province

District	Total Agricultural Area (ha)	Class I (ha)	Class II (ha)	Class III (ha)	Class IV (ha)
Merkez	25.078	-	15.078	8.000	2.000
Yahşihan	11.895	-	5.400	4.000	2.495

Reference: Environmental Status Report for Kırıkkale Province, 2006

The proportion of the land usable in agriculture constitutes 66.2% of the total land. Proportion of meadows and pastures is 15% (See **Table 30**).

Table 29. Land use in Kırıkkale Province

Land type	Area (ha)	%Ratio
Land usable in agriculture	306.506	66,2
Meadows and pastures	69.275	15
Forests and moors	44.694	9,7
Unused land (Rocky land, roads, etc.)	42.525	9,1
Total	463.000	100

Reference: Website of the Kırıkkale Provincial Governorship

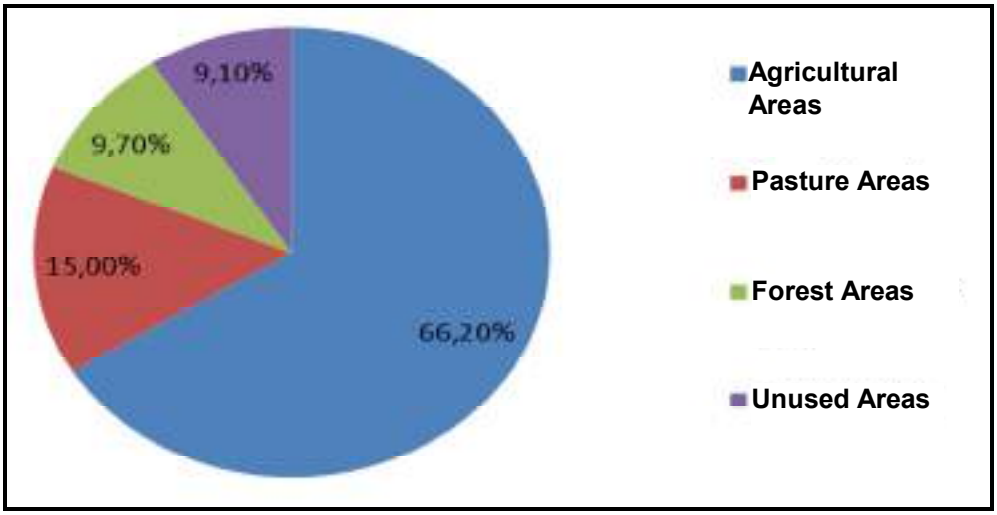


Figure 39. Distribution of the Land Use in Kırıkkale Province

Distribution of the land use of Yahşihan Sub Province, where the project area is located, is shown in graphic and table below. As we can see from these, 51.73% lands of Yahşihan Sub Province having total 155,000 da area are consisting of Agricultural Areas.

Table 30. Distribution of Land Use in Yahşihan District

Land Use Status	Area (da)	% Rate
Agricultural Areas	80.177	51,73
Pasture Areas	39.000	25,16
Forest Areas	18.700	12,06
Other	17.123	11,05
Total Surface Area	155.000	100

Reference: Website of Kırıkkale Provincial Agriculture Directorate

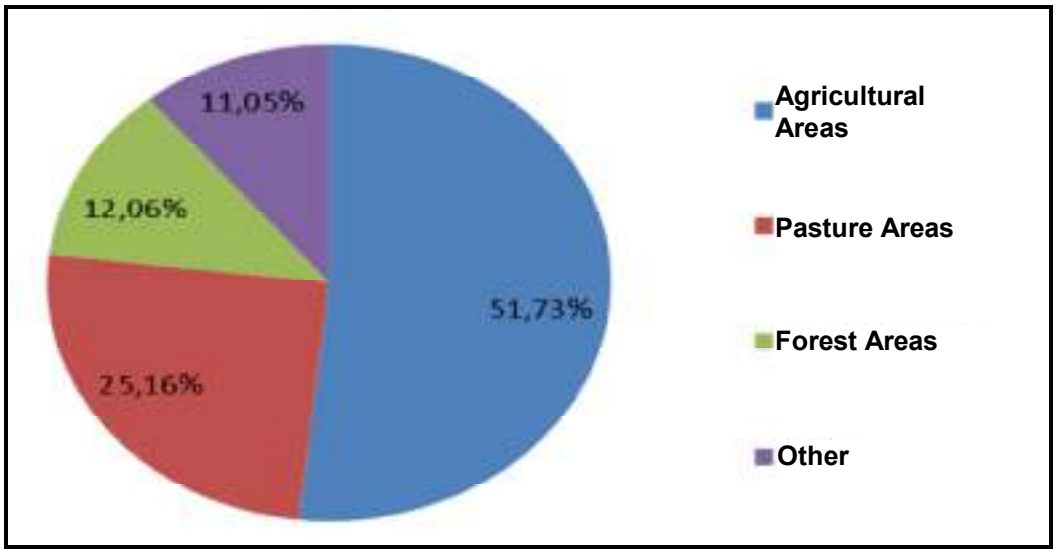


Figure 40. Distribution of Land Use in Yahşihan District

A baseline habitat and flora survey of the Power Plant site undertaken by Turkish ecologists has indicated that the habitat is uniform and the fora is comprised of widespread/common species. A site visit was undertaken by IFC and KEXIM on the 24th June 2014 accompanied by the Project Proponent, environmental advisors 5 Capitals and environmental consultants MGS. The Environmental team were able to confirm that the site is indeed uniform in structure, similar to adjacent farmland, and that the flora is dominated by

transient annual species introduced from locally disturbed ground. There is no indication of complex perennial habitat that is typical of natural habitat in the adjacent foothills. Based on the evidence, the Project Company, 5 Capitals and MGS have concluded that the area for the proposed power plant is not "natural habitat" but is "modified land" and it is likely that the land has been used for agricultural activities in the past, but has not been used for some years. Following construction of the power plant, remaining areas without hard landscape will rapidly return to the current habitat and floral community from the existing seed bank

The said activity area has the qualities of meadow-pasture according to the Land Asset Map given **Annex-2**'de and the Project field is composed of Reddish-brown soils with II. and IV. class characteristics.

There is no agricultural activity on project site. As per new updated information available to the project company most of the area belongs to govermental treasury but there is a small private ownership area. This area will be acquired and/or expropriated by direct negotiation or following the legal procedures according to Turkish expropriate law in forced.

Topsoil (vegetable soil) shall be scraped during land preperation in order to be used later in land arrangement. Scraped top soil shall be germinated to prevent the loss of its properties. Following the completion of the construction works, it will be used in landscaping works.

In the project impact area stated in Section IV.1, there exist mainly brown soils, reddish-brown soils, calcareous brown soils and colluvial soils.

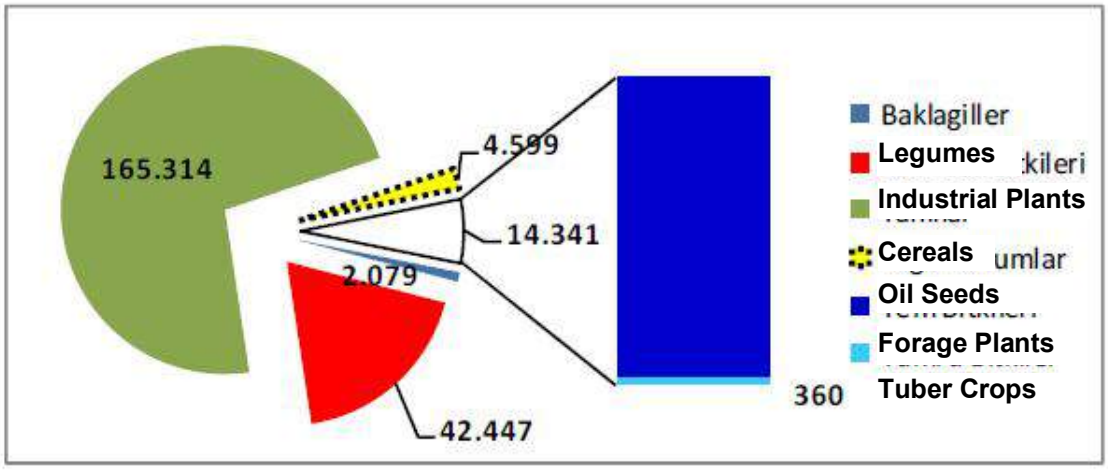
Soil samples taken from two points in the project area are analyzed by Segal Environmental Measurement and Analysis Laboratory and related Analysis Reports are given in **Annex-6** and **Section IV.2.18.**

IV.2.9 Agricultural areas, agricultural development project areas, size of the irrigated and dry agriculture areas, crop patterns and annual production amounts of these, place and economical value of these products in the state

In the lands of Yahşihan District of Kırıkkale Province including the project area, 51.73% have the qualities of agricultural area.

In Kırıkkale, various industrial plants, vegetables and fruits are grown, with crops like wheat and barley in the first place. Grapery has a special place in the region.

As of the year 2007, in the agricultural plants grown in Kırıkkale, crops come in the first place that cover the 60% of the total area with a plantation area amounting to.727.661 decares. This is followed by oilseeds (3.5%), feed plants (0.9%) and legumes (0.8%) respectively. In Kırıkkale, among tuber plants, only sugar beet is grown, and the plantation share of this industrial plant is extremely low



Reference: Kırıkkale Provincial Agricultural Directorate, 2009).

Figure 41. Distribution of Agricultural Products in Kırıkkale Province

Fruit gardens in Kırıkkale that fruits grown show diversity have a trend of decrease in the recent years. The area or fruit gardens that totaled to 43,830 decares in 1995 decreased to 41,900 decares in 1998, to 37,530 in 2000 and to 35,840 in 2005, and were as low as 30,896 decares in 2007. Although stone fruits and pome fruits maintain their position in fruit-growing in the province, nuts are also grown. Apart from these, grapery, which has a long history in the region, is also practiced in the region.

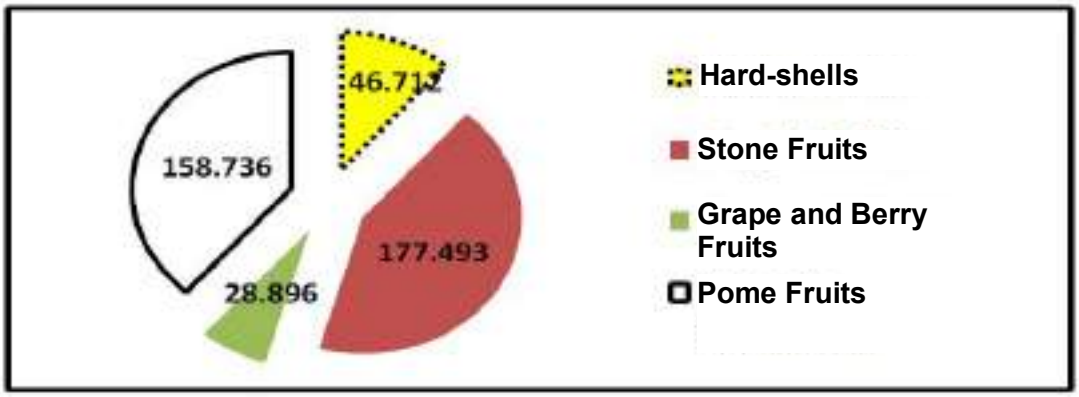


Figure 42. Distribution of Fruit Products of Kırıkkale Province

In the vegetable growing in the region, products more resistant against the cold weather of the winter are grown. Together with this, the vegetables grown in Kırıkkale are diverse as a result of the microclimatic conditions in particular. When evaluated in this respect growing of melon, watermelon in the first place, and also tomatoes, pepper (long green pepper, banana pepper), cucumber, spinach and eggplant dominate.

Irrigated agriculture is practiced on 25.40% of the agricultural land amounting to 80,177 da in total. Proportions of irrigated and non-irrigated agriculture in Yahisah District are given in the table below

Table 31. Sulu ve Kuru Tarım Dağılım Oranları

Characteristics of the land	Amount of land (da)	Percentage (%)
Amount of irrigated land	20,365	25.40
Amount of non-irrigated land	59,812	74.60
Total land	80,177	100

According to the distribution of agricultural products in Yahşihan District, it is observed that growing crops and vegetables come in the first place (**See Table 32**).

Table 32. Annual Production Amounts of the Agricultural Products in Yahşihan District

Agricultural Product	Production amount (da)
Crops	39,500
Legumes	375
Feed Plants	1,500
Industrial Plants	2,000
Vegetables	9,550
Fruits	1,252
Fallow	26,000

Reference: Provincial Agricultural Directorate

There are agricultural areas in the influence area of the Project in places, and meadows-pastures in places. Dry agriculture with fallowing is practiced in the majority of the land, watered agriculture and vegetable growing is practiced in a portion.

Project area is planned to be established on an area of approximately 185,480 square meters in Kırıkkale Province, Yahşihan District within the boundaries of Kılıçlar Municipality on block 102, parcel 2.

In addition, in the scope of the Project, provisions of Law on Protection of Soil and Land Use No: 5403, Pasture Law No: 4342, Water Products Law No: 1380 shall be complied and necessary permits will be taken before starting construction.

IV.2.10 Forest areas, size of forest areas, types and quantities of trees, amount of the land covered and closeness of the land, the existing or planned protection for these and/or purposes for use, if the project area does not take place in forest area, entry of the distance to the closest forest area from the project area, the stand structure map in 1/25,000 scale,

IV.2.10.1 Forest areas and size of forest areas

In the entire province, the total forest area is 51,222 ha, out of which 16,527 ha correspond to normal wood and 34,695 ha correspond to coppice. This rate contributes to 11.06% of Kırıkkale Province. If the area afforested between 1976 and end of 2004 totaling to 11,307 ha is included in this amount, the percentage of forests increase to 13.51%.

Table 33. Distribution of Forest in the Kırıkkale Province in 2006 according to Operation Modes

Forest Area	Wood		Coppice		Total Productive Forest (ha)	Total Spoiled Forest (ha)	Total Forest Area (ha)	Open Area	Total Area
	Normal (ha)	Degraded (ha)	Normal (ha)	Degraded (ha)					
Kırıkkale Province	5,817	10,710	1,603	31,401	7,420	43,801	49,531	486,926	536,457

Reference: Kırıkkale Forest Operations Chief Office

Before commencing the construction works, the landscape works will be performed on the activity area, and the construction works will be started after this. The excavation soil removed during the landscaping and construction works will be used in the filling works in the first place. Excavation soil shall not be deposited to forest areas. No trees will be cut in the project area.

The required tolls to be used against any possible fires shall be kept in the activity area. The required measured for the protection of fire shall be taken, and intervention of the firefighting vehicles to the fire within the shortest time possible shall be ensured. The personnel working in the operation and construction stages within the scope of ACWA NGCCPP project shall work in coordination with the teams of Regional Directorate of Forestry in case of any fire.

In the scope of the Project, permits shall be according to article 17 of Forest Act No:6831. And permit procedures shall be carried out in compliance with Circular No:2011/10 of General Directorate of Environmental Management.

Stand Map is prepared fort he Project site and given in **Annex-2**.

IV.2.10.2 Types of trees, closeness and stand map

According to Stand Map given in **Annex-2,** AgO and Z stand types are present in the Project area. AgO represents, treeless area where topsoil cleaning, soil tilling or terrace works are done however not trees are not yet planted. Z represents agricultural areas.

IV.2.11 Protection areas (National Parks, Nature Parks, Wetlands, Nature Monuments, Nature Protection Areas, Wildlife Protection Areas, Biogenetic Reserve Areas, Biosphere Reserves, Natural Sit and Monuments, Historical and Cultural Sits, Special Environmental Protection Areas, Tourism Areas and Centers, areas under the coverage of the Pastures Law)

Status of project area is given below in consideration of the frame of the Environmental Impact Assessment Regulations, Annex-V, Sensitive Areas published in the Official Gazette dated 17.07.2008 and numbered 26939;

1. Areas required to be protected pursuant to the legislation of our country

a) Within the project area, there are no National Parks, Nature Parks, Natural Monuments and Nature Conservation Areas, which are defined in Article 2 of the National Parks Law No. 2873, dated 09.08.1983 and are identified pursuant to Article 3 of this Law. .

b) Within the project area, there are no "Wildlife Development Areas" determined in accordance with the Terrestrial Hunting Law No. 4915, dated 01.07.2003.

c) Within Yahşihan District, areas defined as "Cultural Heritage, Natural Heritage, Conservation Area and "Protection Area" pursuant to sub-paragraphs 1, 2, 3, and 5 under paragraph (a) entitled as "Definitions" based on Article 3, paragraph 3 of the Law on the Protection of Cultural and Natural Heritage No. 2863, dated 21.07.1993, and pursuant to the relevant articles of the same Law No. 3386, dated 17.06.1987 (Law on the Amendment in some articles of the Law No. 2863 on the Protection of Cultural and Natural Heritage and the inclusion of some articles to this law) are given below with their distance to the project area.

Table 34. Cultural Heritages in Yahisan District

Cultural Heritage	Location	Distance to Project Area
Station building (Memorial Building)	Kılıçlar Municipality	3.7 km
Primary School (Memorial Building)	Kılıçlar Municipality	3.7 km
Station Building, Housing and Warehouse Buildings (Memorial Building)	Irmak Municipality	9.5 km

Cultural Heritage	Location	Distance to Project Area
Mahmutlar Village (Archaeological Sites)		6.5 km

d) Within the project area, there are no Water Products and Reproduction Areas within the scope of the Fisheries Law No. 1380, dated 22.03.1971.

Kızılırmak River, Delice River, Cinali Pond, Ahili Irrigation Pond and Beyobasi Pond located within the border of Kırıkkale Province are Water Products and Reproduction Areas within the scope of the Fisheries Law No. 1380, dated 22.03.1971.

Domestic and process orgininated wastewater generated from facilities of ACWA Power Kırıkkale NGCCPP shall only be discharged to the Kızılırmak River located 200 m from the facility after being treated according to the related provisions of the Water Pollution Control Regulations announced in the Official Gazette dated 31.12.2044 and numbered 25687.

Since the cooling system included in the activity scope will operate in a closed cycle, water shall be required at first and for once, and the losses from evaporation and blow-down water shall be supplemented. Since the cooling system is a closed cycle, no discharge from the closed-cooling system shall be drained to the Kızılırmak River. Therefore, no negative impacts are expected from the project on the Kızılırmak River.

e) Within the project area, there are no “Sensitive Pollution Regions” defined in Article 49 of the Regulation on Air Pollution Control”, which was issued in the Official Gazette No. 19269, dated 02.11.1986.

f) Within the project area, there are no areas deemed as “Specially Protected Areas” by the Council of Ministers pursuant to Article 9 of the Environmental Law No. 2872, dated 09.08.1983.

g) Within the project area, there are no areas protected under the Bosporus Law No. 2960, dated 18.11.1983.

h) Within the project area, there are areas considered as forest areas pursuant to the Forestry Law No. 6831, dated 31.08.1956. Regarding forestry areas to be used in the scope of the project, all necessary permits shall be obtained pursuant to the Forestry Law 6831 Article 17.

i) Within the project area, there are no areas having a coastal construction ban pursuant to the Coastal Law No. 3621, dated 04.04.1990.

j) Within the project area, there are no areas specified in the Olive-Growing and Grafting of Wild Varieties No. 3573, dated 26.01.1939.

k) For the areas specified in the Pasture Law No. 4342 dated 25.02.1998, necessary permissions from Provincial Directorate of Food, Agriculture and Livestock shall be taken.

l) For the areas specified in the Regulation on the Protection of Wetlands, which entered into force after being published in the Official Gazette No. 25818, dated 17.05.2005, “Activity Permission for Wetlands” shall be taken

2. Areas required to be protected pursuant to international conventions to which our Country is a party.

a) Within the project area, there are no conservation areas I and II stated in the "Reproduction Areas of Important Sea Turtle Species" that are taken under protection under the "Treaty for the Conservation of the European Wildlife and Habitat" "the BERN Treaty" that was put into force by being published in the Official Gazette dated 20/2/1984 and numbered 18318, "Habitat and Reproduction Areas of Mediterranean Seal".

b) Within the project area, there are no conservation areas taken under protection under the "Treaty for the Conservation of Mediterranean Against Pollution" (Barcelona Treaty) that was put into force by being published in the Official Gazette dated 12/6/1981 and numbered 17368.

ı) Within the project area, there are no such areas determined as the "Special Conservation Areas" in our country according to the "Protocol Related to the Protection of Special Conservation Areas in the Mediterranean" published in the Official Gazette dated 23/10/1988 and numbered 19968.

ıı) Within the project area and its surroundings, there no such areas included in the "100 Coastal Historical Sit Areas with Common Importance in the Mediterranean" selected according to the Geneva Declaration dated 13/9/1985 and published by the United Nations Environmental Program.

ııı) Within the project area, there no such coastal areas as the habitat and feeding areas of "Sea Species Facing the Risk of Extinction" stated in the article 17 of the Geneva Declaration.

c) Within the project area, there are no cultural, historical and natural areas given a status of "Cultural Heritage and Natural Heritage" that are under protection by the Ministry of Culture in accordance with articles 1 and 2 of the "Convention for the Protection of the World Cultural and Natural Heritage", which entered force after being published in the Official Gazette No. 17959, dated 14.02.1983.

d) Within the project area, there are no such areas taken under protection according to the "Treaty for the Conservation of Wetlands with International Importance as the Habitat of the Water Birds in Particular" (the RAMSAR Treaty) put into force by being published in the Official Gazette dated 17/05/1994 and numbered 21937.

e) Within the project area, there are no such areas that must be protected according to the European Landscape Treaty put into force by being published in the Official Gazette dated 27/7/2003 and numbered 25181.

3. Areas required to be protected

a) Areas determined as to be protected in existing features and having a prohibition for construction (biogenetic reserve areas, geothermal areas, etc. which of the natural features must be protected): On the project site and its immediate vicinity, there are no biogenetic reserve areas and geothermal areas of which the natural character needs to be protected.

b) Agricultural Areas: Agricultural development areas, areas that are or can be watered, and areas included in land usability classes of I, II, III and IV, classes I and II used in precipitation-dependent agriculture and the entire portion of the special crop plantation areas: Project area takes place on forest area.

c) Wetlands: The wetland of the Kızılırmak River is at 200 m east of the project area.

d) Lakes, rivers, gorundwater processing areas: While there are no lakes or groundwater processing areas within and around Project area, the closest river is Kızılırmak River at about 200 m east from border of the project.

f) There are no Areas that are the habitats of the species that are important for scientific researches and/or under current or possible risk of extinction and species that are endemic for our country, biosphere reserves, biotopes, biogenetic reserve areas, areas with unique or geomorphologic formations within the project area.

IV.2.12 Flora and Fauna (species, particularly the local endemic species, animal species living in the area naturally, species taken under protection according to national and international legislation, rare species and those under the risk of extinction and their habitats, names, populations of the hunted animals and the decisions of the central hunting committee related to these animals), defining the study method, showing the vegetation types in the project area on a map. The measures to be taken required for the living beings that will be affected from the project and works (in the construction and operation stages). Performing the vegetation studies in the field in the period of vegetation and stating this period

FLORA

Project site is in B4 square according to Davis grid system (Flora of Turkey and the East Aegen Islands) **(Figure 42).**

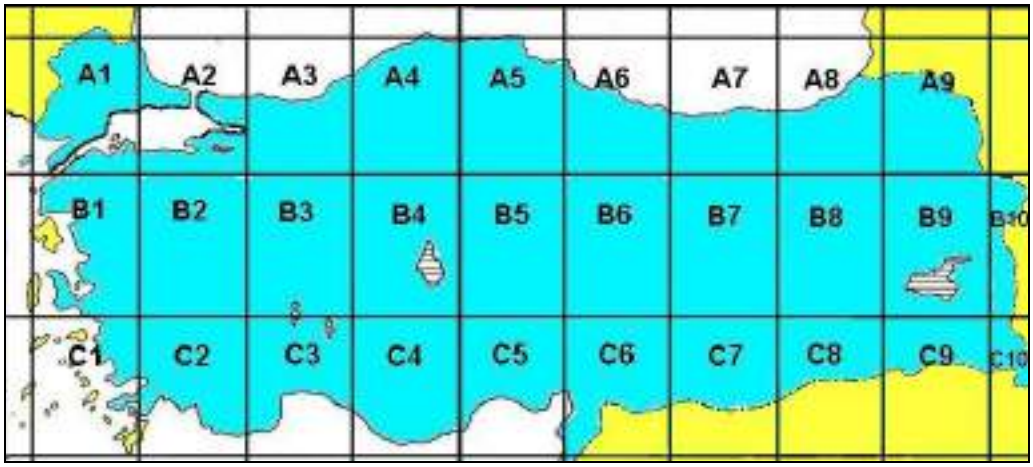


Figure 43. Davis'in Grid System

Vegetation

Within the project area and its surroundings, primarily riparian and steppe vegetation have been identified. Some of the characteristic species of riparian vegetation are;

Tamarix smyrnensis, Plantago lanceolata, Populus alba, Thypha shuttlewortii, Lythrum salicaria and Salix alba.

As for the steppe vegetation, the Arthemisia absinthium, Eryngium campestre variety are being represented with virens, Centaurea virgata, Medicago sativa, Teucrium polium,

Hordeum bulbosum, Bromus sterilis, Poa bulbosa, Aegilops umbellulata subsp. umbellulata, Stipa holosericea, Koelaria cristata and the taxa like Peganum harmala.

Dominant plant types along the coastline of creek are Populus alba, Tamarix smyrnensis and Salix alba.

Particularly the taxa like Lythrum salicaria, Salix alba and Thypha schutlteworth are water – dependent yet, due to possessing wide – spread species, any danger related to the future of taxa is not in question. Furthermore, when it is considered that the project area is at a 200 – meter distance from the Kizilirmak River, there exists no danger in terms of specifically for the water – dependent plant types.

Floristcal Structure

In consequence of the site surveys we have conducted, **133** species and subspecies of taxa belonging to **32** families have been identified from the site. At the project site, there are **25** taxa belonging to Irano-Turanian phytogeographical region, **16** taxa pertaining to Euro-Siberian phytogeographical region and **7** taxa pertaining to Mediterranean phytogeographical region. Great majority of the species identified are of quite widespread and cosmopolitan (85) (Figure – 44). **5** of the species identified from the region are endemic for our country.

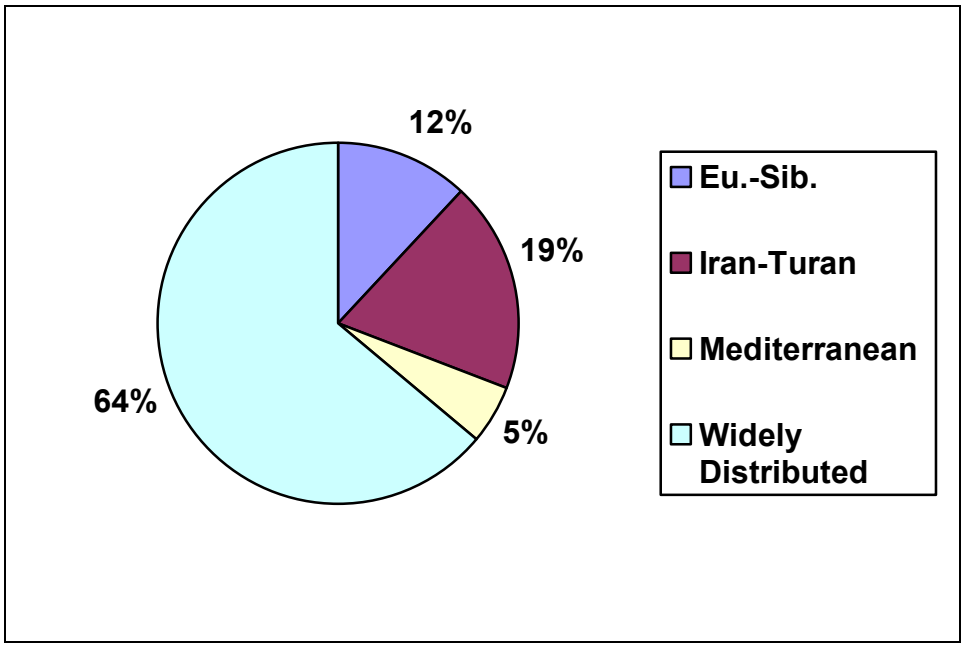


Figure 44. Phytogeographical Regions – Based Taxa Distribution

State of Plants from the Aspect of Hazard Class and Endemism at the Site

5 of **133** taxa identified from the site are contained within the endemic and LC (The least concerned) hazard category (Table – 35). For this reason, although a loss of some of these widespread endemic species shall be experienced individually as a result of the activity within the site, these species are at the recoverable level in time.

Table 35. Endemic Taxa and Hazard Categories

Endemic Taxa	IUCN Categories
Alyssum pateri Nyar subsp. *pateri*	**LC**
Astragalus lycius Boiss.	**LC**
Phlomis pungens Willd. var. *pungens*	**LC**
Scutellaria orientalis L. subsp. *pectinata* (Bentham) Edmondson	**LC**
Wiedemannia orientalis Fisch. & Mey.	**LC**

***LC**: The least concerned*

The list of flore at project site and close area is presented at **Table 36**.

Table 36. Flora List

FAMILYA	NO	NAME OF SPECIES	TURKISH NAME	PHYTOGEOGRAPHIC	ENDEMISM		IUCN
				REGION	R	W	
ACANTHACEAE	1	Acanthus hirsutus Boiss.	Ayı pençesi	Widespread			
APIACEAE	2	Bifora radians M.Bieb.	Küçük kişniş otu, yabani kişniş	Euro-Siberian			
	3	Eryngium campestre L. var. virens Link	Şeker dikeni	Widespread			
	4	Falcaria vulgaris Bernh.	Kaz ayağı	Widespread			
	5	Ferula szowitsiana DC.	Baldıran	Irano-Turanian			
	6	Torilis arvensis (Huds.) Link subsp. arvensis	Derecikotu	Widespread			
ASTERACEAE	7	Achillea wilhemsii C. Koch	Civanperçemi, yavşan	Widespread			
	8	Anthemis tinctoria L. var. tinctoria	Sarı papatya	Widespread			
	9	Artemisia absinthium L.	Pelin	Widespread			
	10	Carduus nutans L. subsp. leiophyllus (Petr.) Stoj. & Stef.	Deve dikeni	Irano-Turanian			
	11	Carduus pycnocephalus L. subsp. albidus (Bieb.) Kazmi	Eşek dikeni	Widespread			
	12	Carthamus lanatus L.	Yünlü aspir	Euro-Siberian			
	13	Carlina vulgaris L.	Domuzdikeni	Irano-Turanian			
	14	Centaurea carduuiformis DC. subsp. carduuiformis var. carduuiformis	Peygamber çiçeği	Widespread			
	15	Centaurea depressa Bieb.	Acımık	Widespread			
	16	Centaurea solstitialis L. subsp. solstitialis	Zerdali dikeni	Widespread			
	17	Centaurea virgata Lam.	Çubuklu peygamber çiçeği	Euro-Siberian			
	18	Chardinia orientalis (L.) O. Kuntze	*	Widespread			
	19	Cirsium lappaceum (Bieb.) Fischer subsp. lappaceum		Widespread			
	20	Cnicus benedictus L. var. benedictus	Şevketibostan	Widespread			
	21	Crepis alpina L.	*	Euro-Siberian			
	22	Crepis foetida L. subsp. rhoedifolia (Bieb.) Celak	Kohum	Irano-Turanian			
	23	Crepis sancta (L.) Babcock	*	Irano-Turanian			
	24	Crupina crupinastrum (Moris) Vis.	*	Widespread			
	25	Echinops viscosus DC. var. bithynicus (Boiss.) Rech. fil	Sakız dikeni	Widespread			
	26	Lactuca serriola L.		Widespread			

FAMILYA	NO	NAME OF SPECIES	TURKISH NAME	PHYTOGEOGRAPHIC	ENDEMISM		IUCN
	27	Onopordum acanthium L.	Galagan, kenger	Widespread			
	28	Onopordum bracteatum Boiss. et Heldr var. bracteatum	Kaluğan, kangal, kangal dikeni	Widespread			
	29	Pilosella piloselloides (Vill.) Sojak subsp. megalomastix (NP)Sell & West	*	Widespread			
	30	Senecio vernalis Waldst. & Kit.	Ekin otu	Widespread			
	31	Tragopogon longirostris Bisch. ex Schultz Bip. var. longirostris	*	Widespread			
	32	Xeranthemum annum L.	Dağ karanfili	Mediterranean			
BORAGINACEAE	33	Anchusa azurea Miller var. azurea	Sığır dili, güriz	Widespread			
	34	Cerinthe minor L. subsp. auriculata (Ten.) Domac	Mum çiçeği	Widespread			
	35	Echium angustifolium Miller	Sığırdili	Mediterranean			
	36	Echium italicum L.	Kurt kuyruğu	Euro-Siberian			
	37	Moltkia coerulea (Willd.) Lehm.	Anadolu taşkesenotu	Euro-Siberian			
	38	Onosma tauricum Pallas ex Willd. var. tauricum	Emzik otu	Euro-Siberian			
BRASSICACEAE	39	Alyssum pateri Nyar subsp. pateri	*	Widespread		X	LC
	40	Cardaria draba (L.) Desv. subsp. chalepensis (L.) O.E. Schulz	Kedi otu	Mediterranean			
	41	Crambe orientalis L. var.orientalis	*	Euro-Siberian			
	42	Descurainia sophia (L.)Webb ex Prantl	Süpürge otu	Euro-Siberian			
	43	Erysimum crassipes Fisch. & Mey.	*	Widespread			
	44	Hirschfeldia incana (L.) Lag.-Foss.	*	Widespread			
	45	Malcolmia africana (L.) R.Br.	*	Widespread			
CARYOPHYLLACEAE	46	Agrostemma githago L.	Buğday çiçeği, buğday karamuğu, ekin ebesi	Widespread			
	47	Gysophila libanotica Boiss.	*	Widespread			
	48	Silene conoidea L.	İtalyan yapışkan otu	Widespread			
	49	Silene dichotoma Ehrh. subsp. dichotoma	*	Widespread			
	50	Silene spergulifolia (Desf.) Bieb.	*	Widespread			
CHENOPODIACEAE	51	Beta lomatogona Fisch. & Mey.	Ala pancar, dağ pancarı	Euro-Siberian			
CISTACEAE	52	Helianthemum ledifolium (L.) Miller var. microcarpum Willk.	*	Widespread			

FAMILYA	NO	NAME OF SPECIES	TURKISH NAME	PHYTOGEOGRAPHIC	ENDEMISM		IUCN
CONVOLVULACEAE	53	Convolvulus arvensis L.	Tarla sarmaşığı	Widespread			
ELAEAGNACEAE	54	Elaeagnus angustifolia L.	Kuş iğdesi, yabani iğde	Widespread			
EUPHORBIACEAE	55	Euphorbia macroclada Boiss.	Sütleğen	Widespread			
FABACEAE	56	Astragalus brachypterus Fisch.	*	Widespread			
	57	Astragalus lycius Boiss.	*	Euro-Siberian		X	LC
	58	Astragalus microcephalus Willd.	Boz geven, kara geven	Euro-Siberian			
	59	Coronilla varia L. subsp. varia	Renkli burçak, Körigen	Euro-Siberian			
	60	Genista sessilifolia DC.	Borcak çalısı	Widespread			
	61	Lathyrus digitatus (Bieb.) Fiori	*	Widespread			
	62	Medicago lupulina L.	Şerbetçiotu yoncası	Widespread			
	63	Medicago radiata L.	*	Irano-Turanian			
	64	Medicago sativa L.	Çevrince	Widespread			
	65	Melilotus officinalis (L.) Desr.	Eşek yoncası, sarı yonca	Widespread			
	66	Onobrychis altissima Grossh.	*	Widespread			
	67	Onobrychis armena Boiss. & Huet.	*	Widespread			
	68	Trifolium hirtum All.	*	Mediterranean			
	69	Trigonella brachycarpa (Fisch.) Morris	Topbaş çemen	Irano-Turanian			
	70	Trigonella courelescens (Bieb.) Hal.	Devre otu	Irano-Turanian			
	71	Trigonella fischeriana Ser.	*	Irano-Turanian			
	72	Trigonella monantha C.A. Meyer subsp. monantha	*	Irano-Turanian			
	73	Trigonella monspeliaca L.	Akdeniz çemeni	Mediterranean			
	74	Trigonella velutina Boiss.	*	Irano-Turanian			
GERANIACEAE	75	Erodium ciconium (L.) L'Herit	*	Widespread			
GLOBULARIACEAE	76	Globularia orientalis L.	Doğu demir omcası	Irano-Turanian			
HYPERICACEAE	77	Hypericum scabrum L.	Kepir otu, mayasıl otu	Irano-Turanian			
LABIATAE	78	Acinos rotundifolius Pers	*	Widespread			
	79	Ajuga chamaepytis (L.) Schreber subsp. chia (Schreber) Arcangeli var. ciliata Briq.	Yer çamı	Widespread			
	80	Marrubium parviflorum Fisch. & Mey. subsp. parviflorum	*	Widespread			

FAMILYA	NO	NAME OF SPECIES	TURKISH NAME	PHYTOGEOGRAPHIC	ENDEMISM		IUCN
	81	Phlomis pungens Willd. var. pungens	*	Widespread		X	LC
	82	Salvia ceratophylla L.	*	Irano-Turanian			
	83	Salvia viridis L.	Ada çayı	Mediterranean			
	84	Scutellaria orientalis L. subsp. pectinata (Bentham) Edmondson	Kaside otu	Irano-Turanian		X	LC
	85	Stachys cretica L. subsp. anatolica Rech. Fil.	*	Widespread			
	86	Teucrium polium L.	Acı yavşan	Widespread			
	87	Thymus sipyleus Boiss. subsp. sipyleus var. sipyleus	Dağ çayı	Widespread			
	88	Wiedemannia orientalis Fisch. & Mey.	Ballıbaba, Sormuk otu	Irano-Turanian		X	LC
	89	Ziziphora capitata L.	Dağ reyhanı	Irano-Turanian			
	90	Ziziphora clinopodioides Lam.	Keklik otu, kır nanesi	Widespread			
	91	Ziziphora tenuior L.	Nane ruhu	Irano-Turanian			
LILIACEAE	92	Allium scorodoprasum L. subsp. rotundum (L.) Stearn	Taş sarımsağı, köpek sarımsağı	Euro-Siberian			
LYTHRACEAE	93	Lythrum salicaria L.		Widespread			
MALVACEAE	94	Alcea biennis Waldts. & Kit.	Gülfatma, Hatmi çiçeği	Widespread			
PAPAVERACEAE	95	Papaver rhoeas L.	Gelincik	Widespread			
PLANTAGINACEAE	96	Plantago lanceolata L.	Yılandili, yılan otu	Widespread			
PLUMBAGINACEAE	97	Limonium bellidifolium (Gouan)Dumort.	*	Euro-Siberian			
	98	Plumbago europea L.	Diş otu, Döven otu, Keler otu	Euro-Siberian			
POACEAE	99	Aegilops umbellulata Zhukovsky subsp. umbellulata	*	Widespread			
	100	Aegilops squarrosa L.	*	Widespread			
	101	Aegilops triuncialis L. subsp. triuncialis	Çayır otu	Widespread			
	102	Avena sativa L.	Yulaf	Widespread			
	103	Briza humilis Bieb.	Başlıklı zembilotu	Widespread			
	104	Bromus japonicus Thunb. subsp. japonicus	*	Widespread			
	105	Bromus sterilis L.	Kıraç çayırı	Widespread			
	106	Bromus tomentellus Boiss.	*	Irano-Turanian			
	107	Chrysopogon gryllus (L.) Trin. subsp. gryllus	*	Widespread			

FAMILYA	NO	NAME OF SPECIES	TURKISH NAME	PHYTOGEOGRAPHIC	ENDEMISM		IUCN
	108	Cynodon dactylon (L.)Pers var. villosus Regel	Ayrık otu	Widespread			
	109	Echinaria capitata (L.) Desf.	Kirpi otu	Widespread			
	110	Festuca sclerophylla Boiss. ex Bischaff	*	Irano-Turanian			
	111	Hordeum murinum L. ssp. leparinum (Link) Arc. var. Simulens Bowden	Pisipisi otu	Irano-Turanian			
	112	Hordeum bulbosum L.	Yumrulu arpa	Widespread			
	113	Koeleria cristata (L.) Pers.	Sorguçlu gümüşotu	Widespread			
	114	Poa bulbosa L.	Yumrulu salkım otu	Widespread			
	115	Secale cereale L. var. cereale	Çavdar	Widespread			
	116	Stipa holosericea Trin.	*	Irano-Turanian			
	117	Stipa lessingiana Trin. & Rupr.	*	Widespread			
	118	Taeniatherum caput-medusae (L.) Nevski subsp. crinitus (Schreber) Melderis	*	Widespread			
POLYGALACEAE	119	Polygala vulgaris L.	Süt otu	Widespread			
RESEDACEAE	120	Reseda lutea L. var. lutea	Gerdanlık	Widespread			
ROSACEAE	121	Potentilla recta L.	Dikparmak otu	Widespread			
	122	Sanguisorba minor Scop. subsp. Minor	Kelek otu	Widespread			
RUBIACEAE	123	Cruciata articulata (L.) Ehrend.	*	Irano-Turanian			
	124	Galium incanum Sm. subsp. elatius (Boiss.) Ehrend.	*	Widespread			
	125	Rubia tinctorum L.	Kök boya	Irano-Turanian			
SALICACEAE	126	Populus alba L.	Kavak	Widespread			
	127	Salix alba L.	Söğüt	Widespread			
SCROPHULARIACEAE	128	Linaria chalepensis (L.)Miller var.chalepensis	*	Mediterranean			
	129	Verbascum cherianthifolium Boiss. var. cherianthifolium	Sığır kuyruğu	Widespread			
	130	Veronica multifida L.	*	Irano-Turanian			
TAMARICACEAE	131	Tamarix smyrnensis Bunge.	Ilgın	Widespread			
THYPHACEAE	132	Thypha schutlteworthii W. D. J. Koch & Sond.	Kamış	Widespread			
ZYGOPHYLLACEAE	133	Peganum harmala L.	Üzerlik	Widespread			

FAUNA

In a general sense, project areas consist of agricultural, steppe lands and wetlands. The site constitutes a natural habitat for a great deal of species pertaining to Amphibians, Reptilia, Aves and Mammalia classes of the vertebrate animals. The highest rate of species with 71% belongs to the birds and this is followed by the reptiles' rate of 13% and mammals' rate of 12%. As for the amphibian species are represented by 3 species in the area which points out a 4% - percentage.

The amphibians are comprised within Caudata and Anura groups. Caudata group is the group covering the tailed amphibians (salamanders). Among the salamanders, there are terrestrial and aquatic species. As the species of this class are cold-blooded, they generally show activity starting from the spring months and remain inactive under the bottom mud of water or soil in cold season. Anura group covers the tailless amphibians (frogs) and the frogs are found in two groups like land and water frogs in our country. Land and water frogs exist at the project site and in its immediate surroundings.

The amphibian species likely to be present at the project site and in its immediate surroundings have been probed and these organisms are represented by 3 types in the area. All amphibians identified at the study area have been determined by IUCN as LC Common-The Least Concern. The species of amphibian have not been come across at the project area.

Reptile species, Testudines and Squamata are the species belonging to 2 groups of Reptillia class. Testudines from these groups comprise the species of turtle; also the turtles are divided into two groups, the terrestrial and aquatic species. Similarly, there are species which have adapted to the fresh water biotopes also in the aquatic species. As for Squamata, it covers the species of lizards and snakes.

Almost all of the species of reptile likely to be available at the project site and in its immediate surroundings are in LC Common – Least Concern category and from the species being dominant and widespread in Turkiye. also according to the Decision of Hunting Period Central Hunting Commission published every year, all of the species scrutinized have been taken under Preservation by the Ministry pursuant to Article – 5 (Law no. 4915, Clause – 4, Subparagraph – 1). Hunting of hunt animals taken under Preservation, keeping them alive or dead and transport are prohibited. The species of endemic reptile have not been come across at the project site.

According to the immigration status of the terrestrial and aquatic biotopes identified at the project site and its immediate surroundings and around along Kizilirmak River and the area where the power plant shall be built, it is possible to seasonally come across following bird species;Local, Summer migrants, Winter migrants. The reproduction of local birds and summer migrant birds in these groups takes place in the vicinity of the line. In general, the field birds, songbirds, and terrestrial forms are dominantly found in the area. Furthermore, the presence of daytime predators and the water edge – hunted and lived birds are in question as well.

Besides nestling local reproduction birds in great numbers within this region, rather scant workspace will reduce the influence of project operations to the migratory birds to minimum level.

As a result of the works executed around the project area, it may be said that structures looking like cages and the like for nesting by the bats are not available and those ones observed or potential species in the locality are the ones coming from the settlements

or remote rocky areas for feeding. Accordingly, it has been seen that almost all of the species identified from the area are in “LC” namely “Common Species” category according to IUCN Red List. Other than the species enumerated herein, other mammal species might be randomly seen in the field.

The mammals that are potentially available at the project area and its immediate surroundings have been studied and almost all of these organisms have been identified to be LC and Common – Least Concern according to IUCN. The species of Vulpes vulpes (Kızıl Tilki) is included in the hunt animals category allowed to be hunted by Article – 6 of Central Hunting Commission decision during hunting is free during 2013 – 2014 hunting period from the hunt animals by the Ministry pursuant to law no. 4915, Clause 4, Subparagraph – 1. The species of endemic animals have not been come across at the project site.

Table 37. The Red List categories for the species under protection according to IUCN

EX (Extinct)	Extinct taxon
EW (Extinct in the wild)	Taxon extinct in the wild
CR (Critically Endangered)	Taxon critically endangered
EN (Endangered)	Taxon endangered
VU (Vulnerable)	Taxon vulnerable to extinction in the wild
NT (Near Threatened)	Taxon under near threaten
LC (Least concern)	Widespread taxon with high population (Low risk)
DD (Data deficient)	Taxon with insufficient data for an assessment of extinction danger according to spread and/or population (Deficient data)
NE (Not Evaluated)	Taxon not evaluated

Birds, mammals, reptiles and amphibians which live or likely to live in the field of activity are presented at **Table 38**, **Table 39**, **Table 40** and **Table 41**.

Table 38. Amphibians

Group / Family	Species and Turkish name	Habitat	Preservation Statue	
			Bern	IUCN
Anura/ Bufonidae	Bufo bufo Siğilli Kurbağa	In the regions with little vegetation and moist rocky zones or wooded sections (up to 3000 m)	III	LC
Anura/ Bufonidae	Bufo viridis (Pseudepidalea viridis) Gece Kurbağası	By the stream edge – intensive moist soils	III	LC
Anura/ Ranidae	Rana ridibunda (Pelophylax ridibundus) Su Kurbağası	In the pools, lakes and with abundant vegetation and slow – flowing waters and mostly in the waters across the very low ones in the waters of plains (up to 2500 m)	III	LC

Table 39. Birds

No	Scientific Name Group/Family/Species	Turkish Name	Preservation Statue		Immigration State
			Bern Annex	IUCN	
Ciconiiformes/Ciconiidae					
1	Ciconia Ciconia	Leylek	II	LC	Reproduction in Summer
FALCONİFORMES/ACCİPİTRİDAE					
2	Buteo Rufinus	Kızıl Şahin	II	LC	Winter migrants
3	Buteo Buteo	Şahin	II	LC	Local
4	Accipiter Nisus	Atmaca	II	LC	Local
5	Accipiter Brevipes	Yoz Atmaca	II	LC	Summer Migrants
6	Falco Tinnunculus	Kerkenez	II	LC	Local
7	Falco Naumanni	Küçük Kerkenez	II	VU	Reproduction in Summer
8	Falco Columbarius	Boz Doğan	II	LC	Winter migrants
COLUMBİİFORMES/COLUMBİDAE					
9	Columba Livia	Kaya Güvercini	III	LC	Local
STRİGİFORMES/ TYTONİDAE					
10	Tyto Alba	Peçeli Baykuş	II	LC	Local
STRİGİFORMES/STRİGİDAE					
11	Athene Noctua	Kukumav	II	LC	Local
APODİFORMES/APODİDAE					
12	Apus Apus	Ebabil	III	LC	Summer Migrants
CORACİİFORMES/CORACİİDAE					
13	Coracias Garrulus	Gökkuzgun	II	NT	Summer Migrants
PASSERİFORMES/ALAUDİDAE					
14	Alauda Arvensis	Tarlakuşu	III	LC	Local
15	Galerida Cristata	Tepeli Toygar	III	LC	Local
PASSERİFORMES/HİRUNDİNİDAE					
16	Hirundo Rustica	Kır Kırlangıcı	II	LC	Summer Migrants
17	Delichon Urbicum	Ev Kırlangıcı	II	LC	Summer Migrants
PASSERİFORMES/MOTACİLLİDAE					
18	Anthus Trivialis	Ağaç İncirkuşu	II	LC	Summer Migrants
19	Anthus Cervinus	Kızıl Gerdanlı İncirkuşu	II	LC	Summer Migrants
20	Motacilla Flava	Sarı Kuyruksallayan	II	LC	Summer Migrants
21	Motacilla Alba	Ak Kuyruksallayan	II	LC	Local
22	Motacilla Cinerea	Dağ Kuyruksallayan	II	LC	Summer Migrants
PASSERİFORMES/PRUNELLİDAE					

No	Scientific Name Group/Family/Species	Turkish Name	Preservation Statue		Immigration State
			Bern Annex	IUCN	
23	Prunella Ocularis	Sürmeli Dağbülbülü	II	LC	
PASSERİFORMES/TURDİDAE					
24	Luscinia Megarhynchos	Bülbül	II	LC	Reproduction in Summer
25	Phoenicurus Ochruros	Kara Kızılkuyruk	II	LC	Local
26	Phoenicurus Phoenicurus	Kızılkuyruk	II	LC	Reproduction in Summer
27	Oenanthe Oenanthe	Kuyrukkakan	II	LC	Reproduction in Summer
28	Oenanthe İsabellina	Boz Kuyrukkakan	II	LC	Reproduction in Summer
29	Oenanthe Hispanica	Kara Kulaklı Kuyrukkakan	II	LC	Reproduction in Summer
30	Saxicola Rubetra	Çayır Taşkuşu	II	LC	Summer Migrants
31	Saxicola Torquata	Taşkuşu	II	LC	Reproduction in Summer
32	Monticola Saxatilis	Taşkızılı	II	LC	Summer Migrants
PASSERİFORMES/SYLVİİDAE					
33	Hippolais Pallida	Ak Mukallit	II	LC	Summer Migrants
34	Sylvia Nisoria	Çizgili Ötleğen	II	LC	Summer Migrants
35	Sylvia Communis	Ak Gerdanlı Ötleğen	II	LC	Reproduction in Summer
36	Phylloscopus Collybita	Çivgın	II	LC	Reproduction in Summer
PASSERİFORMES/MUSCİCAPİDAE					
37	Ficedula Semitorquata	Alaca Sinekkapan	II	NT	Summer Migrants
38	Ficedula Hypoleuca	Kara Sinekkapan	II	LC	Transit visitor
PASSERİFORMES/PARİDAE					
39	Parus Caeruleus	Mavi Baştankara	II	LC	Local
PASSERİFORMES/SİTTİDAE					
40	Sitta Europaea	Sıvacıkuşu	II	LC	Local
PASSERİFORMES/LANİİDAE					
41	Lanius İsabellinus	Kızıl Kuruklu Örümcekkuşu	II	LC	Rastlantısal
42	Lanius Excubitor	Büyük Örümcekkuşu	II	LC	Kış Göçmeni
PASSERİFORMES/CORVİDAE					
43	Pica Pica	Saksağan	-	LC	Local
44	Garrulus Glandarius	Alakarga	-	LC	Local
45	Corvus Monedula	Küçük Kaega	-	LC	Local
46	Corvus Corone Cornix	Leş Kargası	-	LC	Local

No	Scientific Name Group/Family/Species	Turkish Name	Preservation Statue		Immigration State
			Bern Annex	IUCN	
PASSERİFORMES/STURNİDAE					
47	Sturnus Vulgaris	Sığırcık	-	LC	Local
PASSERİFORMES/PASSERİDAE					
48	Passer Domesticus	Serçe	-	LC	Local
49	Passer Montanus	Ağaç Serçesi	III	LC	Local
PASSERİFORMES/FRİNGİLLİDAE					
50	Fringilla Coelebs	İspinoz	III	LC	Local
51	Carduelis Cannabina	Ketenkuşu	II	LC	Local
52	Carduelis Carduelis	Saka	II	LC	Local
53	Carduelis Spinus	Karabaşlı İskele	II	LC	Winter Migrants
54	Loxia Curvirostra	Çaprazgaga	II	LC	Local
PASSERİFORMES/EMBERİZİDAE					
55	Emberiza Hortulana	Kirazkuşu	III	LC	Reproduction in Summer

Table 40. Mammals

Group / Family	Species and Turkish name	Habitat	Preservation Statue	
			Bern	Bern
Insectıvora / Erinaceidae	Erinaceus concolor Kirpi	Vineyards, orchards, culture land and forest	-	LC
Chiroptera/Vespertilionidae	Pipistrellus pipistrellus Cüce yarasa	Nests into wall wedges of the houses in the vicinity of the line.	III	LC
Lagomorpha/ Leporidae	Lepus europaeus Yabani tavşan	Found in the forest or openings.	III	LC
Rodentia/ Muridae	Microtus Iydius Batı Anadolu Tarla Faresi	Lives in all types of cultural land and steppe and orchards.	-	-
	Cricetulus migratorius Cüce avurtlak	Lives in the plateaus, meadows, forest land and cultural land.	-	LC
	Apodemus mystacinus Kayalık Orman Faresi	Lives in the forest and rocks in the openings.	-	LC
	Mus macedonicus Tarla Sarı Ev Faresi	Lives in the open terrain.	-	LC
	Rattus rattus Ev Sıçanı	Lives in built-up areas and grassy, bushy creekline.	-	LC
Carnivora/ Canidae	Vulpes vulpes Tilki	Lives in the forest and around the settlement, all sorts of habitats.	-	LC

Table 41. Reptiles

Group / Family	Species and Turkish name	Habitat	Preservation Statue	
			Bern	Bern
Testudınata/Testudınıdae	Testudo graeca Yaygın Tosbağa	Dry, stony and sandy terrains, among vineyards, orchards	II	VU

Squamata/ Gekkonidae	Cyrtopodion kotschyi İnce parmaklı keler	Lives in rocky areas and building walls	II	LC
Squamata/Scıncıdae	Ablepharus kitaibellii İnce kertenkele	Lives in short – planted outdoors, and in the sections with lemurs and sparse trees. It hides under stones and leaves.	II	LC
Squamata/ Lacertidae	Ophisops elegans Tarla kertenkelesi	Lives in the areas with less vegetation and rocky and ground floor.	II	-
Squamata/ Anguidae	Ophisaurus apodus Oluklu Kertenkele	Lives in the shrubbery, stony slopes with abundant vegetation	II	-
Squamata/ Colubridae	Coluber nummifer (Hemorrhois nummifer) Sikkeli Yılan	Lives in stony zones with little vegetation	III	LC
	Coluber rubriceps (Platyceps collaris) Toros Yılanı	Lives in dry stony and bushy environments	III	LC
	Eirenis modestus Uysal yılan	Stony zones with less vegetation	III	LC
	Elaphe quatuorlineata Sarı yılan	Lives in sparsely wooded scrub and rocky locations	II	NT
	Natrix natrix Yarısucul yılan	Meadows nearby water	III	LC

INTERNATIONAL AND DOMESTIC PRESERVATİON STATUES OF THE FAUNA SPECIES

1. BERN Convention

European Preservation Convention of Wildlife and Natural Habitats have been accepted for the first time in Bern in 1979. By signing this convention in 1984, the Republic of Turkiye has become a party hereof. The objective of this convention: is to ensure preservation of wild flora and fauna and living environments thereof, particularly giving priority to those species which are migratory, whose generation has endangered or maybe vulnerable and develop the collaboration of more than one countries regarding this matter.

According to Bern Convention, the species of fauna taken under Preservation have been divided into two categories.

Annex – II	Species precisely taken under Preservation
Annex – III	Conserved species

Provisions of Article – 6 of Bern Convention:

Every Contracting Party shall take appropriate and necessary legal and administrative measures which will secure that the wild fauna species specified in the list of Annex – II are specially protected. For these species, particularly following matters will be prohibited:

a) All forms of deliberate capture and keeping and deliberate killing,
b) Deliberate damage to the reproduction or resting places or destruction of these place,
c) Disturbance of wild fauna, especially in the reproduction, development and the deliberate disturbance during hibernation in a way to be contrary to the purpose of this Convention,
d) To collect eggs from the wild environment or their deliberate destruction or keep these eggs even if empty,
e) In cases where it would make contribution to the effectiveness of these provisions, including animals that have been embalmed and readily recognizable part obtained from the any material on which this was used, keeping these animals in states of alive or dead and domestic trading hereof.

Annex – II: The list including the species which are explicitly required to be taken under preservation is contained within Annex – II. The contracting parties of the Convention will take necessary legal and administrative measures to ensure that the wild fauna species specified in Annex – II are specifically taken under preservation. Concerning these species, following situations will be particularly prohibited:

Annex – III: Comprises the list of the fauna species taken under preservation. Every party concluding the Convention will take necessary legal and administrative measures to ensure that the wild fauna species specified in Annex – III are taken under preservation.
The exploitation issue of the wild fauna species stated in Annex – II shall be regulated in consideration of the conditions put forth in Article – 2 to keep the populations away from risk. The measures oriented towards this will comprise the following:

Annex – IV Prohibited Hunting Method and Tools and Other Prohibited Operation Forms

Provisions of Article – 7 of Bern Convention:

1 - Every Contracting Party shall take appropriate and necessary legal and administrative measures which will secure protection of wild fauna species specified in list no. III attached hereto.
2 – All sorts of operations of the wild fauna specified in list no.III shall have been regulated in a way not to endanger presence of populations considering the context of article – 2 conditions.

f) – Measures to be taken;
g) Other principles regulating the closed hunting seasons and / or the operation,
h) In order to raise the wild fauna up to adequate population levels, when deemed necessary, temporary or regional prohibition of the operation,
i) Development of the regulation on the sale of wild animals either being alive or death, keeping the same for the purpose of selling, and transport or putting on sale properly.

2. IUCN (International Union for Conservation of Nature and Natural Resources)

Most of the species are comprised in LC common category according to IUCN.

3.Central Hunting Comission (CHC)

Decisions of Central Haunting Commission adherent to General Directorate of Nature Conservation and National Parks are presented below;

Annex List-I Wild animals protected by the Ministry of Foresty and Water Works
Annex List-II Wild animals protected by the Central Haunting Commission
Annex List-III Wild animals permitted to be haunted for limited time by the Central Haunting Commission

According to this;

For amphibians; any of species determined at Project area is not listed at CHC decissions. Most of the amphibians living in Turkey is not included to CHC protection decissions.

For reptiles; all species determined are included to Annex-1 list according to CHC decissions and these species are protected by the Ministry of Forestry and Water Works.

For birds; Almost all of them are contained in a list according to CHC Decisions.

For mammals; Almost all of them are contained in a list according to CHC Decisions.

It is required to act according to the preservation measures for the species specified in the Preservation Lists pertaining to the Hunting Periods drawn up annually in line with the Decisions of Nature Preservation and National Parks General Directorate, Central Hunting Commission.

Projec site is categorized as Hunting Forbidden Field as seen in **Figure 45**.

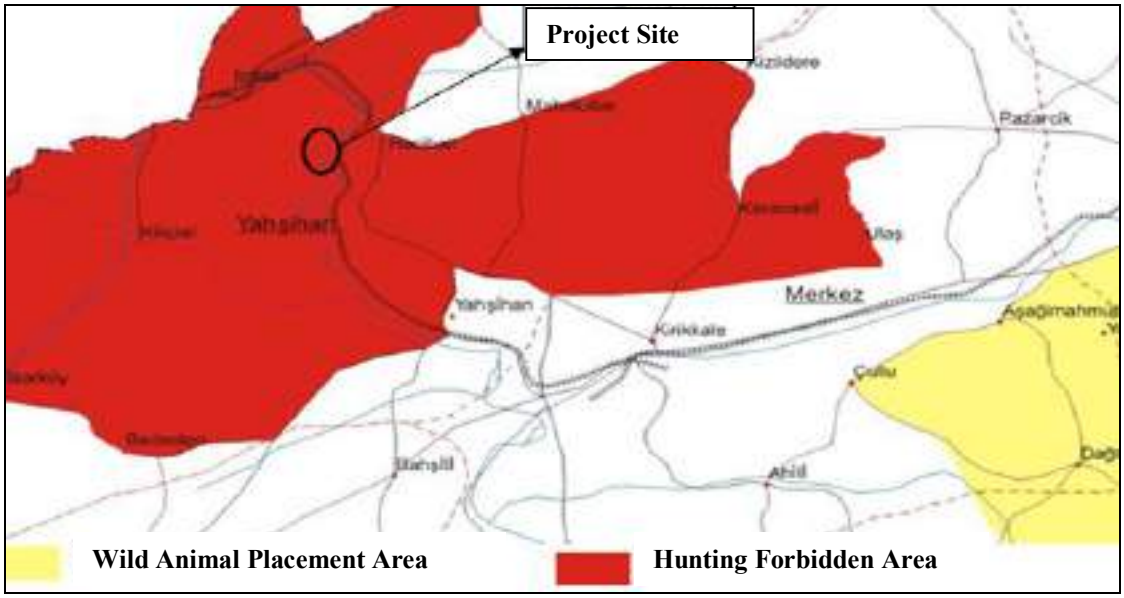


Figure 45. Hunting Forbidden Areas

Mitigation Measures (Construction and Operation Phases)

Because determine species are mobile species, impacts like noise will cause species move outside of the project site to alternative habitats. However, after the construction phase, the species that move to alternative habitats are expected to come back when impacts of construction is over. Therefore, it is not expected to have danger for generations.

For flora and fauna, the most important pollutants resulting from the operation phase of the project known as NO and NO_2 emissions. NO and NO_2 emissions resulting from power plant at ground level will be below the limit values for the concentration values of the flora and fauna on the related regulation is not expected to have a negative effect on the emissions. Design values of the central units will be determined to keep noise levels to a minimum. Therefore, the plant noise levels will occur during the operational phase will be under the limit values specified in Regulation of Assessment and Management of Environmental Noise which was published in the Official Gazette No. 27601 dated 04.06.2010 " Thus, the fauna found in the study area, there will not be negatively affected by noise arising from the project.

In order to minimize these impacts below mitigation measures should be taken;

- Access to the project site will be made over the existing roads as much as possible.
- The roads to be amended during the construction works will be narrow and short as much as possible.
- Entry into the natural areas remaining outside the project site will be forbidden or kept to a minimum as much as possible.
- Environmental measures shall be taken during the construction period, and the relevant legislations shall be complied with.
- Workers employed during construction and operation phases will be trained, and their illegal hunting will be prevented.
- To the extent possible, movements will be restricted inside the project site and project access roads, and the exits outside the defined routes will be prevented.
- Excavation wastes will not be stored near the creek sides.

- For the species included in the protection lists for Hunting Season of 2011-2012, prepared by Central Hunting Committee of Nature Protection and National Parks General Directorate of Forestry and Water Affairs Ministry, the protection measures indicated in the committee decisions, shall be respected. In addition, the provisions of BERN covenant and CITES Agreement will be complied with.

IV.2.13 Mines and fossil fuel resources (reserve capacities, current and planned operational conditions, yearly production and its significance for national or local usage and economic values)

There are no mine or fossil fuel operations within and around the Project area.

IV.2.14 Livestock husbandary (types, grazing fields, yearly production amounts, significance and value of these products for national economy)

IV.2.14.1 Livestock population and livestock husbandary potential of yahşihan district where project takes place

Livestock husbandary constitutes an important source of income in Kırıkkale Province, Yahşihan District where Project takes place.

Cattle and small cattle husbandary is carried out on 10 plateus around the district. Milk and milk products are manufactured individually and offered for sale. Present livestock population, facility sizes per animal and livestock production amount in Yahşihan Distict is given in **Table 42, Table 43** and **Table 44**.

Table 42. Livestock population in Yahşihan District (2010)

Livestock Type	Population (number)
Cattle	1,100
Calf / veal	700
Buffalo	0
Sheep	3,950
Goat	850
Horse	3
Donkey	75
Chicken	3,000
Turkey	200
Duck	150
Goose	20
Pigeon	450

Table 43. Amount of Product

Livestock Type	Amount of Product (ton)
Cattle Milk	576
Beef	50
Sheep-Goat Meat	72
Honey	4

Table 44. Facility Sizes Per Animal

Small Cattle	Facility	Cattle	Facility
1 - 30	4	1 - 5	139
30 - 60	6	6 - 15	95
60 - 100	9	16 - 50	17
More than 100	13	More than 50	1

IV.2.14.2 Livestock husbandary activities in the project area

Farming constitutes the most important source of income in the region where project area takes place. Since facility area is far away to settlements and suitable land for farming and site conditions are not suitable for farming, livestock husbandary activities do not exist in the project area.

IV.2.15 Fuel resources (information about the pipeline in which gas will be taken, distance of the pipeline to the project site)

Natural gas will only be used as fuel in the NGCCPP. Required gas connection shall be provided from BOTAŞ Natural Gas Pipeline. BOTAŞ has indicated 2 alternative routes for the gas pipeline as described in Figure 46. Alternative 1 is approximately 3 km away from the site and Alternative 2 is approximately 4 km away to site. Pipeline routes as per initial feedback from BOTAS will be buried under the ground as per BOTAS regulations and standards. Incase land acquisition/expropriation is required for the realization of the gas pipeline, then Turkish regulations on land acquisition/expropriation will be followed and the requirement of EBRD/IFC on expropriation shall be fulfilled.

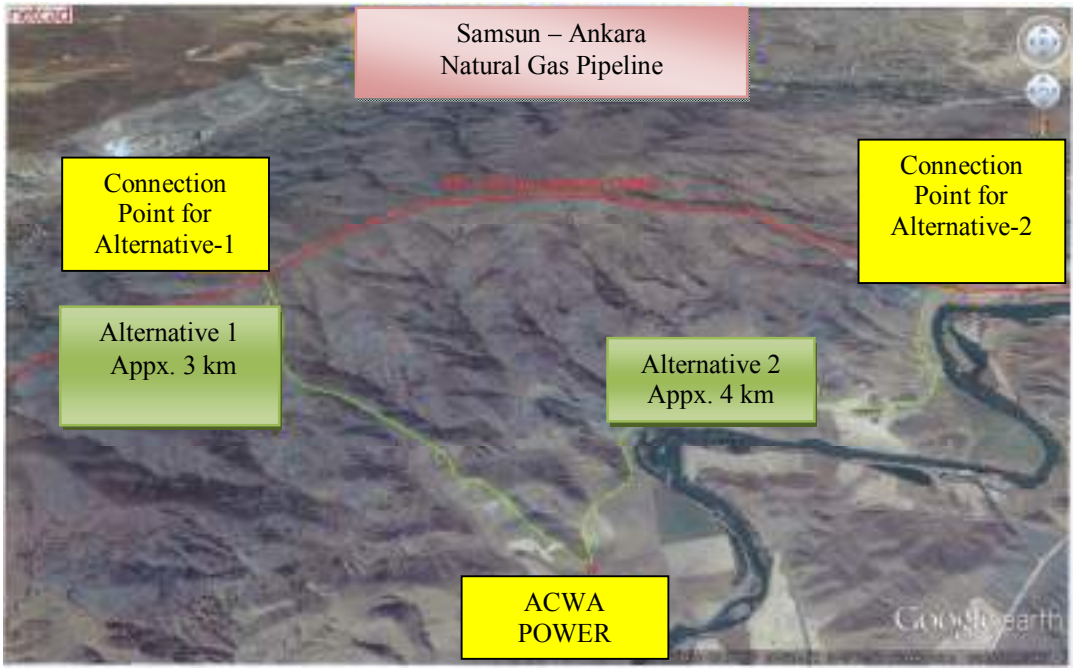


Figure 46. Map Showing Expected Natural Gas Pipeline Route

IV.2.16 Areas of high landscape value and recreation areas

There are no recreation areas and areas of high landscape value within and around the Project area.

IV.2.17 Areas which are under the rule and at the disposal of the authorized governmental bodies (Military Restricted Zones, areas assigned to governmental institutions and organizations for certain purposes, etc.)

There are no “Lands Under Judgment and Disposal of Competent Organs of State (Military Forbidden Zones, areas allocated to certain public institutions and organizations, and areas restricted by the Cabinet Decision numbered 7/16349 published in the Official Gazette numbered 16415 and dated 25 September 1978) within and around the Project area.

IV.2.18 Existing pollution load at the project area and impact area (background noise measurements in the context of regulation on assessment and management of environmental noise, identification of existing pollution load in terms of NOx, pm, cumulative impact of other facilities within the domain of the impact area in which deep sea discharge is implemented, etc.)

In order to detect the existing pollution load at the Project area and surroundings, measurements and analysis are carried out by Segal Environmental Measurement and Analysis Laboratory in May and June months (2013). Results of these measurements and analysis are given in **Annex-6**.

IV.2.18.1 Groundwater measurement and analysis studies

In order to identify the existing quality of groundwater at the Project area and surroundings, samples were taken from two different points and analysis are made by Segal Environmental Measurement and Analysis Laboratory **(See Figure 47** and **Table 45**).

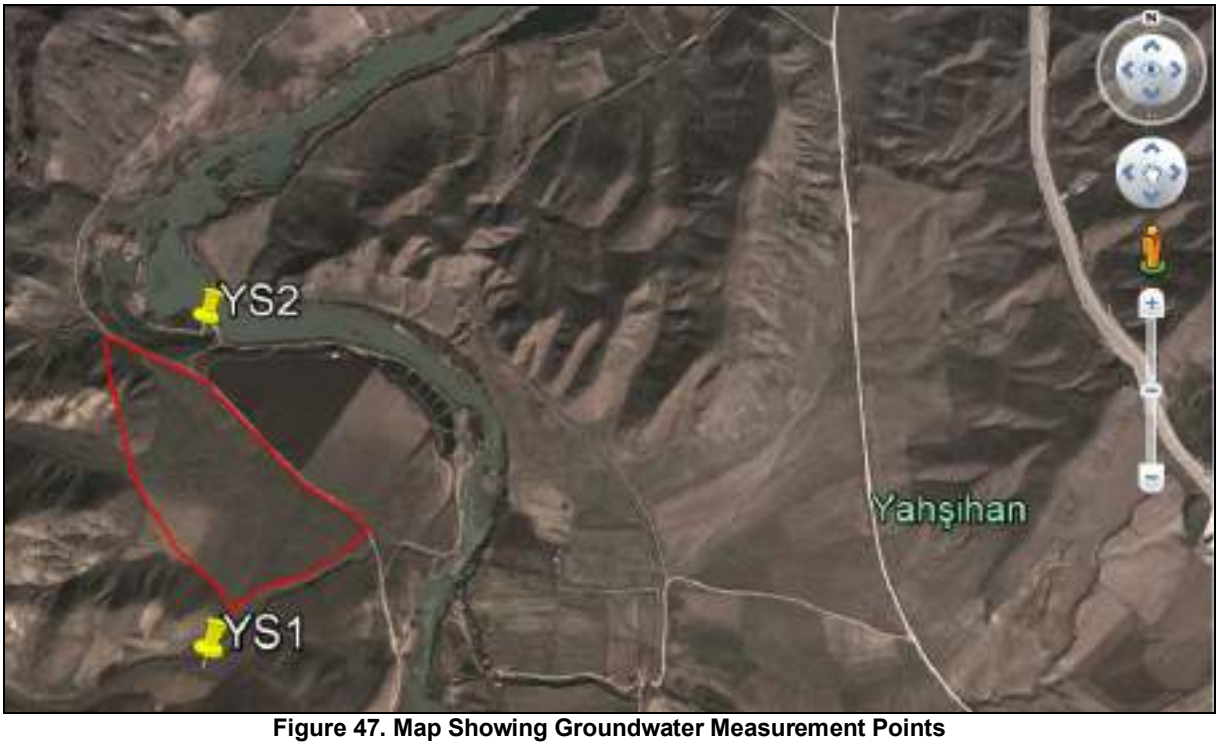


Figure 47. Map Showing Groundwater Measurement Points

Table 45. Groundwater Sample Analysis Results

Parameter-Unit		Sample-1	Sample-2	Management of Surface Water Quality Regulation Table 5			
				Water Quality Classes			
				I	II	III	IV
Temperature (°C)		16.1	15	≤25	≤ 25	≤ 30	> 30
pH		7.85	8.45	6.5-8.5	6.5-8.5	6.0-9.0	6.0-9.0
Conductivity (µS/cm)		592	314	< 400	400-1000	1001-3000	> 3000
Color (RES)	RES 436 nm	<0.5	<0.5	1.5	3	4.3	5
	RES 525 nm	<0.5	<0.5	1.2	2.4	3.7	4,2
	RES 620 nm	<0.5	<0.5	0.8	1.7	2.5	2,8
Dissolved Oxygen (mg/L)		8.6	8.5	> 8	6-8	3-6	< 3
Oxygen Saturation (%)[a]		98.7	97.6	90	70-90	40-70	< 40
Chemical Oxygen Demand (mg/L)		<10	<10	< 25	25-50	50-70	> 70
Biological Oxygen Demand (mg/L)		<4	<4	< 4	4-8	8-20	> 20
Ammonium Nitrogen (mg/L)		<0.1	<0.1	< 0.2[b]	0.2-1[b]	1-2[b]	> 2
Nitrite Nitrogen (mg/L)		0.005	0.003	< 0.002	0.002-0.01	0.01-0.05	> 0.05
Nitrate Nitrogen (mg/L)		2.8	2.3	< 5	5-10	10-20	> 20
Total Kjeldahl Nitrogen (mg/L)		0.35	0.31	0.5	1.5	5	> 5
Total Phosphorus (mg/L)		<0.01	<0.01	< 0.03	0.03-0.16	0.16-0.65	> 0.65
Mercury (µg/L)		<0.5	<0.5	< 0.1	0.1-0.5	0.5-2	> 2
***Cadmium (µg/L)		<1	<1	≤ 2	2-5	5-7	> 7
***Lead (µg/L)		5.4	5.8	≤10	10-20	20-50	> 50
***Cupper (µg/L)		<2	<2	≤20	20-50	50-200	> 200
***Nickel (µg/L)		<5	<5	≤20	20-50	50-200	> 200
***Zinc (µg/L)		<1	<1	≤200	200-500	500-2000	> 2000
Fecal Coliform (KOB/100mL)		120	100	≤10	10-200	200-2000	> 2000
Total Coliform (KOB/100 mL)		2500	2000	≤100	100-20000	20000-100000	> 100000

As a result of groundwater analysis, groundwater is classified as II. Class water in terms of Conductivity, Nitrite Nitrogen, Fecal Coliform and Total Kjeldahl Nitrogen. In terms of other parameters, groundwater is classified as I. Class water.

IV.2.18.1 Surface water measurement and analysis studies

In order to identify the existing quality of surface water at the Project area and surroundings, samples were taken from two different points and analysis are made by Segal Environmental Measurement and Analysis Laboratory **(See Figure 48** and **Table 46**).

Figure 48. Map Showing Surface Water Measurement Points

Table 46. Surface Water Sample Analysis Results

Parameter - Unit		Sample-1	Sample -2	Management of Surface Water Quality Regulation Table 5			
				Water Quality Classes			
				I	II	III	IV
Temperature (oC)		15	20.1	≤25	≤ 25	≤ 30	> 30
pH		8.45	7.24	6.5-8.5	6.5-8.5	6.0-9.0	6.0-9.0
Conductivity (µS/cm)		314	1505	< 400	400-1000	1001-3000	> 3000
Color (RES)	RES 436 nm	<0.5	3.4	1.5	3	4.3	5
	RES 525 nm	<0.5	<0.5	1.2	2.4	3.7	4,2
	RES 620 nm	<0.5	<0.5	0.8	1.7	2.5	2,8
Dissolved Oxygen (mg/L)		8.5	7.36	> 8	6-8	3-6	< 3
Oxygen Saturation (%)[a]		97.6	85.1	90	70-90	40-70	< 40
Chemical Oxygen Demand (mg/L)		<10	<10	< 25	25-50	50-70	> 70
Biological Oxygen Demand (mg/L)		<4	<4	< 4	4-8	8-20	> 20
Ammonium Nitrogen (mg/L)		<0.1	<0.1	< 0.2[b]	0.2-1[b]	1-2[b]	> 2
Nitrite Nitrogen (mg/L)		0.003	0.043	< 0.002	0.002-0.01	0.01-0.05	> 0.05
Nitrate Nitrogen (mg/L)		2.3	1.0	< 5	5-10	10-20	> 20
Total Kjeldahl Nitrogen (mg/L)		0.31	0.88	0.5	1.5	5	> 5
Total Phosphorus (mg/L)		<0.01	0.046	< 0.03	0.03-0.16	0.16-0.65	> 0.65
Mercury (µg/L)		<0.5	<0.5	< 0.1	0.1-0.5	0.5-2	> 2
***Cadmium (µg/L)		<1	<1	≤ 2	2-5	5-7	> 7
***Lead (µg/L)		5.8	<5	≤10	10-20	20-50	> 50
***Cupper (µg/L)		<2	3	≤20	20-50	50-200	> 200
***Nickel (µg/L)		<5	<5	≤20	20-50	50-200	> 200
***Zinc (µg/L)		<1	<1	≤200	200-500	500-2000	> 2000
Fecal Coliform (KOB/100mL)		100	120	≤10	10-200	200-2000	> 2000
Total Coliform (KOB/100 mL)		2000	2500	≤100	100-20000	20000-100000	> 100000

According to results, Sample-1 is classified as II. Class water in terms of Nitrite Nitrogen, Mercury, Fecal Coliform and Total Kjeldahl Nitrogen. In terms of other parameters, Sample-1 is classified as I. Class water.

Sample-2 is classified as II. Class water in terms of Conductivity, Dissolved Oxygen, Nitrate Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus Mercury, Fecal Coliform and Total Coliform. In terms of Nitrite Nitrogen, it is III. Class water and in terms of other parameters, Sample-2 is classified as I. Class water.

IV.2.18.1 Soil measurement and analysis studies

In order to identify the existing quality of soil at the Project area and surroundings, samples were taken from two different points and analysis are made by Segal Environmental Measurement and Analysis Laboratory **(See Figure 49** and **Table 47**).

Figure 49. Map Showing Soil Measurement Points

Table 47. Soil Analysis-1 for Project Site and Close Area

Parameter - Unit	Sample-1	Sample-2	Analysis Method
***Antimon (mg/kg)	<1.25	<1.25	EPA 3051 A, EPA 200.7
***Arsenic (mg/kg)	27	19.5	EPA 3051 A, EPA 200.7
***Copper (mg/kg)	40	32.5	EPA 3051 A, EPA 200.7
***Barium (mg/kg)	145	155	EPA 3051 A, EPA 200.7
***Bor (mg/kg)	78.5	49.5	EPA 3051 A, EPA 200.7
Mercury (mg/kg)	6.5	6.0	EPA 3051 A, SM 3112 B
***Zinc (mg/kg)	73	52.5	EPA 3051 A, EPA 200.7
***Cadmium (mg/kg)	2.1	2.05	EPA 3051 A, EPA 200.7
***Chrome (mg/kg)	75	91.5	EPA 3051 A, EPA 200.7
***Lead (mg/kg)	30	22.5	EPA 3051 A, EPA 200.7

Parameter - Unit	Sample-1	Sample-2	Analysis Method
***Molibden (mg/kg)	<2.5	<2.5	EPA 3051 A, EPA 200.7
***Selenium (mg/kg)	<1.25	<1.25	EPA 3051 A, EPA 200.7
***[1] Total Petroleum Hydrocarbons (mg/kg)	3.8	2.08	TS EN 14039
* TOX (mg/kg)	127.38	280.1	EPA 9023

In addition to heavy metal analysis presented at above table, water saturation, salt, organic matter, Phosphate and Potassium contents of the soil taken from 3 different locations were measured and results are given at below table.

Table 48. Soil Analysis-2 for Project Site and Close Area

Parameter - Unit	Sample-1	Sample-2	Sample-3
İsba%	48 (Tın)	45 (Tın)	47 (Tın)
pH	8.10 (Low alkali)	8.02 (Low alkali)	7.96 (Low alkali)
Lime %	10.35 (Medium lime)	5.96 (Medium lime)	15.89 (High lime)
Salt %	0.010 (Salt free)	0.009 (Salt free)	0.014 (Salt free)
Phosphate (per kg)	2.63 (Slight)	2.86 (Slight)	3.32 (Slight)
Organic Matter %	0.70 (Slight)	0.54 (Slight)	0.60 (Slight)
Potassium	69.82 (Sufficient)	90.54 (Sufficient)	46.37 (Sufficient)

IV.2.18.2 Noise measurement results

Noise measurement results which are carried out from 8 different points in May 2013 by Segal Environmental Measurement and Analysis Laboratory are given in **Table 49** and the map showing the measurement points in **Figure 50.**

Table 49. Noise Measurement Results at Project Site and Close Areas

Sampling Location	Result dBA (Daytime)	Result dBA (Evening)	Result dBA (Night)	Category
Sampling Location-1	52.4	47.8	45.3	A
Sampling Location-2	53.0	47.0	44.9	A
Sampling Location-3	50.4	46.6	43.6	A
Sampling Location-4	45.0	41.3	36.9	A
Sampling Location-5	44.6	41.6	37.5	A
Sampling Location-6	47.5	44.9	39.0	A
Sampling Location-7	46.2	41.2	38.6	A
Sampling Location-8	49.3	46.3	41.0	A

Figure 50. Map Showing Noise Measurement Points

As seen in **Table 49**, noise measurement results are below the limit value of 70 dBA which is stated in Regulation of Environmental Noise Assessment and Management.

IV.2.18.3 NO, NO_2 and NOx measurement results

In order to determine NO, NO_2 and NO_x concentrations in ambient air, passive sampling tubes were placed at 8 different locations in project site and close locations (See **Figure 51** and **Table 50**).

Figure 51. Locations of Passive Sampling Tubes

Table 50. Measurement Results for Passive Sampling Tubes

Sampling Results	NO_2 (µg/m3)	NO_x (µg/m3)	NO (µg/m^3)
May			
Location-1	5.93	14.99	9.06
Location-2	6.54	11.10	4.56
Location-3	6.62	13.68	7.06
Location-4	9.58	14.49	4.91
Location-5	8.58	14.48	5.91
Location-6	9.06	13.66	4.60
Location-7	7.21	10.20	2.99
Location-8	10.51	13.61	3.10
June			
Location-1	4.66	8.23	3.57
Location-2	5.19	14.85	9.65
Location-3	4.41	10.16	5.74
Location-4	5.82	13.38	7.56
Location-5	0.47	8.61	8.14
Location-6	5.56	12.27	6.70
Location-7	3.53	10.94	7.41
Location-8	6.20	10.95	4.75
July			
Location-1	4.13	10.38	6.25
Location-2	4.41	5.33	0.92
Location-3	2.87	8.71	5.85
Location-4	4.41	8.05	3.64
Location-5	4.39	10.00	5.62
Location-6	5.82	10.52	4.70
Location-7	3.50	6.31	2.81
Location-8	6.22	13.21	6.99

IV.2.19 Other features

There is no other point to be mentioned in this part.

IV.3 Characteristics of Socio-Economic Environment

IV.3.1 Economic characteristics (main sectors forming the economic structure of the region, distribution of the regional workforce in these sectors, role and importance of goods and services produced in these sectors throughout the local and national economy, other information)

Kırıkkale ranks 33rd in the ranking of Socio-Economic Development among 81 provinces in 2003 carried out by State Planning Organization. Socio-economic ranking, index and development group of districts in Kırıkkale among 872 districts in Turkey are given in **Table 51**.

Table 51. Socio-Economic Development Ranking of Districts in Kırıkkale (2003)

Development Ranking Among 862 Districts	District	Socio-economic Development Index	Development Group
42	Center	1.92203	2
221	***Yahşihan***	***0.32637***	***3***
237	Karakecili	0.25899	3
293	Bahsili	0.08557	3
542	Keskin	-0.39775	4
570	Delice	-0.45577	4
651	Celebi	-0.59905	4
653	Balıseyh	-0.59957	4
719	Sulakyurt	-0.72719	5

Reference: http://www.Kırıkkale.gov.tr/index.asp?islem=ekonomik

According to **Table 51,** Yahşihan District where Project site takes place, is 221st district throughout districts in Turkey with socio-economic index as 0.326 and development group as 3.

IV.3.1.1 Main sectors forming the economic structure

Industry

The city center of Kırıkkale is an industrial city, mostly composed of public facilities while the other district centers have a rural economic structure. In Kırıkkale, industrial production consists of big public investments and small and middle-sized private investments. The Machinery and Chemical Industry Corporation Factory (MKEK) and Tüpraş Refinery have an important impact on the economic structure of the city. At public level of the society, employment –worker and civil servants- affects the commercial life due to the incomes.

Whereas Kırıkkale industrial production depending on public sector concentrates on defense, metal and petro chemistry, in private sector production develops depending upon these industrial areas as well as agricultural machines, food and silage industry, soil, textile, wood and furniture related industries. 2 of the 5 MKEK factories, which constitute the backbone of the defense industry of the country, 1 of its 2 operations and the Scrap Directorate are situated in the city. Of the 5687 personnel of MKEK, 3157 (55%) live in this city. Also, Of the 3204 worker of MKEK, 1900 (59%) work in this city.

TUPRAS Central Anatolia Refinery, which has a capacity of 5 million ton/year oil processing, and was opened on 25th October, 1986 in Hacılar town in order to meet the oil based products of many cities -notably Ankara- in the Central Anatolia, was privatized in 2005. In TUPRAS facility, which processes the crude oil coming through a 447 km pipeline

from Ceyhan terminal of BOTAŞ, approximately 858 personnel are employed. 1st Organized Industrial Area, in which private sector businesses are situated, is founded on a 150 hectare land, and it was opened in 2001 after the infrastructure construction had been finished. In the Ist OIA, 68 of the 70 industrial parcels are allocated to entrepreneur; of these businesses, 38 of them are producing, 11 of them are not active, 9 of them are in construction situation, 10 of them are in excavation and planning situation.

In the producing businesses 1791 people are employed. When the total of the businesses in 1st OIA are active, 3000-5000 people will be employed. In the active businesses in Kırıkkale OIA, 17 businesses are in Metal Industry, 14 businesses are in Chemical, Oil, Rubber Industries, 11 businesses are in Wood Works and Furniture Industry, 8 businesses are in Food, Beverages, Alcohol Drinks, Tobacco Industries, 1 Textile, Weaving, Garment and Leather Industries and 14 businesses are in other industries.

It was planned that 2nd OIA will be constructed on a 153 hectare area near Kırıkkale-Kırşehir highway, in Keskin-Cankurtaran, 18 km close to the city center. At first stage the infrastructure work of a 66 hectare area is finished. The first stage consists of 28, and the second stage consists of 59 parcels with a total of 87 parcels. Already, 11 businesses have been appropriated lands, 2 businesses have begun production and 1 business is inactive while 4 of them are in construction and 3 are in planning stages. Thus, Kırıkkale will become an attractive industry center for public and private sector investments in the 21st century.

Also, there are 376 workplaces –subject to Auto Craftsman Association and Chamber of Blacksmiths- present in Kırıkkale Industrial Market. In Small Industrial Estate, situated in Keskin district on 4.7 hectare land with 78 workplace capacity, 180 people are employed. Approximately 7000 workers are employed in small and middle-scale industrial facilities in our city. The registered businesses in June 2012 are 212. Due to the closeness of Organized Industrial Area and Small Industrial Estate to University of Kırıkkale, a huge contribution to the economy with regard to the scientific consultancy by the university will be possible.

Agriculture

Agriculture is an important source of income within the economic structure of Kırıkkale. 51.2% of active population is engaged in agriculture. Land suitable for farming within the Province is about 306,506 hectares and this area contributes to 66,2% of the provincial area. 96% of the agricultural lands are used as fields. Agricultural land that can be irrigated is around 38,399 hectares.

Among the land actively used for agriculture, the croplands have the biggest share. Production of legumes and industrial crops has become widely used. Melon, watermelon and grape production are also important in the region.

Demonstrative efforts to improve efficiency in the agricultural sector, as well as ponds and dams studies provide accelerated transition to irrigated agriculture.

Within the Province, importance is given to irrigated agriculture. Etude studies of Balıseyh- Akçakavak, Sulakyurt and Kızılırmak - Hamzalı Dams and Keskin Ceritmuminli Pond have been completed and Project planning studies continues. Construction of Hasandede and Keskin-Cinali have already started..

Projects aiming to raise the income of rural area in farming sector had planned and demonstrated by supports of Special Provincial Administrations and Social Assistance and Solidarity Foundation.

IV.3.1.2 Distribution of workforce according to sectors

Labor force participation rates in Kırıkkale Province are given in **Table 52**.

Table 52. Labor Force Participation Rates

Labor Force Participation Rate (%)	42.4
Labor Force Participation Rate / Coefficient of Change (%)	3.9
Labor Force Participation Rate / 95% Confidence Interval Lower Limit	39.2
Labor Force Participation Rate / 95% Confidence Interval Upper Limit	45.6

Reference: http://tuikapp.tuik.gov.tr/Bolgesel

IV.3.1.3 Role and importance of goods and services produced in these sectors throughout the local and national economy

According to 2001 data of State Planning Organization, national income per capita is 2,725 $ in Kırıkkale. With this feature, Kırıkkale ranks 10th among Turkey.

IV.3.2 Population (Urban and Rural Population in the Area, Population Movements; Migrations, Population Growth Rate, the Average Household Population, Other Information)

IV.3.2.1 Urban and rural population

According to the 2012 year Turkey Address-Based Population Registration System (ADNKS), the population of Kırıkkale Province is 274,727 and 85% of the population (232,959) residing in the city center and the rest of the population which is 41,768 reside in villages and towns. The population of Yahşihan District is 17,675 in which 14,591 people reside in the center and 3,084 people reside in villages and towns **(See Table 52)**

Table 53. Distribution of Urban and Rural Population (2012)

Settlement	Urban Population	Rural Population	Total Population
Yahşihan District	14,591	3,084	17,675
Kırıkkale Province	232,959	41,768	274,727
Turkey	58,448,431	17,178,953	75,627,384

Reference: www.tuik.gov.tr

IV.3.2.2 Population movements and migrations

Statistics of migration from and to Kırıkkale Province **Table 54.**

Table 54. Migration Statistics (2012)

Province	Population	Migration In	Migration Out	Net Migration	Net Migration Rate (‰)
Kırıkkale	274,727	13,776	13,912	- 136	-0.5

Reference: www.tuik.gov.tr

IV.3.2.3 Population growth rate

According to the 2012 year data of TUIK; population growth rate in Kırıkkale Province is ‰-0.96. Likewise migration to center of the province and districts within Kırıkkale is ‰-3.5, migration to villages and towns is ‰13.1.

IV.3.2.4 Average household population

Information about average household population in Kırıkkale Province is given in **Table 55**.

Table 55. Average Household Population (2012)

İl	Total			Provincial and District Centers			Villages and Towns		
	Household Population	Household Number	Average Household Size	Household Population	Household Number	Average Household Size	Household Population	Household Number	Average Household Size
Kırıkkale	383,882	78,760	4.87	282,067	61,195	4.61	101,815	17,565	5.80

Reference: www.tuik.gov.tr

IV.3.3 Social infrastructure services in the area (education, health, cultural services and the availability of these services)

IV.3.3.1 Education

There are 268 schools, 2,537 classrooms, 55,539 students, 3,591 teachers in Kırıkkale Province. The number of students per classroom in primary school is 21, in secondary 19 and in professional and technical education 29 persons[1].

IV.3.3.2 Health

Health institutions in Kırıkkale Province according to Provincial Directorate of Health are given in **Table 56**.

Table 56. Health Institutions

SETTLEMENT	STATE HOSPITAL	INTEGRATED DISTRICT HOSPITAL	ORAL AND DENTAL HEALTH CENTER	TUBERCULOSIS DISPENSARY	PUBLIC HEALTH LABORATORY	ACSAP	COMMUNITY HEALTH CENTER	FAMILY HEALTH CENTER	HEALTH HOUSE	EMERGENCY AID AND RESCUE STATION-112
MERKEZ	3	0	1	1	1	1	1	21	5	4
BAHSILI	0	0	0	0	1	0	1	1	1	1
BALISEYH	0	0	0	0	1	0	1	1	4	1
CELEBİ	0	0	0	0	1	0	1	1	1	1
DELİCE	0	1	0	0	1	0	1	2	4	2
KARAKECILİ	0	1	0	0	1	0	1	1	0	1
KESKİN	0	0	0	0	1	0	1	2	4	1
SULAKYURT	0	1	0	0	1	0	1	1	3	1
YAHSİHAN	***0***	***0***	***0***	***0***	***1***	***0***	***1***	***3***	***2***	***1***

Reference: http://www.Kırıkkalesm.gov.tr

[1] http://Kırıkkale.meb.gov.tr/

IV.3.3.3 Cultural services

There are sports halls, swimming pools, outdoor pitches and stadiums are available for sports events in Kırıkkale Province. There are also various public recreational areas and parks.

IV.3.4 Urban and rural land usage in the project area and its vicinity (distribution of settlement areas, current and planned usage areas, and the industrial zones, houses, tourism areas, etc. in this context)

IV.3.4.1 Urban and rural land usage

Kırıkkale is surrounded by mountains and streams and development of the city is to the east.

The closest settlement to the Project area is Kılıçlar Municipality located in 3.7 km

Project site has empty forest soil property and generally project region is rural land mostly with grasslands.

There are not any important industrial facilities in the vicinity of Project area except ESER NGCCPP which is in the planning stage and located at 1.5 km to the northeast.

There is no tourism area in and around the project area.

IV.3.5 Income (distribution of income according to line of business in the region, maximum, minimum and average income per capita)

IV.3.5.1 Income and line of business

Kırıkkale is an industrial city with the strategic and economic importance. The Machinery and Chemical Industry Corporation Factory (MKEK), TUPRAS Refinery AND Kırıkkale University have an important impact on the economic structure of the city. Moreover, in the Ist OIA located in Yahishan District, 68 of the 70 industrial parcels are allocated to entrepreneur; of these businesses, 38 of them are producing, 11 of them are not active, 9 of them are in construction situation, 10 of them are in excavation and planning situation. In the producing businesses 1791 people are employed. When the total of the businesses in 1st OIA are active, 3000-5000 people will be employed.

Keskin OIA 1st stage is composed of 25 industrial parcels. Already, 11 businesses have been appropriated lands, 2 businesses have begun production and 1 business is inactive while 4 of them are in construction and 3 are in planning stages. Thus, Kırıkkale will become an attractive industry center for public and private sector investments in the 21st century.

Also, there are 376 workplaces –subject to Auto Craftsman Association and Chamber of Blacksmiths- present in Kırıkkale Industrial Market. In Small Industrial Estate, situated in Keskin district on 4.7 hectare land with 78 workplace capacity, 180 people are employed. Approximately 7000 workers are employed in small and middle-scale industrial facilities in our city. The registered businesses in June 2012 are 212. Due to the closeness of Organized Industrial Area and Small Industrial Estate to University of Kırıkkale, a huge contribution to the economy with regard to the scientific consultancy by the university will be possible.

IV.3.6 Unemployment (ratio of unemployed population to the employed population in the region)

According to TUIK 2012 year data, unemployment rate in the Province is 12%. Unemployed population is around 132,000. Unemployed population is mainly composed of students, housewifes, retired people and citizens unable to work (sick / elderly / disabled).

IV.3.7 Health (endemic diseases)

According to information obtained from the official website of the Provincial Health Directorate; cancer cases are found in the province. Distribution of cancer cases according to 2010 Year data is given in **Table 57.**

Table 57. Statistics About Cancer Cases (2010)

Cancer Type	Number of Cases
Prostate	37
Lung	29
Colon	25
Stomach	20
Bladder	19
Skin	15
Endometrial	11
Thyroid	9
Breast	7
Pancreas	7
Testis	6
Rectum	5
Brain	3
Kidney	3
Liver	3
Bone	3
Laryngeal	3
Nasopharyngeal	3
Lymphoma	2
Parathyroid	1
Total	***211***

Reference:http://www.Kırıkkalesm.gov.tr

IV.3.8 Other Features

There is no subject to be conveyed in this section.

SECTION 5. EFFECTS OF THE PROJECT ON THE AREA DEFINED IN SECTION IV, AND THE MEASURES TO BE TAKEN

(In this section, the effects of the project on the physical and biological environment, the legal, administrative and technical measures to be taken in order to prevent these effects, to minimize and to improve them are explained in detail under V.I and V.2. headings).

V.1 Site preparation, activities at the stages of construction and installation, effects on the physical and biologic environment and measures to be taken

V.1.1 The amounts and locations of excavations to be made within the scope of the construction of the units and site preparation; the machines used for excavation

ACWA Power Kırıkkale NGCCPP Project will be constructed on 185,480 m^2 land area. For the ACWA Power Kırıkkale NGCCPP Project 116,765 m^2 area of 185,480 m^2 area will be used for unit construction, so that topsoil stripping will be done on 185,480 m^2 area and the main excavation will be done one 185,480 m^2 area.

Excavation process and excavation amount on the project area

On 116,765 m^2 area, 4-5 m depth of excavation is predicted. Therefore, it is calculated that 522,285 m^3 excavation soils will be produced.

30 cm of topsoil stripping is expected. As a result of topsoil stripping 78,343 m^3 topsoil will be stripped. This topsoil will be protected by germination process. After the construction phase, this topsoil will be used for rehabilitation activities.

The machines that will be used during excavation process;

- Pumper
- Dozer
- Excavator
- Loader
- Cylinder
- Trucks

Explosives will not be used for the excavation process.

Dust emission due to excavation works is calculated at **Section V.1.3**. In order to minimize dust emissions, the excavation area will be moistening by use of pumper continuously.

Excavation wastes will not be dumped into streambed according to 09.06.2006 dated and 26284 dated Prime minister Circular. Obligations of 18.03.2004 dated and 25406 numbered Regulation of Excavation, Construction and Demolition Waste shall be obeyed.

V.1.2 How such as and where the excavation residues stones, sands etc. are to be transported, and for which purposes are to be used (location and number of proposed storage of excavation residues will be mentioned and shown on 1/25,000 scale map)

As a result of topsoil stripping 78,343 m^3 topsoil will be stripped. This topsoil will be protected by germination process. After the construction phase, this topsoil will be used for rehabilitation activities.

Before construction phase, land arrangement activities will be done at project area. After topsoil stripping, 522,285 m^3 excavation residues will be produced due to excavation activities. 350,000 m^3 of these excavation residues will be used for filling works. Remain residue of 172,285 m^3 soil will used for land leveling activities. Excavation waste left after leveling activities will be sent to excavation waste storage area shown by the Municipality.

172,285 m^3 excavation residues will not be dumped on streambed, surface water resource, and agriculture or forestry area.

In the concept of the project during the storage of excavation waste Obligations of 18.03.2004 dated and 25406 numbered Regulation of Excavation, Construction and Demolition Waste and 08.06.2010 dated and 27605 numbered Regulation of Soil Pollution Control and Point Source Polluted Areas will be obeyed.

During transportation, loading and storage of excavation waste 03.07.2009 dated and 27277 numbered Regulation of Industrial Source Air Pollution Control obligations will be obeyed. Loading Works will be done without tossing, trucks will be covered and water spray will be used in order to minimize dust emissions.

V.1.3 During construction for dust source activities crushing, grinding, transporting and storage cumulative values (materials, vehicles and machines, dust source activities crushing, grinding, transportation, storage, measures for dust emissions, dust emission calculations by use of emission factors, if emission values calculated by emission factors exceed the limits at appendix-2 of industrial source air pollution control regulation air quality modeling study, reference for emission factors)

During construction phase dust emission will be realize due to land arrangement and excavation and filling works.

A ready-mixed concrete plant is planned to build with a capacity of 100 m^3/hr and approximately 50,000 m^3 ready-mixed concrete will be produced during the construction phase. The aggregate that is need for ready-mixed concrete plant will be purchased from market as ready to process. Worksite and ready-mixed concrete plant will be built in field of activity properly. Depending on planned mixed concrete type, aggregate, cement, water and chemical additives (melamine and powder based) that improve resistance, density and workability of concrete will be used for ready concrete production. These materials will be weighed automatically and sent to mixers. Produced ready concrete will be taken from silos to transmixers and sent to construction site. Ready-mixed concrete plant will be used through construction phase and closed when completion of the construction. Material types and amounts are given below that planned to be used for ready-mixed construction plant.

Aggregate : 60,000 m^3 (concrete need x 1.2)
Cement : 7,500 m^3

Dust Emission Calculation for Excavation Works

The calculation is given below that represent excavation Works.
Topsoil Amount : 78,343 m^3
Excavation Soil Amount : 522,285 m^3
Filling Soil Amount : 200,000 m^3

Table 58. Excavation/Material Amount during Construction Phase

Excavation/ Material Source – Unite		Amount (m^3)	Density kg/dm^3 - ton/m^3	Amount (ton)	Duration			Material Amount (ton/hr)
					(month)	(day)	(hr)	
Land Arrangement- Construction Works - Excavation		522,285	1,8	940,113	12	26	16	188.3
Topsoil Stripping		78,343	1,5	117,515	6	26	16	47.1
Construction Works - Filling	Materials from Excavation	350,000	1,8	630.000	12	26	16	126,2
	Outsourced Materials	50,000	2,3	115.000	12	26	16	23
Ready-Mixed Concrete		50,000	2,2	110,000	12	26	16	22
Aggregate		60,000	1,6	96,000	12	26	16	19.2
Cement		7,500	2,6	19,500	12	26	16	3.9

Because excavation soil residue will be stored appreciate area, loading and transporting of residue soil will be done at different areas and times. Therefore, these works are evaluated separately.

Because excavation and filling works will be done at the same area and time, these works are evaluated together.

Dust emission calculations for proposed units are done according to dust emission factors given at Appendix-12 Table 12.6 of 03.07.2009 dated and 27277 number Regulation of Industrial Source Air Pollution Control and U.S Environmental Protection Agency reference values. The emission factors are given in **Table 59**:

Table 59. Emission Factors

Sources	Emission Factors kg/ton	
	Uncontrolled	Controlled
Disassembly	0.025	0.0125
Loading	0.010	0.005
Transportation (round-trip total distance)	0.7	0.35
Discharge	0.010	0.005
Unloading of cement	0.36	0.0005
Storage	0.58	

At **Table 60,** dust emissions are presented according to dust source works.

Table 60. Dust Emission Amounts in Construction Phase

Topsoil Stripping Dust Emissions (Uncontrolled Situation)				
Emission Source		**Material Amount (ton/hr)**	**Emission Factor (kg/ton)**	**Dust Emission Mass Flow rate (kg/hr)**
Topsoil Stripping		47.1	0.025	1.17
Topsoil Loading		47.1	0.01	0.47
Topsoil Transportation[1]		47.1	0.7	0.7
Topsoil Unloading		47.1	0.01	0.47
Topsoil Storage		47.1	0.58	2.73
	[1]Approximate transportation distance, km			*0.5*
	Transportation amount capacity of one truck at one run, ton			*25*
	Storage area			*0.1 ha*
	TOTAL DUST			**5.54 kg/hr**
Excavation Works Sourced Dust Emissions (Uncontrolled Situation)				
Emission Source		**Material Amount (ton/hr)**	**Emission Factor (kg/ton)**	**Dust Emission Mass Flow rate (kg/hr)**
Excavation Soil Stripping		188.3	0.025	4.7
Excavation Soil Loading		188.3	0.01	1.88
Excavation Soil Transportation		188.3	0.7	2.8
Excavation Soil Unloading		188.3	0.01	1.88
Excavation Soil Filling Works		126.2	0.01	1.26
Excavation Soil Storage		62.12	0.58	14.4
Concrete Plant	Ready Concrete Loading	22	0.005	0.11
	Ready Concrete Transportation[1]	22	0.7	0.35
	[1]Approximate transportation distance, km			*0,5*
	Transportation amount capacity of one truck at one run, ton			*25*
	Storage area			*0.5 ha*
	TOTAL DUST			**27.38**
	GENERAL TOTAL DUST			**32.92 kg/hr**

The calculation given above are done according to emission factors for stone excavating, crushing, sorting plants for uncontrolled situation given at Industrial Source air Pollution Control. Because general total dust amount exceeds 1 kg/hr, dust dispersion modeling is requested depending on the evaluation of results through Appendix-2 Table 2.1 of 03.07.2009 dated and 27277 number Regulation of Industrial Source Air Pollution Control. Model results are given below;

The meteorological data of 2012 recorded at Kırıkkale Meteorology Station (Station No: 17135, Latitude: 39.51N; Longitude: 33.31E) is used for modeling studies. The air quality modeling outputs are given at **Annex 3**.

Air Quality Contribution Value for Particulate Matter (PM) Emissions

Daily and yearly air Quality contribution value for PM is given at **Table 61**.

Table 61. Air Quality Contribution Value for Particulate Matter (PM) Emissions

	Daily	Yearly
Construction Phase	204.15 µg/m^3	27.43 µg/m^3

Daily PM

According to 06.06.2008 dated and 26898 numbered Regulation of Air Quality Evaluation and Management, particulate matter limit value for 24 hours is 50 µg/m^3 and it is not permitted to exceed this value 35 times in a year. As a result of model study, during construction phase, particulate matter concentrations exceed limit values for only 8 times and regulatory requirements are **fulfilled**. The locations that exceedance occurs are given below;

- The highest 1. Value 204.15 µg/m^3 (534600, 4414800)
- The highest 2. Value 108.39 µg/m^3 (534600, 4414550)
- The highest 3. Value 63.02 µg/m^3 (536600, 4415800)
- The highest 4. Value 62.48 µg/m^3 (536100, 4416050)
- The highest 5. Value 61.53 µg/m^3 (536100, 4415300)
- The highest 6. Value 61.27 µg/m^3 (534100, 4415550)
- The highest 7. Value 60.86 µg/m^3 (536600, 4415300)
- The highest 8. Value 50.58 µg/m^3 (537100, 4414550)
- The highest 9. Value 45.71µg/m^3 (534850, 4416550)

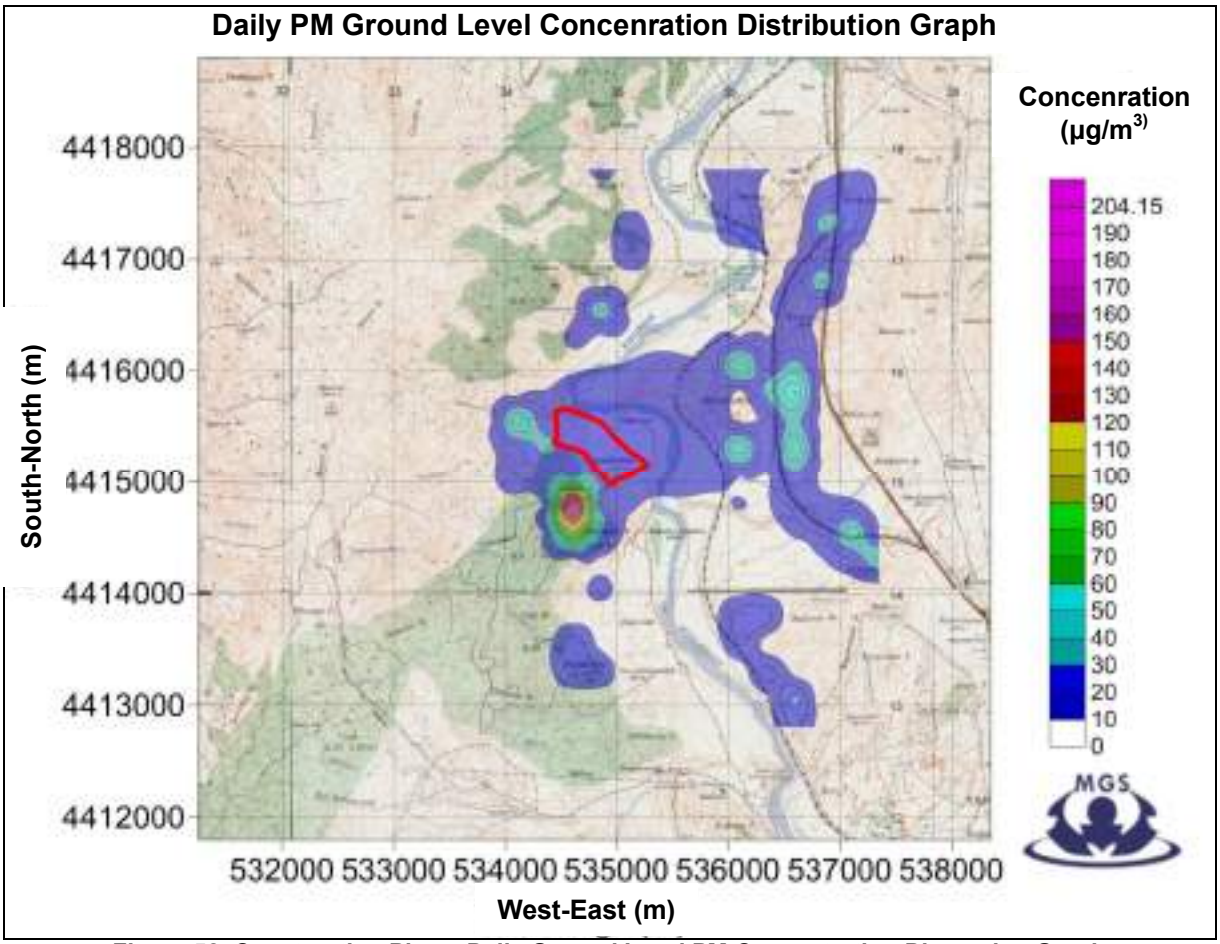


Figure 52. Construction Phase Daily Ground Level PM Concentration Dispersion Graph

Yearly PM

Yearly air quality contribution value is given below for the construction phase.

- The highest 1. Value 27.43 µg/m^3 (534600, 4414800)

According to 06.06.2008 dated and 26898 numbered Regulation of Air Quality Evaluation and Management, starting from 01.01.2019, particulate matter yearly limit value is 40 µg/m^3 and construction phase yearly particulate matter concentration **(27.43 µg/m^3)** is below the limit value. Regulatory requirements are **fulfilled.**

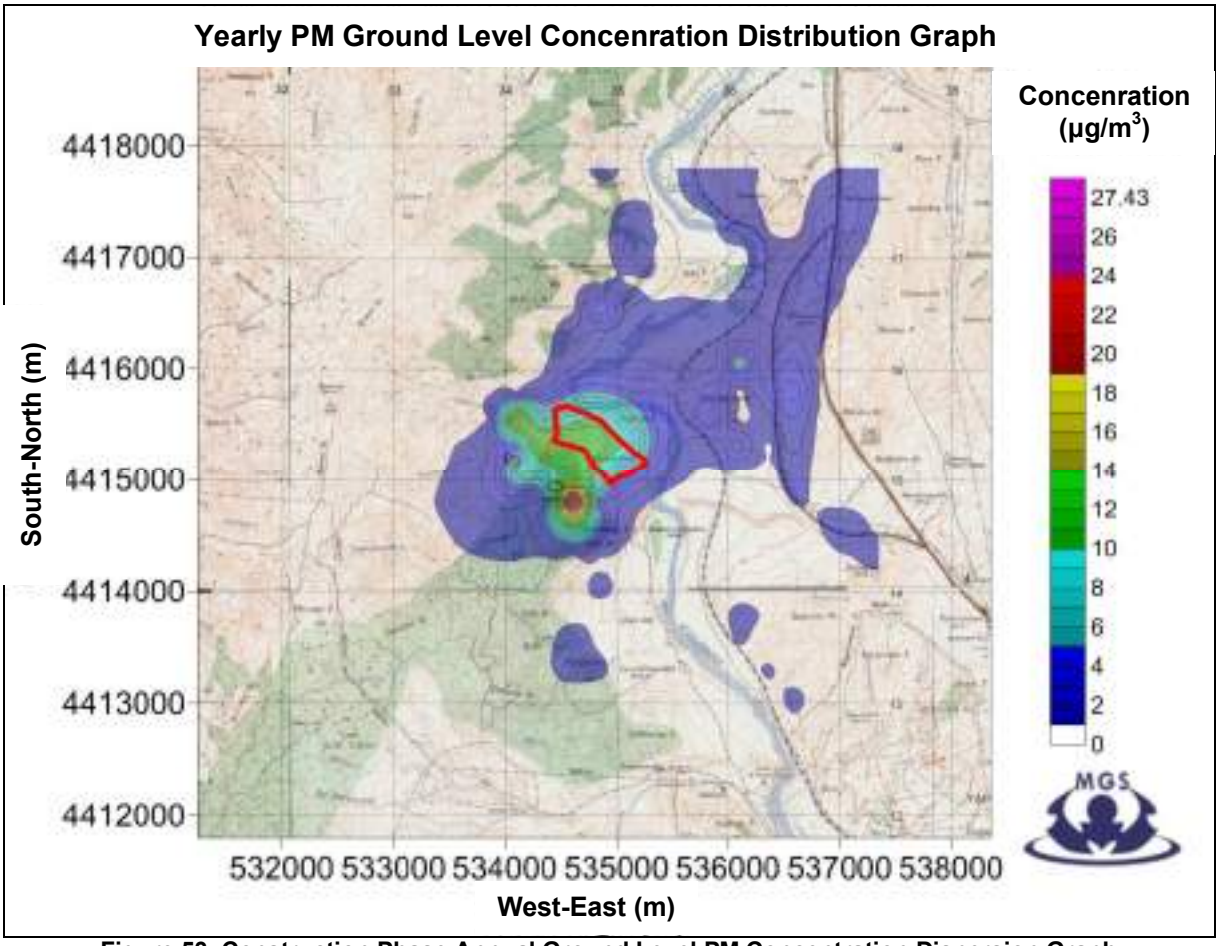


Figure 53. Construction Phase Annual Ground Level PM Concentration Dispersion Graph

Air Quality Contribution Value for Settled Dust Emissions

According model results, daily and yearly air Quality contribution value for settled dust is given at **Table 62**.

Table 62. Air Quality Contribution Value for Settled Emissions

	Annual
Construction Phase	68,85 mg/m^2/day

Monthly Settled Dust

Construction phase monthly air quality contribution value for settled dust is given below.

- The highest 1. Value 82.63 mg/m^2/day (534600, 4415300)

Construction sourced settled dust concentrations are **below** the short term limit values (390 mg/m^2/day) given in 03.07.2009 dated and 27277 numbered Regulation of Industrial Source Air Pollution Control which will be in force till 2014.

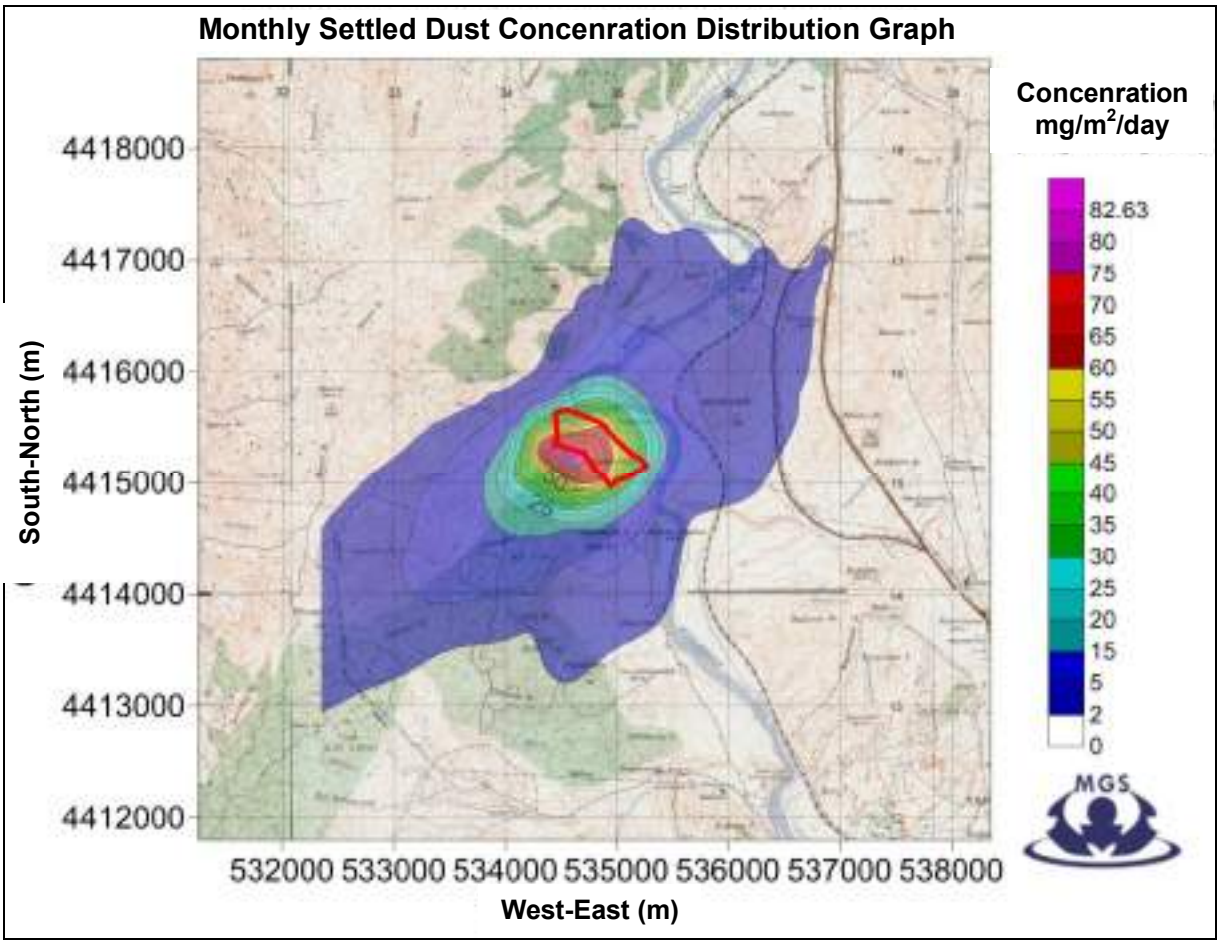


Figure 54. Construction Phase Monthly Ground Level Settled Dust Concentration Dispersion Graph

Yearly Settled Dust

Construction phase yearly air quality contribution value for settled dust is given below.

- The highest 1. Value 68.85 mg/m^2/day (534600, 4415300)

Construction sourced settled dust concentrations are **below** the long term limit values (210 mg/m^2/day) given in 03.07.2009 dated and 27277 numbered Regulation of Industrial Source Air Pollution Control which will be in force till 2014.

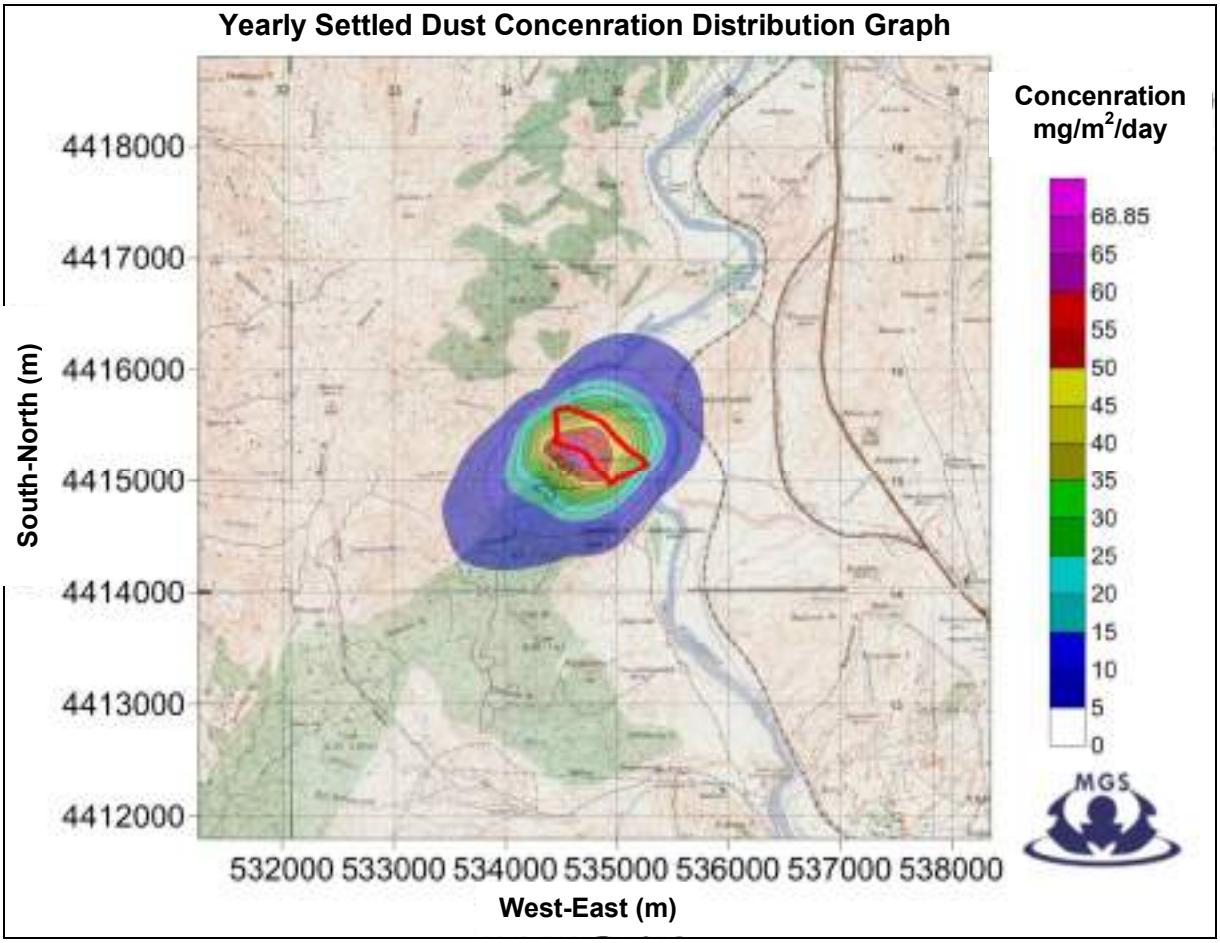


Figure 55. Construction Phase Yearly Ground Level Settled Dust Concentration Dispersion Graph

V.1.4 Transport and storage of explosive, inflammable, dangerous and toxic materials to be used during site preparation and also during the construction of the units; for which procedures to use them, and the tools and machines to be used for these procedures

Explosive and toxic materials will not be used for the land preparation works. Work machines will be used for excavation and land preparation activities. Explosive and imflable materials such as fuels, welding gasses, dyes and solvents will be needed for construction activities. Temporary storage is planned for such kind of materials. The leakproof concrete ground will be used for the storage area which will be roof covered.

During land preparation and excavation activities, 24.12.1973 dated and 14752 numbered Charter of Measures for Flammable, Explosive, Dangerous and Hazardous Substances in the Workplace and Works obligations will be fulfilled.

V.1.5 Works to be implemented for ground safety (bearing strength, allowable stress, settlement calculations)

V.1.5.1 Project site ground profile

Considering the all findings provided by visual inspections, drilling works, test pit and geophysical works, it could be said that; the blanket layer in the working area composes of alluvial fan deposits (Qay), alluvial deposits (Qal) and debris flows (Qym) which are the youngest deposits in the area. The bedrock is mostly sandstone, siltstone and claystone alternation of Samanlik Formation (Ks) which outcrops on the hilly side of the area at the NW. Gravelstone and sandstone levels of Ilıcapınar Formation (Kı) is another rock type locates at the farthest NW side of working area.

Soils; Alluvial fan sediments (Qay) are most common soil deposits in the investigation area. These deposits are locates on the map section 109/ 2 parcel. The thickness of these deposits, which covers the bedrock, varies between 8,00-20,00 m. The average thickness is 15 m. These soils are generally uncemented, medium dense and dense silty sands (SM), clayey sands (SC) and from medium to low plastic clays (CI and CL) which exist rarely. The consistencies of these clays are stiff to very stiff and hard. All these features could be seen in the borehole and test pit logs given in Section 6 and 7.

Alluvial deposits (Qal) of flood plain which cover all the area of the map section 108 parcel 1 where locates at the west side of Kızılırmak River is the other soil type in the area. The average thickness of these deposits is about 14 m. These deposits mainly consist of medium to dense, uncemented gravely silty sands (SM). They also contain very stiff and low practice clays in group CL

In addition to the soil types mentioned above, some debris flow deposits exist at slope foots of the hilly part locates at the North part of study area. These sediment made of gravely and blocky sands with a shallow thickness.

Rocks; Bedrock in the investigation area is represented by the alteration of sandstone-siltstone levels of Samanlık Formation (Ks) which also outcrops at the hilly part of the area at the NW. The RMR classification of rocks of Samanlık Formation (Ks) done by using the obtained data from borehole samples and laboratory works. RMR classification of the rocks was done according to the criteria's given Bieniawski 1989. The rock levels of Samanlık Formation (Ks) are generally in very poor to poor rock classes while some parts show fair rock quality. Fair and poor rocks are mostly found at the S or SE part of the area

while the very poor rocks spread towards northern part of the area and they represent the upper 5-10 meters thick part of the Samanlık Formation under the alluvial blanket layer.

The other rock units in the area are gravelstone and claystone levels of Ilıca Formation (Ki). These rock outcrops are found in a restricted part of the NW side of the area. According to the visually inspection these outcrops are completely or highly weathered.

V.1.5.2 Bearing Capacity Analysis

Terzaghi's ultimate bearing capacity formula was used, to understand the bearing capacity of the soils in the investigation area. Calculations were carried out on the model foundation by using the soil parameters obtained from each borehole.

It is assumed that model foundation depth is 1,00 meter (Df) , dimension of the foundation is 2,00 x 2,00 meters and the shape is square. Approaches to the ultimate bearing capacity of soils in the project area were done by using the obtained soil parameters in the above equation. (**Bkz. Table 63**).

Table 63. Bearing Capacity Figures for Model Foundation

Borehole No	Foundation size (B x L)	Depth of Foundation (Df)	Ultimate Bearing Capacity (qd)
SK-1	2,00 x 2,00 meter	1,00 meter	2,5 kg/cm^2
SK-2	2,00 x 2,00 meter	1,00 meter	1,5 kg/cm^2
SK-3	2,00 x 2,00 meter	1,00 meter	2,5 kg/cm^2
SK-4	2,00 x 2,00 meter	1,00 meter	2,0 kg/cm^2
SK-5	2,00 x 2,00 meter	1,00 meter	1,5 kg/cm^2
SK-6	2,00 x 2,00 meter	1,00 meter	3,0 kg/cm^2
SK-7	2,00 x 2,00 meter	1,00 meter	3,0 kg/cm^2
SK-8	2,00 x 2,00 meter	1,00 meter	2,5 kg/cm^2

V.1.5.3 Settlement Properties

The Cl group clays belong to Alluvia fan deposits (Qay) look most susceptible material in respect of settlement in the study area. Approximately, 12,00 meters thick similar Cl layer were cut at the depths between 4,00 – 16,00 meters in SK-7 No borehole. Based on the data obtained from this borehole, a settlement calculation was carried out for 2,00 x 2,00 size model foundation foot. The formula given by Bowles 1996 was used in the calculations.

It was assumed that 2,00 kg/cm2 load is applied to the foundation soil through the foot. Than amount of the settlement Δs was calculated as 0.68 cm.

Detailed information about Settlement Properties is given at Annex -5.

V.1.6 Where and how flood prevention and drainage works will be made

All units that are proposed for the project will be planned on over the flood elevation of Kızılırmak River.

Action to be taken to drain the field if necessary, the amount of land to be used during excavation will be kept at the lowest level, terracing will be done to reduce the long and continuous gradients, the flow of storm water will be provided at low speed channels,

construction at the entrance to the inner roads and parking areas and facilities suitable for stabilization open drainage channels. In the design of flood and drainage channels, the value highest rainfall 100 year will be used. In addition, within the boundaries of the NGCCPP temporary drainage channels to collect rain water around the construction site will be created. The collected storm water will be discharged into the Kızılırmak River. In addition, portable pumps will be used in construction sites in order to collect water in an emergency situations.

According to criteria of drainage system of the plant, project owner will be responsible for take all precautions against surface water floods. General Directorate of State Hydraulic Works will not be held responsible for losses occur over the structuring plant and immovable property and third parties due to the potential surface water flood. However, where experts were identified this does not cause by facility, the project owner will not be held liable for damages of floods.

V.1.7 Transportation infrastructure within the project, the infrastructure construction related transactions, used materials, chemical materials, tools, machines, infrastructure during the construction of crushing, grinding, handling, storage, such as dust source mechanical processes

Ankara-Kırıkkale road will be used for transportation to the project site. After leaving out the road, it comes with presently possible to reach the gravel road. The immediate vicinity of the site and a large number of asphalt, soil and gravel roads are available. Therefore, there will be no difficulty for transport to project site. By the operation phase start, improvements are possible to make on gravel road.

V.1.8 Electrification plan within the project, actions for the implementation of the plan, and materials to be used

Electrification plan and implementation of the plan for the project will be determined by detailed engineering work.

V.1.9 Types of fuels, consumptions, emissions due to fuel usage start from land preparation until the commissioning of the plant

Construction equipment that will be used during the construction period will use mostly diesel as a fuel. Diesel, with a density of 820 to 845 kg/m^3, has a content of maximum of 10 mg/kg of sulfur, 0.01% ash, 200 mg/kg of water, 25 mg/kg particulate matter[2]

Gas emissions while continuing construction activities of the project will occur from construction equipment. Machines are planned to be used are provided in **Table 64**.

Table 64. List of Machine and Equipment That will be Used During Construction Phase

Machine/Equipment	Amount	Usage Place	Motor Power (Kw)
Dozer	2	Construction Activities	99
Crane	2	Construction Activities	37
Cylinder	1	Construction Activities	63
Motopomp	2	Construction Activities	10
Loader	2+1	Construction Activities + Concrete Plant	191
Digger	1	Construction Activities	156
Truck	8+2	Construction Activities + Concrete Plant	235

[2] www.tupras.com.tr

Machine/Equipment	Amount	Usage Place	Motor Power (Kw)
Pumper	1+1	Construction Activities + Concrete Plant	191
Generator	1+1	Construction Activities + Concrete Plant	63
Excavator	2	Construction Activities	94
Concrete Plant	1	Concrete Plant	110
Truck Mixer	3	Concrete Plant	280
Concrete Pump	2	Concrete Plant	265

Based on the machine/equipment list given in **Table 64**, emission mass flow rates are calculated according to emission factors (kg/ton of fuel) of diesel-powered motor vehicles given at table 65 and presented in **Table 66** and **Table 67**.

Table 65. Emission Factors (Tier 4 Emission Standards for Motors up to 560 kW -EPA)

Motor Power	Year	CO (g/Kwh)	HC (g/Kwh)	NO_x (g/Kwh)	PM (g/Kwh)
56 ≤ kW < 130 (75 ≤ hp < 175)	2012 and Upper	5.0	0.19	0.40	0.02
130 ≤ kW ≤ 560 (175 ≤ hp ≤ 750)	2011 and Upper	3.5	0.19	0.40	0.02

Table 66. Expected Pollutant Amounts from Work Machines

Source	Vehicles and Work Machines	Expected Pollution Amount (kg/hr)	
Dozer (2 units)	PM	0.02 g/Kwh x 99 Kw x 2 units x kg/1000 g	0.00396
	NO_x	0.04 g/Kwh x 99 Kw x 2 units x kg/1000 g	0.00792
	CO	5 g/Kwh x 99 Kw x 2 units x kg/1000 g	0.99
	HC	0.19 g/Kwh x 99 Kw x 2 units kg/1000 g	0.03762
Crane (2 units)	PM	0.02 g/Kwh x 37 Kw x 2 units x kg/1000 g	0.00148
	NO_x	0.04 g/Kwh x 37 Kw x 2 units x kg/1000 g	0.00296
	CO	3.5 g/Kwh x 37 Kw x 2 units x kg/1000 g	0.259
	HC	0.19 g/Kwh x 37 Kw x 2 units kg/1000 g	0.01406
Cylinder (2 units)	PM	0.02 g/Kwh x 63 Kw x 2 units x kg/1000 g	0.00252
	NO_x	0.04 g/Kwh x 63 Kw x 2 units x kg/1000 g	0.00504
	CO	5 g/Kwh x 63 Kw x 2 units x kg/1000 g	0.63
	HC	0.19 g/Kwh x 63 Kw x 2 units kg/1000 g	0.02394
Motopomp (2 units)	PM	0.02 g/Kwh x 10 Kw x 2 units x kg/1000 g	0.0004
	NO_x	0.04 g/Kwh x 10 Kw x 2 units x kg/1000 g	0.0008
	CO	5 g/Kwh x 10 Kw x 2 units x kg/1000 g	0.1
	HC	0.19 g/Kwh x 10 Kw x 2 units kg/1000 g	0.0038
Loader (3 units)	PM	0.02 g/Kwh x 191 Kw x 3 units x kg/1000 g	0.01146
	NO_x	0.04 g/Kwh x 191 Kw x 3 units x kg/1000 g	0.02292
	CO	3.5 g/Kwh x 191 Kw x 3 units x kg/1000 g	2.0055
	HC	0.19 g/Kwh x 191 Kw x 3 units kg/1000 g	0.10887
Digger (1 units)	PM	0.02 g/Kwh x 156 Kw x 1 units x kg/1000 g	0.00312
	NO_x	0.04 g/Kwh x 156 Kw x 1 units x kg/1000 g	0.00624
	CO	3.5 g/Kwh x 156 Kw x 1 units x kg/1000 g	0.546
	HC	0.19 g/Kwh x 156 Kw x 1 units kg/1000 g	0.02964
Truck (10 units)	PM	0.02 g/Kwh x 235 Kw x 10 units x kg/1000 g	0.047
	NO_x	0.04 g/Kwh x 235 Kw x 10 units x kg/1000 g	0.094
	CO	3.5 g/Kwh x 235 Kw x 10 units x kg/1000 g	8.225
	HC	0.19 g/Kwh x 235 Kw x 10 units kg/1000 g	0.4465

Source	Vehicles and Work Machines	Expected Pollution Amount (kg/hr)	
Pumper (2 units)	PM	0.02 g/Kwh x 191 Kw x 2 units x kg/1000 g	0.00764
	NO_x	0.04 g/Kwh x 191 Kw x 2 units x kg/1000 g	0.01528
	CO	3.5 g/Kwh x 191 Kw x 2 units x kg/1000 g	1.337
	HC	0.19 g/Kwh x 191 Kw x 2 units kg/1000 g	0.07258
Generator (2 units)	PM	0.02 g/Kwh x 63 Kw x 2 units x kg/1000 g	0.00252
	NO_x	0.04 g/Kwh x 63 Kw x 2 units x kg/1000 g	0.00504
	CO	3.5 g/Kwh x 63 Kw x 2 units x kg/1000 g	0.441
	HC	0.19 g/Kwh x 63 Kw x 2 units kg/1000 g	0.02394
Concrete Plant (1 unit)	PM	0.02 g/Kwh x 110 Kw x 1 unit x kg/1000 g	0.0022
	NO_x	0.04 g/Kwh x 110 Kw x 1 unit x kg/1000 g	0.0044
	CO	3.5 g/Kwh x 110 Kw x 1 unit x kg/1000 g	0.385
	HC	0.19 g/Kwh x 110 Kw x 1 unit kg/1000 g	0.0209
Transmixer (3 units)	PM	0.02 g/Kwh x 280 Kw x 3 units x kg/1000 g	0.0168
	NO_x	0.04 g/Kwh x 280 Kw x 3 units x kg/1000 g	0.0336
	CO	3.5 g/Kwh x 280 Kw x 3 units x kg/1000 g	2.94
	HC	0.19 g/Kwh x 280 Kw x 3 units kg/1000 g	0.1596
Excavator (2 units)	PM	0.02 g/Kwh x 94 Kw x 2 units x kg/1000 g	0.00376
	NO_x	0.04 g/Kwh x 94 Kw x 2 units x kg/1000 g	0.00752
	CO	3.5 g/Kwh x 94 Kw x 2 units x kg/1000 g	0.658
	HC	0.19 g/Kwh x 94 Kw x 2 units kg/1000 g	0.03572
Concrete Pump (2 units)	PM	0.02 g/Kwh x 265 Kw x 2 units x kg/1000 g	0.0106
	NO_x	0.04 g/Kwh x 265 Kw x 2 units x kg/1000 g	0.0212
	CO	3.5 g/Kwh x 265 Kw x 2 units x kg/1000 g	1.855
	HC	0.19 g/Kwh x 265 Kw x 2 units kg/1000 g	0.1007

Table 67. Total Mass Flowrate During Construction Phase

Pollutant	Total Mass Flowrate (kg/hr)	Regulatory Limit Value	Evaluation
PM	0.11346	1	Below the limit value
NO_x	0.22692	4	Below the limit value
CO	20.3715	50	Below the limit value
HC	1.07787	3	Below the limit value

Emission calculations are done above for all machines and vehicles that will be used at construction phase. After the construction phase, work machines sourced emissions will be finished. During the construction phase, all work machines will not be expected work at the same time.

V.1.10 Water supply system and plan within the scope of the project, where the water will be supplied, amount of water to be obtained from the possible resources and amounts of these waters for usage purposes, their properties, where and how they will be supplied, amount and properties of the wastewater to be generated, how it will be treated and where it will be discharges, measures to be taken in this respect (preparation of a water management plan concerning drinking and service water for construction and operation phases, explanation on what to do in case of shortage of water supply)

V.1.10.1 Water supply and consumption amount within the scope of the project

During the construction phase, water will be consumed for drinking, usage, dust suppression, fire protection and concrete plant (**Table 68**).

Table 68. Water Consumption at Construction Phase

Usage Purpose	Usage Amount	Supply Type
Drinking water	75 m^3/day	The existing network / carboy
Usage, dust suppression, fire protection	10-15 m^3/day	The existing network
Concrete plant	12,500 m^3	Caisson wells

V.1.10.2 Potable Water Consumption

30 months is foreseen as part of the activity in the construction phase of the project. During the construction activities of the project is planned to employ at most 1,000 staff at the same time. Staff numbers at the construction site to work at different times, and the average number of employees is 500 people at the same time as foreseen. The amount of water required 150 liters per person/day, and maximum water requirement of 150 m^3/day and is calculated as an average consumption of 75 m^3/day. Potable water required to meet the needs of staff shall be provided from drinking water supply network and/or purchased commercially.

V.1.10.3 Usage, dust suppression and fire protection water consumption

During the construction phase, water will be used for construction activities. 10-15 m^3/day water is foreseen to be consumed for dust suppression and fire protection.

The water need for usage purpose will be supplied from water supply network.

V.1.10.4 Concrete plant water consumption

Concrete plant needs water to be used during construction activities. 50,000 m^3 concrete will be planned to be used for the power plant construction. 250 lt of water is needed for 1 m^3 concrete production. 180 lt of this amount will be used as an additive in concrete production and 70 liters of water used in the washing of concrete mixers. Therefore, the scope of the project 9,000 m^3 for additive and 3,500 m^3 for cleaning, at total 12,500 m^3 of water is needed for concrete plant. This water will be supplied from caisson wells which will be drilled close to the Kızılırmak River. Ready-mixed concrete plant will be consisting of silo, tapes and bunkers. Concrete plant will be installed in project site. Concrete plant is used during construction; with the completion of the construction phase concrete plant will be closed.

V.1.10.5 Wastewater generation and treatment methods

During construction phase, domestic wastewater will be generated due to daily activities of staff. Assuming that all of the water used by the personnel will return as wastewater, a daily maximum 150 m^3/day and on average 75 m^3/day wastewater will be generated. In this respect, the facilities (WC, shower, etc.) in the project site to be set up shall be used to meet the needs of the personnel. Domestic wastewater treatment plant will be designed with a treatment capacity of 150 m^3/day for 1,000 staff.

Domestic wastewater will be treated at domestic wastewater treatment plant which will be installed at Project site. The treatment plant will be conventional domestic treatment plant and before start-up "Package Wastewater Treatment Plant Project Approval" will be submitted according to 14.02.2013 dated and 2013/4 numbered Circular.

Water Pollution Control Regulations, which was published and enacted in the Official Gazette of 31.12.2004 with no. 25687, contains the following provisions: Article 26. a reads as follows: "For the wastewater sources that are located outside the urban areas and that discharges directly into the receiving medium, separate or common wastewater treatment facilities should be established in order to treat these wastewaters..". Article 26.e reads as follows: "Real and judicial persons, depending on their activity type, are obliged to meet the discharge standards given in Table 5 to Table 21 in the annex of this Regulation for the wastewaters they discharge into the receiving medium". In addition, Article 27 of the same Regulations reads as follows: "The standard values to be complied with when discharging domestic wastewaters into receiving aquatic mediums are given in Table 21."

Taking into account the said provisions, and since maximum 1,000 personnel will be employed in the construction site during the project site, the Standards for Discharging Domestic Wastewater into Receiving Medium given in **Table 69** shall be complied with.

Domestic wastewaters that will be generated during the construction phase of the Plant will be treated in a Packet Wastewater Treatment Facility, appropriate discharge limits will be obtained and then they will be discharged into Kızılırmak River.

Table 69. Water Pollution Control Regulation- Table 21.1: Sector: Domestic Wastewaters* (Class 1: Pollution Load as Raw BOD Being between 5-120 Kg/Day, Population = 84 - 2000)

Parameter	Unit	Composite Sample 2 Hours	Composite Sample 24 Hours
Biochemical Oxygen Demand (BOD5)	(mg/L)	50	45
Chemical Oxygen Demand (COD)	(mg/L)	180	120
Suspended Solids (SS)	(mg/L)	70	45
pH	-	6-9	6-9

Wastewater will be generated due to mixer cleaning process at concrete plant. The amount comes to 3,500 m^3 of wastewater. Concrete plant wastewater will be delivered to sedimentation tank (see Figure 56). After settling process, wastewater which is getting rid of suspended solids will be used for cleaning activities again. Only physical treatment will be performed at settling tank and there will be no chemical usage.

After drying in the subsequent settling sludges shall be sent to solid waste disposal facility.

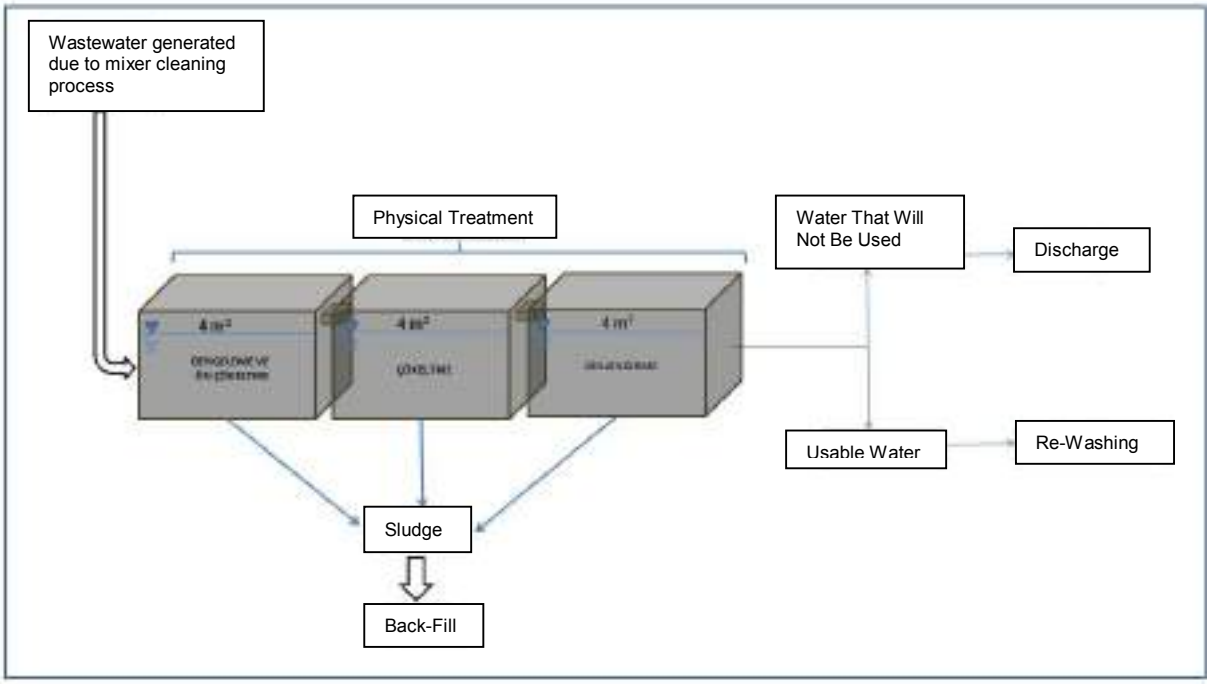


Figure 56. Settling Tank

For dust suppression process water will be used and most of the used water will be emitted by ground, remain water will evaporate. Therefore, there is no wastewater generation due to this process.

V.1.11 Materials to be used in cooling water and discharge structures within the project scope, precautions to be taken during the construction of the structures related with cooling water

The water to be needed during the project operation phase will be obtained by opening Caisson wells which will drill close to Kızılırmak River. The water will be reused in cooling system. Therefore, there will be no cooling wastewater discharge sourced from closed-cooling system.

V.1.12 The purpose of reuse of cooling water before discharging to the sea, units that will be used for this purpose, properties, possible changes in amount and structure at cooling water that will discharge to the sea

The planned facility, designed to be wet cooling tower. Therefore, the cooling water for the system is needed, which will be provided from caisson wells near Kızılırmak River only one time, then reused in cooling system. Therefore, the cooling water from the wells will not be discharge into any receiving environment.

V.1.13 The distance to natural gas pipeline, interaction, procedure for natural gas pipeline connection

The fuel to be used in power plant will be obtained from BOTAŞ Natural Gas Pipeline. Connection to the natural gas pipeline will be designed and implement properly for proper and continuous functioning of the power plant. For this purpose, by use of pressure reduction and measurement station, natural gas pressure will be reduced to required level for power plant. Technical methods to be applied in the construction of the gas pipeline, BOTAŞ safety regulations and obligations will be complied.

V.1.14 Types and quantities of the solid wastes to be generated as a result of the works to be executed until the commissioning the units from the land preparation (undertaking that it will not disposed to the creek beds), where these wastes are to be disposed of or for what purpose they will be used., temporary waste storage areas shown at site plan, properties of temporary storage areas (properties of wastes, detailed information about lifetime of wastes, permits under EIA regulation presentation as annex)

Solid wastes, amounts and disposal method are presented at **Table 70** for the construction phase.

Table 70. Solid Wastes and Disposal Method during Construction Phase

Source	Waste Type	Amount	Measures To Be Taken	Disposal Method
Staff Sourced Solid Wastes	Domestic Waste	1,150 kg/day (1.000 people x 1.14 kg/day-person)	➢ Collected separately from other wastes at sealed impermeable containers ➢ Solid Waste Control Regulation to be complied with the relevant provisions ➢ Recovering and reusing of waste where possible ➢ Domestic wastewater treatment sludge properly disposal according to laboratory analysis	Taken by the Municipality in certain periods, will be disposed of.
	Waste Vegetable Oils	Variable	➢ Collected separately from other wastes at sealed impermeable containers ➢ Uncontrolled disposal to the environment will be prevented ➢ Complied with the relevant provisions of Regulation on Control of Waste Vegetable Oil	Disposed by licensed disposal firms
Construction Sourced Solid Wastes	Construction and Excavation Waste	Variable	➢ Collected separately from other wastes at impermeable areas ➢ Complied with the relevant provisions of the Solid Waste Control Regulation, ➢ Separately collection of recoverable and/or recyclable materials ➢ Concrete plant sludge from the settling tank shall be sent to solid waste disposal facility.	Reuse is to be provided as possible. Taken by the Municipality in certain periods Recycled by licensed recycle firms
	Waste Mineral Oils	Variable	➢ All kinds of waste oil and engine oil from machinery and tools to analyze by the competent laboratories ➢ Recycling/disposal in accordance with the results of the analysis will be delivered to licensed facilities ➢ Complied with the relevant provisions of Regulation on Control of Waste Oils	Disposed by licensed disposal firms
	End of Life Tires	Variable	➢ Sent to an authorized disposal facilities will be provided for end of life tires ➢ Complied with relevant provisions of the Regulation on the Control of	Disposed by licensed disposal firms

Source	Waste Type	Amount	Measures To Be Taken	Disposal Method
			End of Life Tires.	
	Waste Batteries and Accumulators	Variable	➢ Complied with the relevant provisions of Regulation on Control of Waste Batteries and Accumulators	Disposed by licensed disposal firms
	Packaging Waste	Variable	➢ Preventing mixing with other wastes and providing separate collection ➢ Uncontrolled disposal to the environment will be prevented ➢ Complied with relevant provisions of the Packaging and Packaging Waste Control Regulation.	Disposed by licensed disposal firms
	Medical Waste	Variable	➢ Collected separately from other wastes at special design containers ➢ Complied with the relevant provisions of Regulation on Control of Medical Waste	Disposal by Municipality After signing medical waste protocol

V.1.15 Possible effects of the terrestrial and aquatic flora/fauna, and measures to be taken the effects of activities on marine environment on marine flora and fauna and measures to be taken

Information on terrestrial flora-fauna characteristics and ecosystem are presented in **Section IV.2.5** and **IV.2.12.** Since no marine activity will be carried out within the scope of the Project, construction activities will have no effect on marine environment.

V.1.16 Vibration to be generated within the scope of the project, noise sources and levels, preparation of acoustic report according to Directive on Evaluation and Management of Environmental Noise, (taking Acoustic Format in www.cbs.gov.tr as a basis)

Noise measurements were carried out in Project site and its near surrounding to determine the actual situation and the results are presented in **Section IV.2.18** and **Annex-6**. Based on these measurement results, noise levels to ne generated by machinery and equipment that will operate in construction stage of the Project were determined and Acoustic Report containing calculations was prepared **(See Annex-8**).

As per article 23 of Directive on Evaluation and Management of Environmental Noise, Lday (L_P) noise level that will be generated during construction works in construction stage should not exceed the level of 70 dBA around the closest sensitive building to the working site. The calculations in acoustic report found that 70 dBA limit value was met starting from 100 m.

The closest sensitive building to the construction site is the residences in Kılıçlar Town in 3.7 km west. The calculations showed that noise level was **33.50 dBA** at 3,700 m, which is below the limit of Directive on Evaluation and Management of Environmental Noise. As a result, the closest settlement places are not expected to be negatively affected from noise.

The calculations were made based on the assumption that all construction equipment will operate at the same time at the same place. This is not quite possible in practice. Therefore, noise levels obtained in calculations will be 8-10 dBA lower than the calculated value..

The personnel will be provided with protective equipment (helmet, hearing protection and earplugs etc.) to protect the health of the personnel. Within the scope of the project, provisions of Labor Law no 4857 and bylaws and directives issued and Directive on Evaluation and Management of Environmental Noise published in Official Gazette no 27601 dated 04.06.2010 shall be complied with.

V.1.17 Size of agricultural land to be disposed for land preparation and to supply necessary land for the construction site, their land utilization competencies and agricultural products

Since there is no agricultural land within the Project site, there is no agricultural land to be disposed in land preparation and construction period.

Furthermore, Soil Conservation and Land Use Law No 5403; Pasture Law No 4342; Aquaculture Law No 1380 shall be abided by and necessary permissions will be taken before the start of construction Works.

V.1.18 Types and numbers of the trees to be cut down during land preparation and for the construction site, natural plant species to be destroyed and total area involving these activities

There are no trees to be cut down in the Project site. As indicated in stand map of the site of the plant, Project site is composed of AgO and Z stand types.

V.1.19 How the personnel to be employed in the works to be executed from the land preparation until the commissioning of the units, and how and from where the housing and other technical / social infrastructure needs will be provided.

Approximately 1000 people are planned to be employed in the period with the most intensive construction activities and a total of 500 people on average. The personnel will be able to meet all their needs in dormitory, dining hall, kitchen, locker room, shower, WC, lavatory, warehouse, administrative and technical offices that will be established in the construction site.

The personnel will be primarily employed from the settlements around the project site and surrounding settlement locations. In case the personnel coming from their houses prefer to stay in their homes, they will be transported by the service cars if appropriate with respect to construction activities and/or if they so demand.

V.1.20 Determination of the intensity and spread effects on the underground and over-ground culture and natural assets in and near surroundings of the project (effects on the traditional urban tissue, archeological remnants, and on the natural values to be protected).

A review of the literature on the Project site and its near surrounding and analysis of 1/25000 maps showed that there is no archeological, historical, urban site and natural park, natural protected are, natural park etc. in the site. At the construction stage of the Project, in case archeological remains are found, administration of the nearest museum will be contacted as per the relevant law (Article 4 Notification Obligation (Law on the Protection of Cultural and Natural Assets dated 21.07.1983). the activities that are planned to be performed within the scope of the study will have no negative effect on traditional and urban fabric of Kırıkkale and Yahşihan.

V.1.21 Of the works to be carried out from the land preparation until the commissioning of the units, those that are risky and dangerous for human health and environment (Information on the measures to be taken against fire and explosions that negatively affect environment and social health)

Potential risks for human health and safety within the scope of planned construction activities are related with possible accidents that can happen in these types of construction Works. In this context, the contracting firm that undertakes construction Works will make use of knowledge and experience to make the site safe for all personnel and to ensure the safety of excavation, construction scaffolding and heavy construction equipment (e.g. Crane etc.) for all site personnel and of globally recognized safety rules. The workers will be provided with personal protective equipment (helmet, gloves, belt etc.).

The provisions of "Occupational Health and Safety Law" that was published in Official Gazette dated 30.06.2012 and numbered 28339 will be abided by in all activities within the scope of the Project.

- Potential traffic accidents caused increased traffic due to transport of construction materials, personnel and workers are planned to be prevented or minimized by taking precautions such as training the personnel, speed limit, putting additional traffic signs and warning signs and conducting regular periodic maintenance and checks of vehicles.
- Electric shock can be risky and dangerous for human health in electrical works. Qualified personnel will be employed and the personnel will be trained about work safety to minimize these accidents.
- In the period during which construction and commissioning activities continue, Project Owner will be liable to ensure health and safety about work; he will be responsible for taking necessary precautions including providing training and information to the personnel, provision of necessary tools and devices, adaptation of health and safety measures to changing conditions and improving current situation.
- The personnel will undergo periodic examination by a workplace Doctor who will work as per Occupational Health and Safety Regulation" and in an assigned Health Center. In this context, the provisions of "Regulation on Working Conditions and Duties and Authorities of Workplace Doctor" dated 27.11.2010 will be abided by.
- Furthermore, as required by the relevant legislation, an infirmary and health personnel will be present in the site. Strains and mild injuries will be treated there, in case of more serious injuries, nearby hospitals will be contacted.

V.1.22 Assessment of the traffic loads of all in-site and out-side transports to be made within the scope of the project on and its effects.

V.1.22.1 Traffic load

Ankara-Kırıkkale highway will be used to reach the planned plant. No new access road will be opened or no expansion will be made on the existing roads. In-site Access roads with suitable capacity will be constructed within the scope of the Project. These roads will be covered with asphalt to prevent dust formation.

During the transport of all materials to be used in construction activities the trucks will take all applicable safety measures and abide by traffic rules.

A total of 33 heavy vehicles (truck, excavator, etc.) will be used during construction phase (**See Table 64**). Necessary measures will be taken to transport these vehicles to the construction site and they will remain there until the completion of works.

According to Highways and State Highways Traffic Volume Map prepared by the General Directorate of Highways and Monitoring Program conducted by the Department of Transportation and Cost Studies Branch Directorate, traffic volume in 2012 was as follows:

Car	: 2,084 vehicles/day
Medium loaded Commercial Vehicles	: 190 vehicles/day
Bus	: 5 vehicles/day
Truck	: 197 vehicles/day
Truck+Trailer, Tractor+Side Trailer	: 32 vehicles/day
Total	: 2,508 vehicles/day (**See Figure 57**).

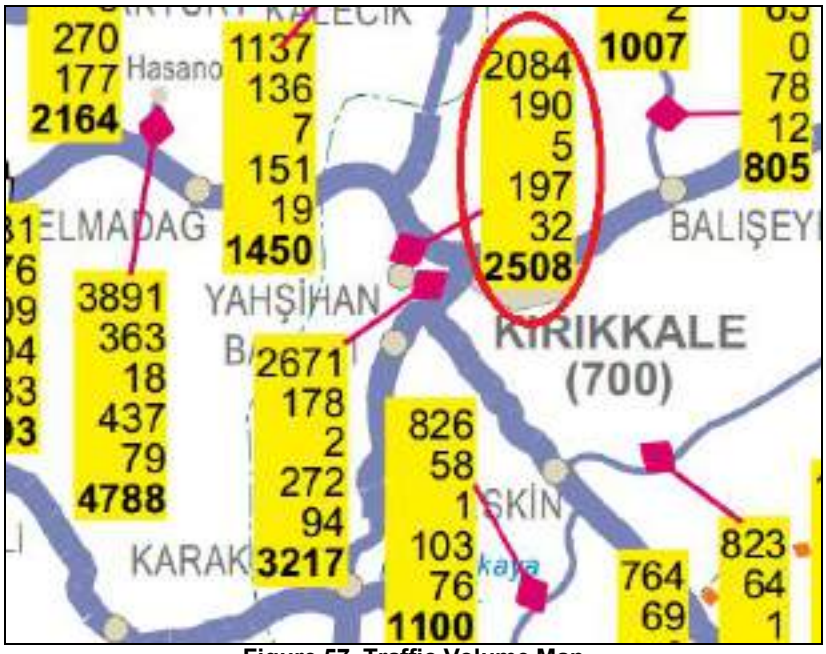


Figure 57. Traffic Volume Map

The route marked with red color in **Figure 55** will be used to reach the site. As indicated above, total vehicle volume in the planned road route is 2508 vehicles/day. Total vehicle volume is expected to be 2541 vehicles/day with an additional load of 33 vehicles/day during the construction phase of the Project. In conclusion, 1.31% increase is expected in the current traffic load due to the construction activities of the plant.

V.1.22.2 Mitigation measures

The following will be abided by to minimize the effect resulting from Access roads to the Project site:

- The vehicles will not be loaded to excess their axle load
- All transportation procedures will be realized by covering material loaded trucks.
- The trucks in the traffic will observe speed limits.
- The roads will not be damaged during construction and commissioning phases; in case of and damage caused, the damage will be covered by the project owner within the framework of a protocol to be made with Highways 4.Region Directorship (Ankara).

V.1.23 The size of land arrangement works to be carried out for creating landscape items in the project site and for other purposes. (afforestation, green space arrangements etc.) plant and tree species to be selected for this purpose

The aim of landscape work is to visually conceal the Project area and to create a nice environment for the enterprise. In this context, vegetative soil pulled away from the surface during excavation Works is planned to be used by spreading on necessary areas within the scope of the landscape Project.

Planting activities for the stabilization of excavation and filling shales that will occur during the construction of vehicle roads and facilities of plants will create a harmony between the road, plant and environmental landscape. Barriers will be installed in necessary areas to minimize the effects of potential erosion; supporting Works and terracing was applied using large Stones and afforestation Works will be carried out in these regions. After the completion of construction phase, considering natural vegetation and landscape, plants, mostly consisting of trees and local plants will be planted in plant site.

V.1.24 Other Features

There is no subject to be conveyed in this section.

V.2 Activities during commissioning of the project, the effects on physical and biologic environment and measures to be taken

V.2.1 Characteristics of the units within the scope of the project, allocation of the activities over the units, their capacities, detailed process flow diagrams of each unit, explanation of the process, services to be provided for each activity units, characteristics and amount of the machinery, vehicles, tools and equipment to be used (Detailed explanation of the differences between cooling system and other processes)

V.2.1.1 Characteristics, capacities, process flow diagrams of all units within the scope of the project

2+1 (2 gas turbines and 1 steam turbine) have been anticipated within the project scope and power of each turbine is 309.6 MW. The approximate thermal output power of gas turbine is calculated as (309.6x2)/0.3723 = 1,663 MWt and steam turbine as 328 MW.

Natural gas will be used as fuel in the plant. Necessary natural gas will be supplied from BOTAŞ Natural Gas Transmission Line. Annual natural gas amount to be used in plant will be 1,250,000,000 m³, energy amount to be produced will be at the level of 7,557 GWh/year.

Main and auxiliary units of the planned plant are presented in **Table 71.**

Table 71. Units of the Planned Plant

Main and Auxiliary Units of the Plant		
2 Dry Low NO_x Boiler Gas Turbine	3 Auxiliary Transformers	380 kV switchyard
2 horizontal flow type three pressure level HRSG	15/380 kV main step-up transformer	Water Treatment Plant
1 Condensing, three pressure level Steam Turbine (ST) with horizontal exit,	Isolated Phase Connector	Waste Water Treatment Plant
3 water or air cooled generator units	Electricity systems	Boiler feeding water pumps
1 wet type cooling tower	Mechanical systems	Gas supply and heating system

In the proposed plant, burning of natural gas in burning chamber will generate hot burning gas; the gas will expand and pass through the gas turbine and will rotate turbine blades. The shaft connected to the electric generator will rotate by the rotation of blades and electric energy will be generated. Hot exhaust gas produced in the gas turbines will be taken into the Heat Recovery Steam Generator to be reused and the water in the boiler will evaporate. Steam generated at high pressure will operate steam turbine and generate additional electrical energy. This system is termed as combined cycle power plant as two separate processes are used to generate electricity.

Waste steam that will return in HRSG will be condensed passing through a condensation unit. Condensed water will be re-fed to the system for reuse.

Electric consumption will be reduced and electric consumption in the plant will decrease due to the use of wet type cooling system. Process flow diagram envisaged for the plant is presented in **Figure 58**.

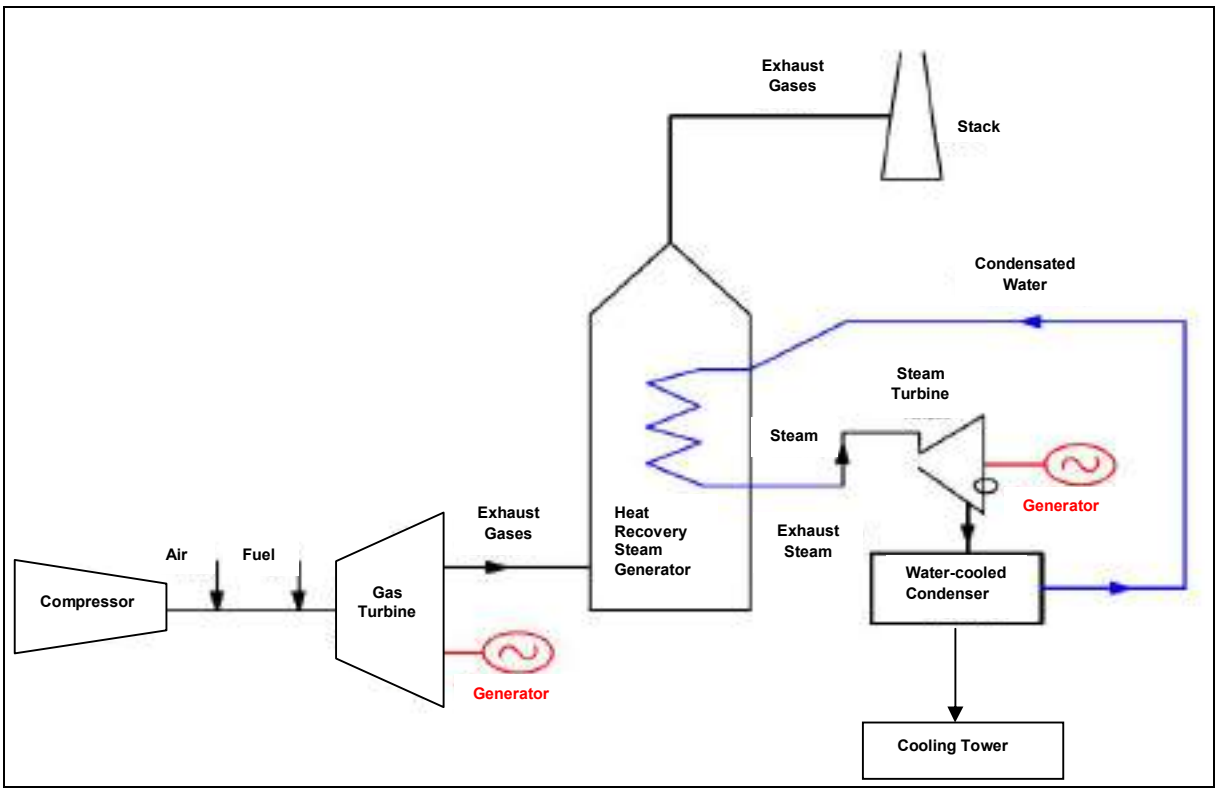


Figure 58. Proses Flow Diagram

Gas Turbine

Gas turbine is a unit that converts the energy in burning gas into mechanical energy. Gas turbine excites the generator thus mechanical energy is converted into electrical energy.

Pressure and temperature of air taken into air inlet system is increased by compression in compressor side of gas turbine. The air that will be used for cooling and sealing is drawn from the compressor in several levels. After the final compressor level, the air travels around the burning chamber, cools it and enters to the boiler. It is mixed with fuel coming from fuel distribution system. After the burning of fuel and air in the burning chamber, hot gases enter the burning chamber from high pressure turbine level. Hot gases reach HSRG after passing through low pressure level and exhaust diffuser. 2 gas turbines will be used in the envisaged Project; dry type low NO_x was selected as burning system.

Hot exhaust gases that will emit from gas turbine will be sent to HRSG for reuse, and thus steam will be generated. Steam to be obtained at high pressure will generate electric energy by operating the steam turbine. Thus, electric will be generated in two stages (combined cycle). Waste steam that returns from steam generator will condensate after passing from the condenser and condensed water will be re-sent to the system for re-use.

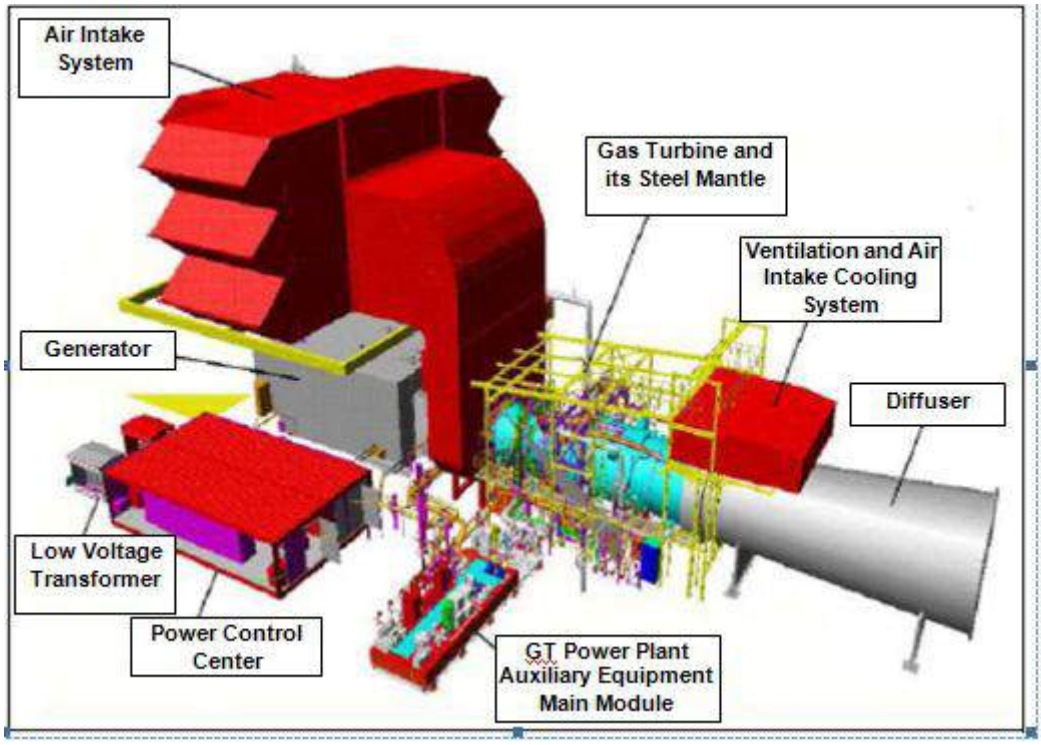
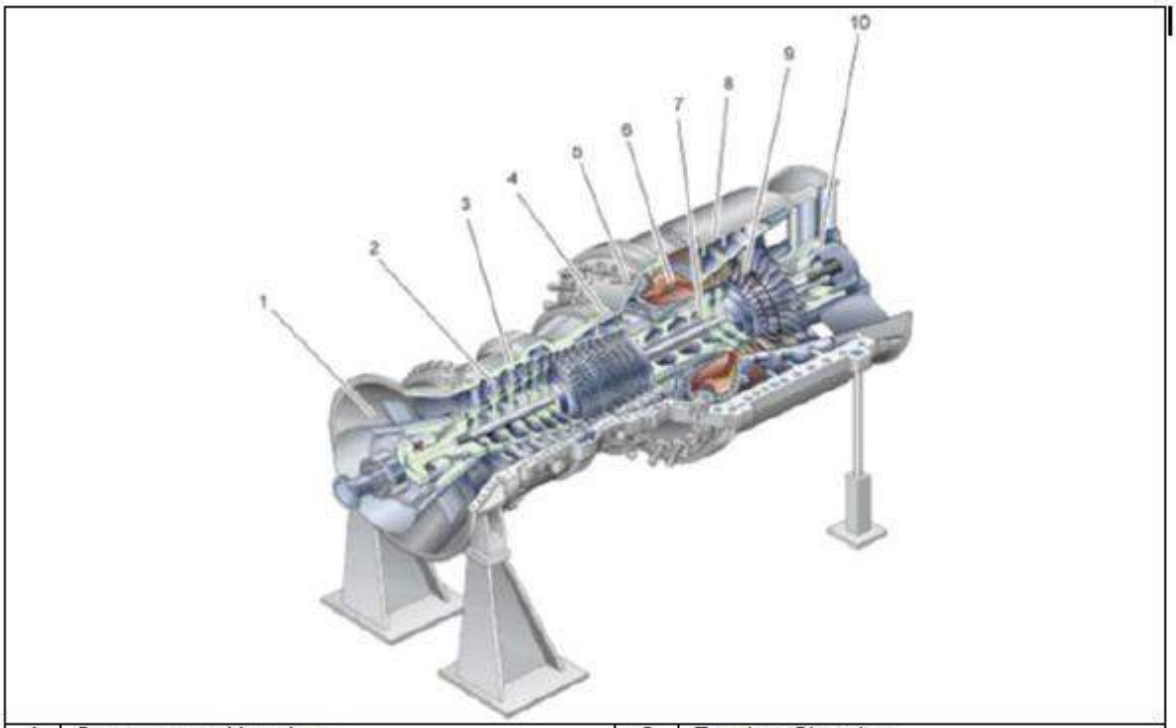


Figure 59. A Typical Gas Turbine



1	Compressor Housing	6	Burning Chamber
2	Compressor	7	Blade
3	Compressor Guide Blades Connector 1	8	Turbine Body
4	Burning Chamber Outer Protection Layer	9	Turbine
5	Boiler	10	Compressor Housing

Figure 60. General Cross Section of Cylindrical Burning Chamber and Gas Turbine

Table 72. Technical Properties of Gas Turbine

Technical Properties	Gas Turbine
Burning system	Dry low NO_x
Gross Production in the Generator Station	270.700 kW
Number of Stacks	1
Shaft Speed of Gas Turbine	3.000 rpm
Pressure Rate of Gas Turbine	~17
Intake Temperature to the Gas Turbine	17 °C
Exit Temperature from the Gas Turbine	586,5°C
Compressor Suction Air Flow	641,6 kg/s
Gas Flow Output from the Turbine	655,5 kg/s
Temperature Rate in the Generator Station	9.111 kJ/kWh
Productivity in the Generator Station	%39,51

Heat Recovery Steam Generator (HRSG)

Exhaust gases of gas turbine enter into reheat, self-unburned heat recovery steam generator with three different pressurized temperature. High pressure fresh steam from HRSG creates rotation force in the common steam turbine. The steam produced here using the waste heat of gas turbine exhaust is sent to steam turbine. As auxiliary equipment to HRSG, high pressure steam temperature reducer, intermediate heating exit stem (medium pressure input steam) temperature reducer, safety valves, sound absorber, blow-down tank.

Each waste heat boilers will contains separate heater, evaporator and economizer units to generate high pressure (HP), intermediary pressure (IP) and low pressure (LP).

A typical Heat Recovery Steam Generator will include the following units:

- Gas turbine exhaust gas system
- Stack gas channels
- Isolation
- Ventilation and drainage systems
- Actuating system
- Blow down system
- Pipes and valves related with the boiler
- Stack

Technical properties of heat recovery steam generator are presented in **Table 73**.

Table 73. Characteristics of Heat Recovery Steam Generator

Technical Characteristics	HRSG
Amount	2
Type	Horizontal, Natural Flow
Amount of Pressure Level (Stages, HP, LP & IP)	3 Pressure
Design Pressure of the Boilers (bar) (HP / IP / LP)	119.6 / 29.93 / 4.135
Design Temperature of the Boilers (Celsius) (HP / IP / LP)	567.2 / 566.5 / 233.5
Boiler Intake Mass Flow (Burning Gas Turbine)	655.5 kg/sec.
Boiler Intake Temperature (Burning Gas Turbine)	586
Boiler Exit Burning Gas Amount	655.5 kg/sec.
Burning Gas Temperature from Boiler (from the Stack)	87 ^{o}C

Steam Turbine

Steam turbine is fed with the steam generated in heat recovery steam generator. In steam process, high pressure steam coming from heat recovery steam generator enters into high pressure turbine and expands to intermediary heating pressure. High pressure output steam coming from exhaust side of high pressure turbine (intermediary heating input steam) mixes with intermediary pressure steam and is re-heated in heat recovery steam generator. Heating output steam (intermediary input steam) enters to intermediary pressure turbine. On the other hand, low pressure stem enters into low pressure turbine. Low pressure exiting from steam generator and the steam in temperature enter into the condenser and turns into water by condensation via the cooling system. They are sent to degasser/feeding water tank to take uncondensed gases using condensation pumps. Water is again pumped into heat recovery steam generator by feeding water tank using feeding water pumps. Water/steam closed cycle circulates between heat recovery steam generator, steam turbine and condenser.

One steam turbine was envisaged for the Project. Mechanical energy obtained from the turbine will be converted into electrical energy using generator. Turbine is planned to have a rotation speed of 3000 rpm (**See Figure 61**). Technical properties of steam turbine are presented in **Table 74**.

The steam turbine will have the following units:

- The steam turbine will have the following units:
-
- Glands and sealing systems
- Automatic drainage system
- Lubrication and control lubrication systems
- Instrumentation and control system
- 3 phase alternative current generator
- Turbine, generator and generator transformer protection systems
- Cooling systems
- Synchronization units.

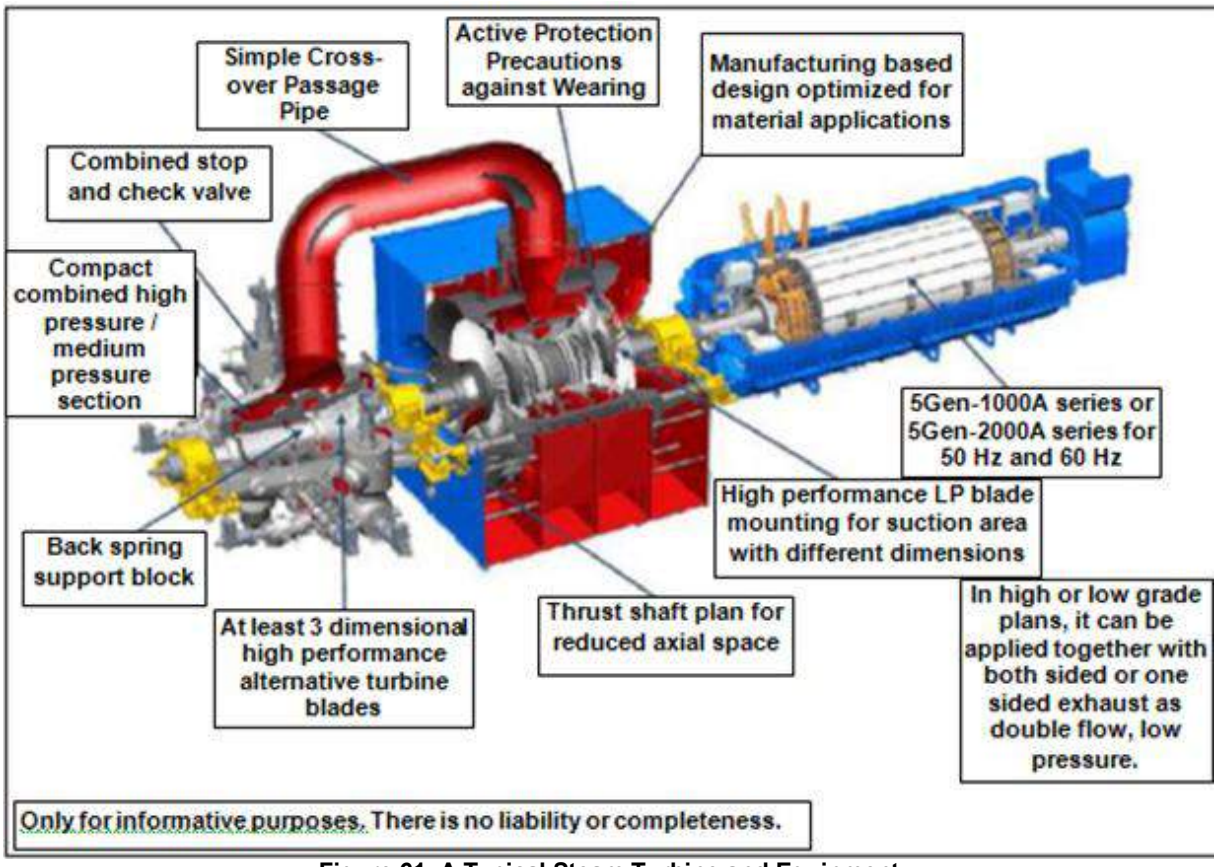


Figure 61. A Typical Steam Turbine and Equipment

Table 74. Technical Properties of Steam Turbine

Technical Properties	**Steam Turbine**
Gross Capacity of the Project Area	278.300 kW
Type	Re-heated
Number of Phases	3
Steam Turbine Entrance HP Steam Temperature	563,8°C
Steam Turbine Entrance HP Steam Pressure	116,1 bar
Steam Turbine Entrance HP Steam Amount	145,8 kg/s
Steam Turbine Entrance IP Steam Temperature	563,8°C
Steam Turbine Entrance IP Steam Pressure	28,64 bar
Steam Turbine Entrance IP Steam Amount	171,6 kg/s
Steam Turbine Entrance LP Steam Temperature	231,9°C
Steam Turbine Entrance LP Steam Pressure	3,90 bar
Steam Turbine Entrance LP Steam Amount	20,5 kg/s
Steam Turbine Exhaust Temperature	31,63 °C
Steam Turbine Exhaust Pressure	0,0466 bar
Steam Turbine Exhaust Mass Discharge	196,2 kg/s

Pre-Heating Boiler

A pre-heating boiler with a steam debit of approximately 6.5 ton/h is envisaged to be installed within the scope of the Project. Only natural gas will be used in pre-heating boiler and it will have an efficiency level of approximately 90%.

Pre-heating boiler was designed to be used in case of re-commissioning of the plant after it is ceased for any reason. Since steam generation in heat recovery steam generator takes a long time during re-commissioning of the plant, pre-heating boiler will be used to

generate steam quickly. Pre-heating boiler that quickly generates steam during re-commissioning will be turned off after the system is regularly commissioned. This unit, which will not be constantly used, is only planned to shorten re-commissioning time of the plant and to make energy production more efficient.

Cooling System

The low pressure and temperature steam from steam turbine is sent to steam condenser and condensed by means of the cooling system to turn into water. Later on, this condensed water is sent back to the Heat Recovery Steam Generator. In this way, the water / steam closed cycle is circulated between the boiler, steam turbine and the condenser.

The cooling system is planned as closed cycle open type penstock cooling tower (Wet Type Fan System). Air is vertically suctioned from the air inlet in the bottom of the tower, travels in reverse direction of water flow and is discharged into the atmosphere at a high speed.

Approximately 40,000 m^3 circulation water is required for the cooling system. This amount will be supplied from caisson wells that will be opened near Kızılırmak River.

In the cooling system, in the circulation water circulated in a closed cycle vaporization and blow down losses will occur. To meet evaporation losses, water will be supplied from caisson wells. Details on amount of water to be supplied from caisson wells and additional water amounts are presented in **Section V.2.2.**

During the vaporization losses occurring in the cooling system, the dissolved minerals and the solid particles found in the cooling water cannot be evaporated. The water evaporated in the cooling towers is the H_2O molecules.

Chemical substances should be used in cooling system to maintain cooling water quality. There is a chemical dosing unit within this unit. The chemicals used in this unit and their purposes are presented in **Table 75**.

Table 75. Chemicals to be used in the Cooling System

Name of the Chemical	Amount	Objective
Anti-lime	21 kg/hr	Preventing the lime formation and corrosion in the system
Diluent	1.375 kg/month	Preventing and controlling the formation of precipitates
Chloride/sodium hypochlorite	14 kg/hr	Preventing the growth of the algae and biological organisms
Sulfuric acid	88 kg/hr	Adjusting the pH of the water

Technical properties of cooling tower that is planned to be used in the plant are presented in **Table 76**.

Table 76. Technical Properties of the Cooling Tower

Technical Characteristics	Value
Row number	2
Cell number	18
Cooling capacity	40190 ton /hr
Surface area	-
Estimated space taken	146.5 m x 36.2 m
Air speed	4.74 m/sec (intake)
Total ventilator capacity	159,1 kW x 18 sets
Temperature of blow-down water	18 ^{o}C

The steam system consists of three different pressure systems: high pressure (HP), intermediary pressure (IP) and low pressure (LP). The system guarantees temperature required for actuation and normal operation, the distribution and supply of the steam generated by HRSG. In normal process procedure, steam generated by HRSG feeds the general of the system. Each boiler has a turbine by-pass system that allows for the independent operation of each gas turbine and its boiler from the steam turbine. Desuperheater is obtained by the injection of water into injection coolers.

Dry Low NO_x boiler.

Dry Low NO_x boiler is an advanced boiler that can adjust fuel/air mixture in the boiler and thus reduce the temperature of the flame generated in the boiler and NO_x formation.

Switching Station

It is a lower stage of electric generation, transmission and distribution system where voltage is converted from high form to low or reverse form.

Step-up Transformer

The voltage of the energy generated in the generator is increased to network voltage level.

Generator

Diesel generator capacity proposed for ACWA Natural Gas Combined Cycle Plant Project is 1.200 kW, it will be used only in emergency situations. If it operates in full-load, it is expected to consume approximately 345 lt/hr fuel.

Auxiliary Equipment

There is auxiliary equipment that doesn't have any environmental effects however that should be considered for the space need of the plant. Apart from these, there will be a Continuous Emission Monitoring System-CEMS to monitor stack emissions. In addition, the activity area will contain a managerial building, social building, maintainence-rapair workshop, storage, control room, water treatment plant, waste water treatment plant, switchyard and RMS-A and RMS-B station to reduce natural gas pressure and to measure gas amount.

V.2.2 Amounts of water to be used in Project units, the processes (detailed explanation of cooling system) for which the water will be used, place and method of water supply, pre-treatments to be applied on water (including treatment units and the units where water will be used as Addition/Feed water), water preparation flow Diagram, water steam cycle, water treatments to be applied in process flow diagram cycle, chemicals to be used and their amounts, the effects of cooling water on the receiving environment and measures to be taken

V.2.2.1 General

For ACWA Power Natural Gas Combined Cycle Plant Kırıkkale, water will be used for two purposes: process and domestic. The water that will be used in the plant will be supplied from caisson wells (5 or 6) that will be opened near Kızılırmak River.

Amount of water that will be taken from these caisson wells was calculated as 97.6 lt/sec according to Darcy equation (See Geotechnical Survey Report, **Annex-5**). As the plant operates according to the principle of closed cycle, water will be supplied from caisson wells only once, and later lower amount of water will be drawn to meet the losses in the system. 1,275 m^3/hr (354.16 lt/sec) water should be supplied to meet evaporation and blow-down losses and demi water (**See Table 77**).

Table 77. Process Water Utilization Amounts During Operation

Water utilization	Quantity	
	m^3/hr	m^3/day
Cooling system evaporation losses	790	18960
Cooling system blowdown	350	8400
Heat recovery steam generator blow-down	35	840
Other Uses (washing, cleaning etc.)	40	960
Demineralization Unit Regeneration Waste	25	600
SaFilter Backwashing	35	840
TOTAL	**1,275**	**30,600**

In below table, monthly average flow rate of 10 years (1999-2008) as obtained from Flow Observation Station No:1503 located Yahşihan bridge operated by EİE (General Directorate of Electrical Power Resources Survey and Development Administration) is presented. As can be seen from the table, the amount of water continuously required (estimated as 0.354 m^3/s) for the plant to be supplied from the caisson wells is significantly very low when compared to the averege monthly flow rate of the river.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Agu	Sep
Average (m^3/s)	40	41	47	53	43	31	24	42	58	80	78	64

Water mass diagram of the plant is presented in **Figure 62**.

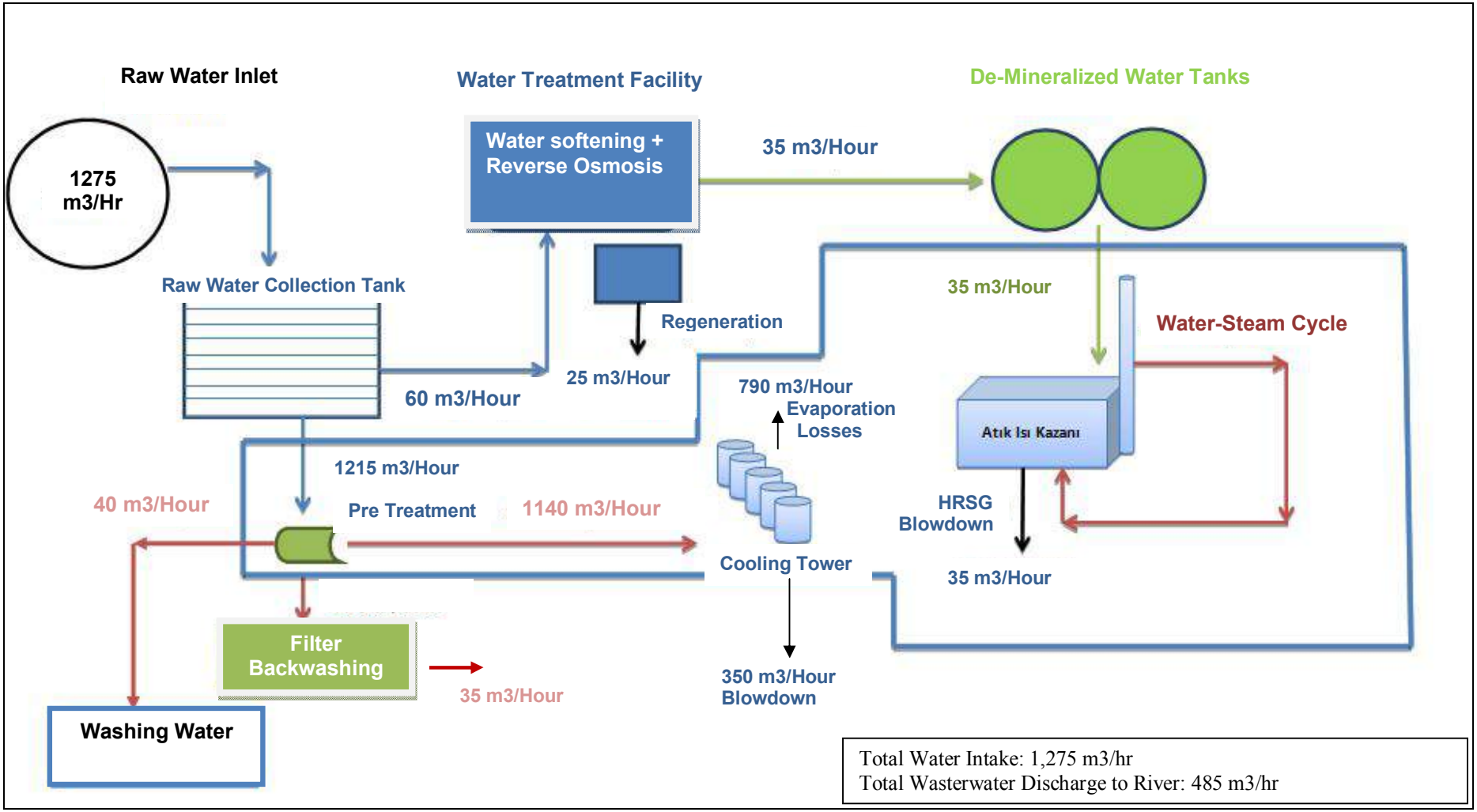


Figure 62. Water Mass Diagram

V.2.2.2 Process Water Use

In ACWA Power Kırıkkale Natural Gas Combined Cycle Plant, the water necessary to meet evaporation losses, heat recovery steam generator and cooling system blow-down water supply and washing procedures in the plant will be met from caisson wells. The water that is taken to the plant will be firstly sent to water treatment system before sending to the system. Amount of process water to be used in the plant is presented in **Table 77**. Formation of wastewaters that will be generated in the plant is presented in **Figure 63**. Storm water will be collected seperatly and discharged directly to the receiving environment.

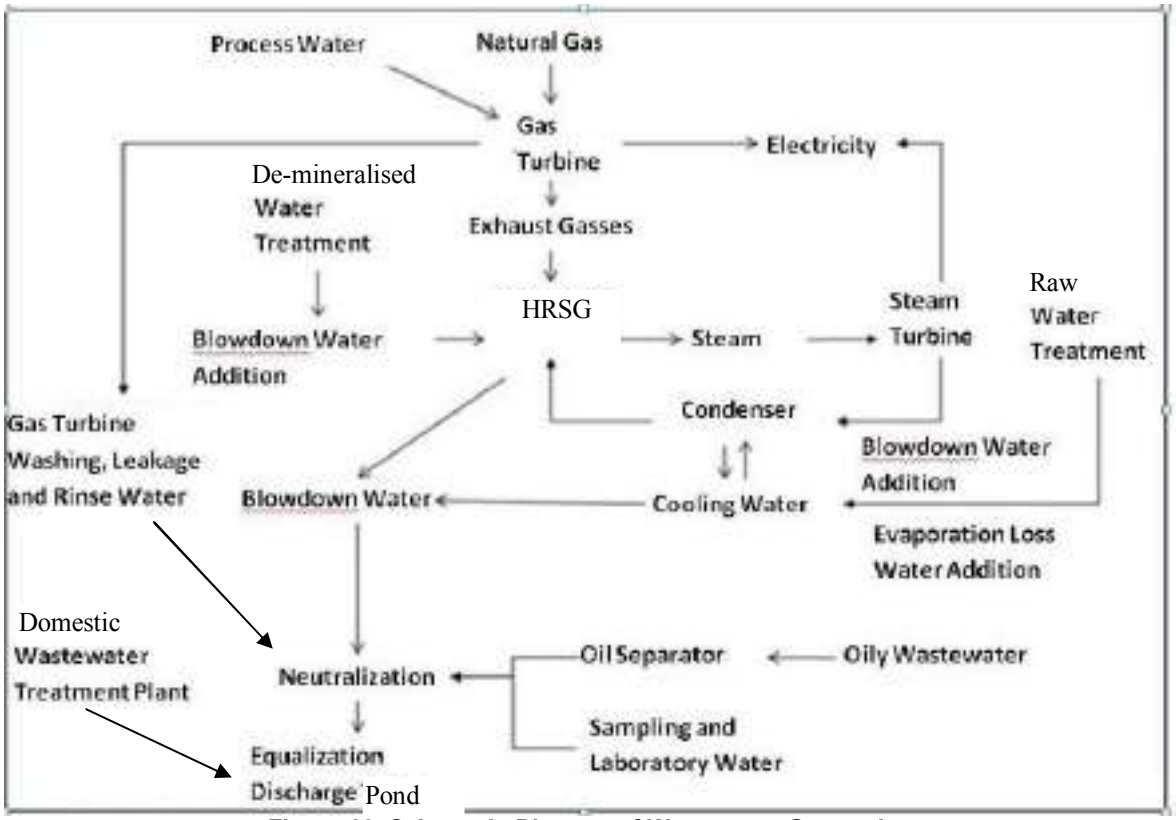


Figure 63. Schematic Diagram of Wastewater Generation

Cooling System Water

In context of the project, the cooling system is designed as a closed cycle fan cooling tower. In this system approximately 400 l/sec circulation water is required. This amount in question will be supplied from caisson wells to be opened in Kızılırmak River.

In the cooling system, in the circulation water circulated in a closed cycle vaporization and blow-down losses will occur. In order to meet the evaporation and blowdown losses, 1,140 m^3/ hour water should be added to the system.

Heat Recovery Steam Generator Blow-Down Water

35 m^3/hr water is necessary to generate steam in HRSG. The water required for HRSG unit of the plant will be supplied from caisson wells. The water supplied from caisson wells will be subjected to re-precipitation. Then the water will be subjected to ultrafiltration unit, filtered water tank, water softening unit, reverse osmosis system,

electrode ionization unit and finally to demineralization water storage tank. Demineralization water is fed to heat recovery steam generator with a flow rate of 35 m^3/hr. Water treatment unit capacity in which water to be taken into HRSG shall be treated is designed as 60 m^3/hr. In water softening unit 25 m^3/hr of the water shall be used in regeneration process.

Blow-down procedure is necessary to keep dissolved solid matters in steam boilers. When the concentration of water in boiler increases, a certain amount of water is blowed at certain intervals and period according to concentration level from the region with high degree of pollution at bottom level,, water is fed at lower concentrations to compensate the blowed water and thus concentration is reduced. This procedure is termed as bottom blow-down. Surface blow-down should be made to eliminate the drawbacks of condensation and foaming of the suspended substances in boiler. Surface blow-down is obligatory in terms of the quality of steam generated in a steam generator, boiler efficiency and operation safety. Blow-down water is generally discharged to outside. To save from energy and water, on condition that properties of water quality remain constant, it is important to keep blow-down water to be discharged to outside at minimum level.

Blow-water with a debit of 35 m^3/hour will be produced in HRSG within the plant. Blow-down water will be treated in neutralization pool; they will be balanced by being taken to discharge pool outside wastewater treatment plant and they will be discharged.

Gas Turbine Washing, Leakage and Rinsing Waters

Gas turbine compressors must be washed regularly. At this stage, the water supplied from the caisson wells will be treated and used in the Clarifier (sand filter) in the facility. Wastewater produced in the clarifier are analyzed in detail in the next section. The water that exit from treatment will be balanced by taking into discharge pool located in the exit of wastewater treatment plant after being treated in neutralization pool and then will be discharged.

Washing of the gas turbines is not going to be made continuously; rather the washing will be made periodically and when needed. Therefore, the waste waters sourcing from this stage are not continuous. The gas turbine washing waste waters will be collected in the Discontinuous Waste Water Treatment Pond before the Waste Water Treatment Facility and will be balanced here. The waters collected here will then be taken into Continuous Wastewater Equalization tank then they will be sent to the Wastewater Treatment Facility.

Filter Backwashing Waters Filtre

Process water shall be directly used as cooling water after passing through preliminary treatment-clarifier (sand filter) while, boiler water shall be used after treatmed in advanced treatment facility. 35 m^3/hr of pretreated water shall be used in backwashing.

Oily Waste Waters

The oily waste waters emerging from the activities in the project from the repair-maintenance works will first be taken into Grease separation unit to separate the Grease in the waters; then they will be sent to the neutralization pond. During the activities in the project area, the provisions of the “Waste Oil Control Regulatory” published in the Official Gazette dated 30.07.2008 and numbered 26952 will be followed

Rain Waters from the Switchyard and the Other Units

Within the scope of the facility, drainage and rain water collection channels will be excavated and the waters will be collected through these channels to be discharged to Kızılırmak River. Similarly, rain waters in switchyard and facility during the operation of the facility will be collected with collection channels separate from wastewater collection channels and will be sent Kızılırmak River.

V.2.2.3 Domestic Water Use

Potable water supply for the personnel to be employed in operation phase shall be supplied from the drinking water network in the region and/or purchased from the market. In case of failure to supply from drinking water network and/or the market, water shall be provided from caisson wells. Provided water shall be used after being treated in the water treatment plant located in the facility.

The water obtained from the caisson wells pass from pre-sedimentation basins in clarifier and then are taken into Active carbon Filtering system (an advanced treatment unit). After completion of the advanced treatment, the water is distributed for drinking and domestic use. The capacity of the Advanced Water Treatment Facility where the water is treated is designed as 60 m^3/day.

The waste water that will occur during the operation stage of the facility is domestic waste water based on the consumption as drinking water and utility water. During the operation stage of the project, approximately 60 people will be employed.

Taking the daily need of water per person as 150 lt/day (source: Water Supply and Waste Water Removal Applications, İTÜ, 1998, Prof. Dr. Dinçer TOPACIK, prof. Dr. Veysel EROĞLU), the total water needed is calculated as 9 m^3/day. If we accept that all of the water used by the personnel will return as waste water, a total of 9 m^3/day waste water will be produced.

Article 26.a. of the Regulatory for Water Pollution Control published on the Official Gazette dated 31.12.2004 and numbered 25687 states that “for the waste water resources out of the city discharging to receptor environment individual or common treatment facilities are required for treatment of the water.” and the Item 26.e. states that “natural or legal persons, based on their type of activities, are liable to provide discharge standards for the waste water as indicated from Table 5 to Table 21 listed in the appendix of the supplement of the Regulatory.” Besides, in the Article 27 of the same regulatory, it is stated that “the standard values to be followed in discharging the domestic waste water into receptor environments are given in Table 21”.

Taking the provisions into account, the standards for discharging the domestic waste water into receptor environments will be followed and the domestic waters produced during the operational stage will be treated in Package Waste Water Treatment Facility; and will be discharged to the Kızılırmak River after reaching the discharge limits complying with the Discharging Standards for Domestic Waste Water into the Receptor Environment. (**See Table 78**).

Table 78. Water Pollution Control Regulation – Table 21.1. Sector: Domestic Waste Water* (Class 1: The pollution load is between 5-120 kg / day as raw BOI, Population: 84-2000)

Parameter	Unit	Composite Sample for two hours	Composite Sample for 24 hours
Biochemical Oxygen Demand (BOD5)	(mg/L)	50	45
Chemical Oxygen Demand (COD)	(mg/L)	180	120
Suspended Solid (SS)	(mg/L)	70	45

V.2.3 The uses of cooling water before discharge into sea, relevant planned units, possible changes in the structure and amount of the water that is discharged back to sea, the distance of collection and discharge of water, mode of discharging into sea, (should be supported with modeling, Modeling Report should be added to ESIA Report)

The water which is planned to be used in the facility will be supplied from caisson wells to be opened near Kızılırmak River and will be re-used in the system. As a result, no cooling water will be discharged to the receiving environment as the facility operates in closed-cycle cooling system, and the cooling tower blowdown will be discharged to the reciveing environment after treatment and has to within the allowable discharge limits.

V.2.4 Production methods and technologies to be used in activity units, production flow diagram, thermal power of the plant

V.2.4.1 Production methods and technologies to be used in activity units

Detailed information on the units to be used in the facility and operation principles of these units is presented in **Section V.2.1**.

V.2.4.2 Production flow diagram

Detailed information on facility units and operation principles are presented in **Chapter V.2.1**, process flow diagram is presented in **Figure 12**.

V.2.4.3 Thermal power of the plant

2+1 /2 gas turbine and 1 steam turbine) are planned in ACWA Power Kırıkkale Natural Gas Combined Cycle Plant. Each gas turbine will have a power of 309,6 MW. Thermal power of gas turbine is approximately (309,6x2)/0.3723 = 1,663 MW_t.

Low- NO_x boilers will be used in the facility. Low- NO_x boilers can regulate fuel/air mixture in the boiler and thus reduce the temperature of flame that is produced in boiler and thus reduce NO_x formation.

V.2.5 Amount of wastewater to be produced in all units of the Project, physical chemical and bacteriologic properties, parameters to be discharged in

wastewater treatment plants, discharge ratios and discharging procedures, mode of discharge of wastewater after treatment procedure to the receiving environment

The processes in the Project will produce industrial wastewaters and domestic waste waters due to water use of the personnel.

Wastewater treatment plants will be established to treat domestic and industrial wastewaters.

V.2.5.1 Process water treatment system

Process water that will be supplied from caisson wells should be subjected to pre-treatment to remove the substances in its content and for demineralization (removal of dissolves salts) **(See Figure 64)**.

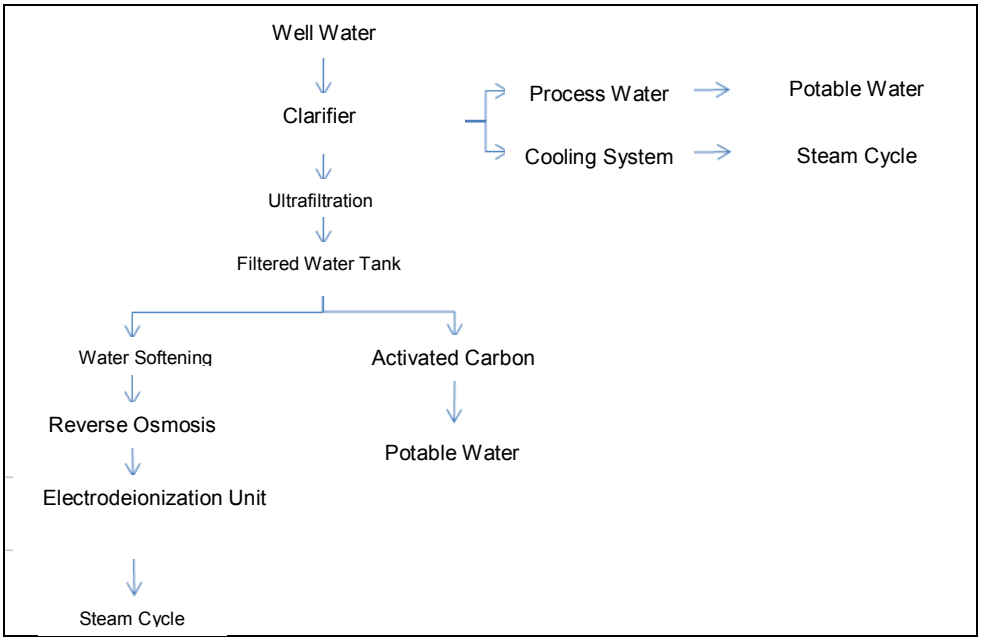


Figure 64. Treatment Process

Clarifier

The water in water treatment system will be firstly taken to clarifier at a debit of 1,113 m^3/hr. The system will contains two cylindrical clarifiers with a capacity of 560 m^3/hr. Raw water taken to the clarifier will be kept there to precipitate suspended solid substances. 1.050 m^3/hr of the water that exit from the clarifier will be taken to the cooling system to meet cooling system losses and 16 m^3/hr will be taken to be used as process water. Water with a capacity of 41 m^3/hr will be taken to water filtration unit; it will be treated to be used in process and potable water.

The particles that precipitate at the bottom of the clarifier are sent to equalization basin **(See Figure 65)**.

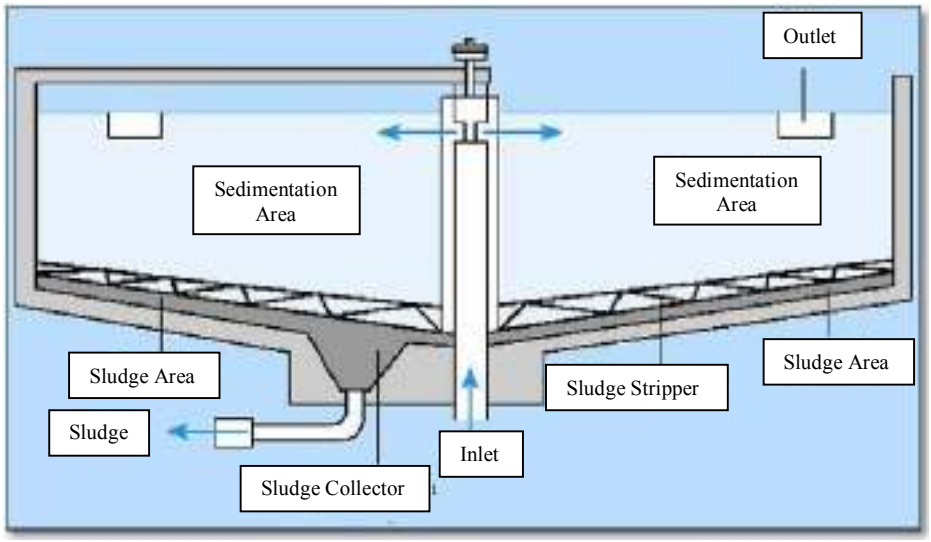


Figure 65. Cross-sample of Clarification Tank

Ultrafiltration

It is one of the membrane filtration method. Unlike similar treatment methods such as nanofiltration and reverse osmosis Technologies, it improves all physical properties of water without interfering with chemical structure of water (**See Figure 66**).

Figure 66. An Example of Ultrafiltration System

In the Ultrafiltering unit two UF filters with a capacity of 50 m^3/hr will be used and after passing through a filter with a discharge rate of 41 m^3/ hr the filtered water will be taken into the Filtered Water Tank to be used in process and as drinking water and the treatment continues. The waste water in question will emerge as the washing process is realized and it is not continuous. Waste water formation during the washing process is expected at a discharge rate of 30 m^3/day.

Water Softening

Hard water causes problems by forming lime layers in the system. Besides, during the heating of the water for steam production calcium carbonate and magnesium carbonate leaves the water and accumulates in the boiler. In time, the boiler spends more

energy to reach heat and its lifetime becomes shorter. At the same time, hard water wears and blocks the materials used.

In water softening unit, the calcium and magnesium found in the water are removed. Water softening process is realized by the cationic resines found in the mineral tank which work by simple ionic Exchange principle. The resines catch the Ca and Mg ions and leave Na ions in their places. In case the Na ions in the resines are consumed, the system is regenerated and taken into service again.

In Ultrafiltration System the waters coming from the filtration are taken into Filtered Water Tank to be used as process water and drinking water; and the treatment continues. The waters to be used as process waters are taken into Water Softening Unit.

In water treatment system 2 vertical cylindrical water softeners with a capacity of 38 m^3/hr will be used, the waters softened in these units are taken into Reverse Osmosis Unit. The waste waters sourcing from the Water Softening Unit and having a discharge rate of 24 m^3/day are sent to the Neutralization Unit.

Reverse Osmosis

The reverse osmosis technology is the most precise filtration technology ever known. During the normal osmosis process, transfer of water molecules from the liquid phase with low ionic concentration to the liquid phase with high ionic concentration is realized; these two liquid phases are separated by a semi-permeable membrane from each other **(See Figure 67**).

Figure 67. An example of Reverse Osmosis System

In water treatment system two skid mounted type reverse osmosis units will be located; the first of these will have a capacity of 32 m^3/hr while the second one has a capacity of 28 m^3/hr. The waters being processed in the units in question at discharge rate of 37 m^3/hr will be taken into the Electrodeionization Unit.

Electrodeionization (EDI)

Electrodeionization removes the ions found in the process water by using the classical ion exchange resines with the help of the electrical current passing through a bed; the pollutant ions continuously move towards the concentrate line from the feeding water. By doing so, the water treatment is completed and the chemical losses which are the disadvantages of the classical regeneration processes are prevented. In the system one skid mounted type EDI unit will be used and its capacity will be 25 m^3/hr.

The waters processed in the unit in question with a discharge rate of 28 m^3/hr will be taken into the Demineralizated Water Storage Tank and from here, the system is fed to produce steam in the Heat Recovery Steam Generator. The waste waters with 3 m^3/hr discharge rate coming from the deionization system and displaying discontinuity are sent back to the Filtered Water Tank.

Active Carbon Filters

The active carbon is used in the waters to remove the dissolved organic and inorganic pollutants as well as to remove the color, smell and taste. The carbon minerals of which surface areas are increased approximately 100 times absorb the organic substances and filter them.

The active carbon filters are used in polyethylene tanks or in epoxy coated steel tanks. The only point changing in the systems is the working principle of the automation systems. These systems which can be time controlled, volume controlled, electronic panel controlled (microprocessor) or manually controlled can be used in both tank models.

The waters passed from the ultrafiltration system are taken into Filtered Waters Tank to be used as process and drinking water and treatment continues on. The waters to be used as process or drinking water are taken into Active Carbon Filter System.

The waters processed in the unit in question at a discharge rate of 60 m^3/day are taken into the Drinking and Utility Water Tank and then distributed in the facility.

V.2.5.2 Package wastewater treatment system (domestic wastewater)

Wastewater likely to occur during operation phase of the project are; domestic wastewater that will occur depending on water consumption for potable and utility purpose of personnel. Approximately 60 persons shall work during operation phase within the scope of the project. Consequently, total water requirement has been calculated as approximately 9 m^3/day by taking water volume per person as 150 lt/day. Likewise, 9m^3/day waste water formation shall be in question by assuming that entire water to be used by personnel shall return as waste water. Waste waters to be occurred shall be discharged to Kızılırmak River after being treated in waste water treatment facility within the scope of the facility.

Domestic package treatment facilities are biological treatment systems thanks to domestic waste water properties. In order to prevent sticking of large particles in mechanical equipments such as pumps, etc. in the treatment facilities, physical treatment is provided by use of pre-sedimentation basins, meshes, or by grates; and if the Grease amount is high in the waste water, physical treatment units such as Grease holders are used. The organic substances in domestic waste water that cause pollution can be changed into harmless forms that can do no harm to the nature by use of the micro-organisms (bacteria) placed into the treatment facility and can be treated biologically.

The most common process used for the domestic waste water is the active sludge process; however, there are some modifications in the active sludge process. The most widespread among these are classical active sludge system, gradely ventilated active sludge system, contact stabilization systems, long ventilated systems and consecutive discontinuous systems-SBR. Two main elements, nutritions and oxygen are needed for the growth of the bacteria. The bacteria use the organic materials in waste water as nutritions. The oxygen required can be provided by use of blowers dripped inside the waste water.

After the biological treatment the waste water is taken into the final sedimentation unit. Here, the sludge formed must be stabilized (decomposition) in order not to be harmful to human health and the environment. This stabilization can be provided by aerobic and anaerobic processes. In order to decrease the amount of sludge to be stabilized sludge thickeners are used. In sludge thickening tanks, sludge thick as 5% concentration can be obtained. After thickening and stabilizing the sludge, it must be dehydrated. Therefore the sludge cake is obtained and this material can easily be transferred to final removal areas or can be used as agricultural fertilizers. The treated water coming from the deposits are disinfected and discharged to the receiving environment.

Among the Package Type Waste Water Treatment Facilities those constructed by steel are the most preferred compact treatment systems. The most significant disadvantage of these systems is to be susceptible to corrosion and their need to be painted.

V.2.6 Quantity and feature of other solid wastes to be generated during activity of the plant, storage/piling, disposal processes, where and how these wastes shall be transported to or which purposes they shall be recycled for

V.2.6.1 Domestic solid waste

46 kg/day domestic natured solid waste is expected to be generated during operation phase of power plant. Waste likely to occur within the scope of the project shall be accumulated in closed sealed containers separately from other wastes and relevant provisions of "Solid Waste Control Regulation being published and enacted in the Official Gazette dated 14/03/1991 and no. 20814.

Solid wastes possible to be recycled shall be accumulated separately and shall be used again accordingly.

Treatment sludge coming out of package waste water treatment facility is in non-dangerous nature and they shall be disposed of together with other solid wastes.

Sludge coming out of industrial wastewater treatment facility shall be stored in containers and shall be dispatched to the licensed facilities capable of disposing such type of wastes by trucks.

V.2.6.2 Medical waste

Medical waste in very little amount shall occur as a result of medical interventions in infirmary. These wastes shall be disposed pursuant to "Medical Wastes Control Regulation" published in the Official Gazette dated 22/07/2005 and no. 25883.

V.2.6.3 Waste batteries and accumulators

Waste batteries and accumulators arising from activities during operation phase as in construction phase of the project shall be collected and reviewed pursuant to "Waste Batteries and Accumulators Control Regulation" published in the Official Gazette dated 31/08/2004 and no. 25569.

V.2.6.4 Waste oil

Waste oil formation is not expected since maintenance works of vehicles and machines within the scope of the project are not performed on the project site. Replacements shall be performed within the scope of the project according to "Waste Oil Control Regulations" without causing contamination in potential urgent requirements.

Hazardous wastes likely to occur within the scope of the project shall be obtained by licensed firms and shall be dispatched to the facilities accepting hazardous waste. Waste oils requiring disposal during operation and maintenance activities shall be disposed of licensed firms. "Hazardous Wastes Control Regulation" published and enacted in the Official Gazette dated 14/03/2005 and no. 25755 shall be complied with during operation phase. Comes within the scope of CCPP project switchyard transformers and capacitors to be used in the insulation material and/or power generation systems, the national and international restrictions about Persistant Organik Pollutants, PCT (polychlorinated terphenyls), PCB (polychlorinated biphenyls) and asbestos will be complied.

V.2.6.5 Package waste

Packaging wastes occurred within the scope of the project shall be collected separately from solid wastes and their disposal shall be performed by taking as a basis "Packaging Wastes Control Regulation" published in the Official Gazette dated 24/08/2011 and no. 28035.

V.2.7 Sources and level of vibration and noise generated due the works to be executed from the land preparation until commissioning of the units; their cumulative values; preparation of the acoustic report on the basis of the Acoustic Format available at the address of www.cevreorman.gov.tr pursuant to "Regulations on Assessment and Management of the Environmental Noise"

Acoustic Report has been prepared in order for identifying noise level occurred when the facility is put into operation and has been submitted in **Annex 8**.

Noise levels of main noise sources to be included in the plat are provided in **Table 79**.

Table 79. Machine Equipment List to be Operated On the Project Site during Operation Phase of the Facility

Type of Machine	Pcs	L_W (dBA)
Steam Turbine	2	111[1]
Gas Turbine	2	87.9[2]
Turbine Ventilation Fan	2	92.1[2]
Generator Set	2	98.8[2]
Cooling Tower	1	90[2]
Start-up Substation	1	85[1]
Water Pump + Boiler Feed Water Pump	6	90[1]

1:http://www.energy.ca.gov
2. http://www.atcoem.com/Resources/Documents/Noisecontrolhandbook.pdf

Noise impacts during operation phase in the said report have been analyzed by considering estimated noise levels in day, evening and night hours. Estimated noise levels reaching the nearest residential units to the facility and occurred from noise source units in the facility shall not exceed environmental limit values designated within the scope of

"Areas where houses are intensive of areas where commercial buildings and noise sensitive utilities are together" in Table 4 Annex-VIII ÇGDYY (**Table 80**).

Table 80. Environmental Noise Limit Values for Industrial Facilities

Areas	L_{day} (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)
Education, culture and health areas of noise sensitive utilities and areas where summerhouses and camping are intensive	60	55	50
Areas where houses are intensive of areas where commercial buildings and noise sensitive utilities are together	*65*	*60*	*55*
Areas where workplaces are intensive of areas where commercial buildings and noise sensitive utilities are together	68	63	58
For each facility within Organized Industrial Zone or Economy Industrial Zone	70	65	60

Reference: ÇGDYY Annex-VIII Table 4

Legal limit values of noise level of operation period as seen in calculations are provided in the nearest sensitive recipient hereof. Environmental noise occurred during operation phase of the facility shall be monitored and reported by Investor Firm.

The nearest sensitive structure to power plant site is Kılıçlar Municipality in 3.700 m distance. Limit values provide for Industrial Facilities in Table 80 are Lday 65 dBA, Levening 60dBA and Lnight 55 dBA. When L_{day}, $L_{evening}$, L_{night} values calculated for power plant are compared within limit values specified in Annex-7, Table 4 "Regulations on Assessment and Management of the Environmental Noise dated 04/06/2010 and no. 27601.

It meets 65 dBA which is standard value from L_{day} type in 100 m.
It meets 60 dBA which is standard value from Levening type in 150 m.
It meets 55 dBA which is standard value from Lnight type in 250 m.

As a result of calculations made, 3.700 m distance noise value which is the nearest sensitive receiving environment to the project site is in 27,00 dBA level and it is below L_{day}, $L_{evening}$, L_{night} values. However, while making noise calculations for power plants, it has been assumed that noise sources are in open area. Yet, noise sources shall be in enclosed environment and required insulation shall be made by investor within building. Thus, noise level to be occurred shall be lower as 10-20 dBA than noise level calculated.

Once power plants are put into operation, noise measurements shall be performed periodically at noise sources.

The criteria relating to noise levels emitted to environment from enterprise, facility, workshop, manufacturing factory and workplaces set out in Article 22 of Regulations on Assessment and Management of the Environmental Noise" (RAMEN), which was published and enacted in Official Gazette of 04.06.2010 with no. 27601, stipulate the following provisions:

a) Noise level emitted to environment from each enterprise and facility shall not exceed limit values set out in Table 4 included in Annex-VII.

c) Total environmental noise level emitted to environment from small industrial zone or organized industrial zone together with more than one workplaces, workshops, factory shall not exceed background noise level from Leq noise indicator type more than 7-10 dBA range. By taking this range as a basis, total environmental noise level shall be designated with the Decision of Provincial Local Environmental Board by considering distance between locations sensitive to noise and noise source, the number of persons being affected on the area being exposed to noise and similar factors. In case limit value set out in this paragraph is exceeded, each workplace shall be equally responsible for limit value exceeding that is contributing background noise level. Each workplace shall take required measures after designating rates contributing to noise.

ç) Impact noise likely to occur as a result of activities of enterprise, facility, workshop, factory and workplaces shall not exceed 100 dBC from LCmax noise indicator type.

Regulations on Assessment and Management of the Environmental Noise published and enacted in the Official Gazette dated 04/06/2010 and no. 7 and the provisions set out above when power plant is put into operation shall be duly complied with.

V.2.8 Amount of raw material, auxiliary material required for the project, how and where they shall be provided, their transportation, storage, impacts during transportation and storage, element analysis of fuel, calorific value

V.2.8.1 Raw Material required for the project

Raw Material required for the project is natural gas. The said natural gas shall be supplied from BOTAŞ Natural Gas Transmission Line.

Natural gas volume to be used within the scope of the project is 1,250,000,000 m^3/year.

V.2.8.1 Auxiliary Material required for the project

Use of auxiliary fuel in power plant is not envisaged.

V.2.8.1 Supply of raw material and auxiliary materials

Ram material (natural gas) to be used in power plant shall be supplied from BOTAŞ Natural Gas Transmission Line.

V.2.8.1 Transportation and storage of raw material and auxiliary material

Ram material (natural gas) to be used in power plant shall be supplied from BOTAŞ Natural Gas Transmission Line. Natural gas shall be brought to the power plant via a branch line to be taken from this line and shall not be stored in the power plant site.

Connection from the power plant to BOTAŞ Natural Gas Transmission Line shall be designed and implemented in a way that it shall meet required conditions for proper and continuous operation of electrical power plant. For this purpose, natural gas to be taken via branch line to be made from transmission line shall be dropped to 42 bar pressure that is the requirement of the power plant in pressure reduction and measurement station to be installed.

Technical implementation shall comply with safety regulation and obligations of BOTAŞ. Gas pressure in pipeline varies between minimum gas pressure 42 required for operation of the power plant in delivery point with 70 bar (maximum).

"Control Regulation of Hazardous Chemical Materials and Products" published and enacted in the Official Gazette dated 11/07/1993 and no. 21634 and "Hazardous Wastes Control Regulation" published and enacted in the Official Gazette dated 14/03/2005 and no. 25755 shall be complied with in the activities relating to storage, transportation and use of dangerous and hazardous materials in the operation phase. Under the project, the national and international restrictions associated with the use of CFC (chlorofluorocarbon) and HFC (hydrofluorocarbon) will be complied.

V.2.8.1 Elemental analysis of raw materials

1,250,000,000 m³ natural gas shall be burned in recommended power plant on annual basis. Elemental analysis of natural gas has been provided in **Table 81**.

Table 81. Elemental analysis of natural gas

Chemical Component	% Mol.
Methane	Min % 82
Ethane	Max. % 12
Propane	Max. % 4
Butane	Max. % 2.5
Pentane and other heavy hydrocarbons	Max. % 1
CO_2	Max. % 3
O_2	Max. % 0.5
Nitrogen	Max. % 6
H_2S	Max. 5, 10 mg/m^3
Mercaptan Sulphur	Max. 16,07 mg/m^3
Total Sulphur	Max. 115,5 mg/m^3

Maximum calorific value of natural gas is 10,427 kcal/m3 and minimum 8.100 kcal/m^3.
m3: 1 m3 gas volume in 15°C and 1, 01325 absolute pressure)

V.2.9 Burning of main fuel and auxiliary fuel to be used under the scope of the project at which units and in what quantities burning systems to be used, specifications of fuel, nominal calorific power, emissions, contribution amount to existing air quality, reducing measures and their efficiency, instruments and systems to be used for measurements and systems (systems to be set up for instant-online-measuring and assessment of flue gas emissions, operations to be carried out for measurement of the existing air quality), the method used in the modeling system, description of the model, meteorological data to be used in the model (precipitation, wind, atmospheric stability/resolution, height of mixture, etc.), model inputs, results of model considering also worst-case scenario, potential and remaining effects, recommended measures, indication of outputs obtained as the result of modeling on the land usage map, specifications of filters to be used, maintenance of filters, measures to be taken in case of failures, (performing an emission distribution modeling for emissions arising from power plant).

Only natural gas, as fuel, shall be used within the scope of the project. Annual total 1,250,000,000 m³ natural gas shall be used in the power plant.

Since the fuel to be used in NGCCPP is natural gas, primary contaminants occurred as a result of burning shall be nitrogen oxides (NOx) and carbon monoxide (CO) emissions. Since the power plant shall burn only natural gas, sulphur oxides (SO_x) and particle material (PM) emissions shall be in negligible level.

V.2.9.1 At which Units and in what quantity the main fuel and auxiliary fuel will be burned up and burning/combustion systems to be used

Only natural gas, as fuel, shall be used within the scope of the project. Annual total 1,250,000,000 m³ natural gas shall be used in the power plant. Natural gas has been determined as only fuel in the project and no secondary fuel use has been envisaged in gas turbines. Gas turbines have been designed for burning only natural gas and air passing through filter and coming from outside is compressed in compressor part of turbine and is mixed with natural gas in combustion unit and burning is performed in this way. Rotation of turbine shaft is ensured with expansion of hot gases in turbine part. Conventional electrical generation process is started upon completion of this process and mechanical energy generated by turbine generates usable energy by driving generator shaft.

V.2.9.2 Fuel specifications

In principle natural gas consists of hydrocarbons like methane (CH_4) and at very low rate ethane (C_4H_{10}) and propane (C_3H_8). Additionally it may also contain in its composition such gases as Nitrogen (N_2), Carbon dioxide (CO_2), hydrogen sulfur (H_2S) and helium. However, since H_2S is a harmful component, natural gas is cleaned from this component at the natural gas production point and then pumped into the pipeline. Natural gas is a colorless and odorless gas which is lighter than air. Results of Analysis of Natural Gas to be taken from BOTAŞ Natural Gas Pipeline passing near the Project Area are as follows:

Table 82. Kırıkkale Region Gas Chromatograph Values

MONTHLY AVERAGE VALUES												
DATE	**Upper Calorific**	**Lower Calorific**	**Methane**	**Ethane**	**Propane**	**I-Butan**	**N-Butan**	**I-Pentan**	**N-Pentan**	**N_2**	**CO_2**	**C_6+**
February 2010	253800.90	228600.13	2741.23507	24.88939	7.38494	1.18801	1.11588	0.21497	0.14375	22.10444	1.66482	0.05939
March 2010	281301.58	253362.81	3032.63560	29.39720	8.27673	1.45753	1.33787	0.26109	0.17239	24.00248	1.89608	0.58577
April 2010	272402.96	245372.51	2931.51500	29.95349	9.24396	1.47055	1.38379	0.26990	0.18020	23.84671	2.03243	0.10429
May 2010	281752.83	253728.16	3021.84570	34.65501	10.74193	1.69530	1.67708	0.32744	0.21789	26.20438	2.49735	0.13792
June 2010	273542.49	246424.81	2917.99800	37.63391	12.55657	1.96972	1.90386	0.38022	0.26139	24.59410	2.56503	0.13728
July 2010	282531.49	254568.52	3019.16443	37.25784	12.15722	1.99075	1.92880	0.39681	0.27595	24.40971	2.29130	0.12708
August 2010	283053.92	255027.52	3011.47420	41.47176	13.48109	2.18377	2.09104	0.43693	0.30849	25.68897	2.70791	0.15585
September 2010	273752.55	246656.98	2918.91700	38.61339	12.30561	2.01447	1.92498	0.40022	0.27988	23.04806	2.36274	0.13339
October 2010	281937.71	254259.13	3027.26040	32.80325	10.26834	1.73296	1.66023	0.34399	0.23488	23.62471	1.96936	0.10166
November 2010	272843.91	245797.18	2929.58370	31.76003	9.93905	1.67721	1.60712	0.33315	0.22750	22.86828	1.90556	0.09818
December 2010	281391.06	253478.50	3029.54336	30.54877	9.43477	1.48010	1.39620	0.27026	0.18241	24.96170	2.10809	0.07437
January 2011	281357.89	253454.37	3027.92100	31.05613	9.59277	1.48202	1.39061	0.26809	0.17971	25.81158	2.21792	0.07971
Total	3319669.29	2990730.62	35609.09346	400.04017	125.38298	20.34238	19.41745	3.90307	2.66444	291.16512	26.21860	1.79490
Average	9094.98	8193.78	97.55916	1.09600	0.34352	0.05573	0.05320	0.01069	0.00730	0.79771	0.07183	0.00492

V.2.9.3 Fuel calorific power, nominal calorific power calculation

Fuel Calorific Power=Consumed fuel amount (kg/h) x fuel sub calorific value (Kcal/Kg)
Fuel Consumed in Unit Time: kg/hr
Sub Calorific Value: kcal/kg
4,18 kJ : 1kcal
Kj/s=kW
1 hour (h): 3600 s
1000 KW: 1 MW

Total Gas Volume to be Used: 1,250,000,000 m^3/h

Total Calorific Power= 1,250,000,000 m3 /year x 1 year/7,200 hours x 1 hours/3600 s x 8.250 Kcal/m3 x 4,18 kJ/kcal =1,663,049 kW

Nominal Calorific Power=1,663 MW.

V.2.9.4 Waste gas flow rate

Flue Gas Flow Rate=Flue cross section area* flue gas rate
Flue Gas Flow Rate = 23,8 m^2 x 31,2 m/s x 3600 s/hr
Flue Gas Flow Rate=2,673,216 m^3/h

V.2.9.5 Assessment of the facility within the scope of Annex-1 control regulation of industrial air pollution (base and limit values of air emission for the enterprises)

a) Natural gas shall be used in the said facility as a fuel and sootiness degree of waste gases of the facility must be maximum 3 (three) according to Bacharach scale.

b)Emission in dust form in waste gases shall not exceed the limits set out in **Figure 68**.

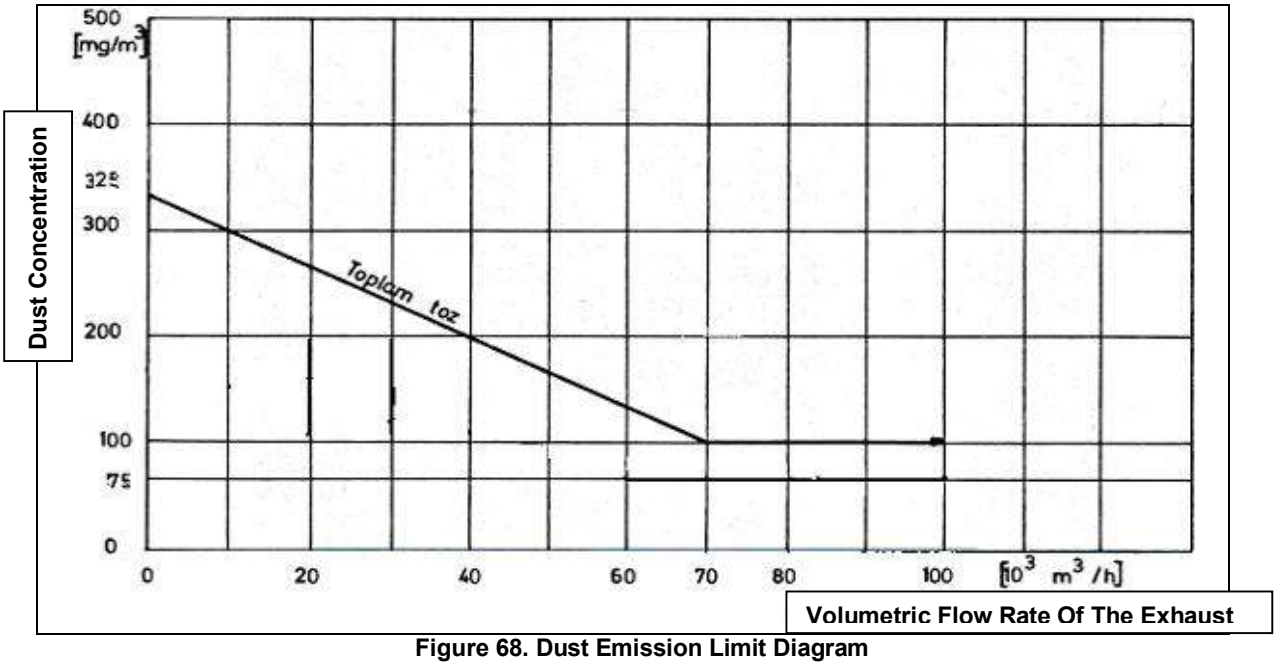


Figure 68. Dust Emission Limit Diagram

Material storage in open area shall not be performed within the scope of the project. Transportation and storage of residuals of combustion and generation causing dust shall not be performed within the scope of the project. Roads shall be regularly cleaned for inside of the facility and all kinds of measures shall be taken against dusting and roads shall be covered with concrete materials for inside of the facility. No particle material shall be created in emissions occurred due to combustion of natural gas in the facility.

Gas and steam emissions in waste gases:

These emissions shall be measured while the facility is working at the highest capacity by considering formation of these emissions and their discharge period to atmosphere according to generation process of the facility.

In cases restriction of total emissions is necessary, concentration and mass flow rate limits may be reduced in the rate of 1/3 for gas and steam emissions provided below depending on meteorological, topographic situation and existing pollution load of the area in the facilities, existing or to be installed in competent authority residential areas.

In the event waste gas is discharged from several flues in the same enterprise, emissions from the same class (kg/hour) shall be collected and evaluated accordingly. However, if flues are outside of their impact areas from one another, each flue shall be assessed individually.

NGCCPP project has total three (two waste heat steam generator flue, one pre heating flue) flues and cumulative evaluation has been conducted by considering three flues while assessing emissions arising from the facility.

V.2.9.6 Assessment of the facility within the scope of Annex-2 control regulation of industrial based air pollution and mass emission calculations

Primarily NO_X and CO emissions shall occur as flue gas as a result of combustions of natural gas in the facility. Since the power plant shall burn only natural gas, sulphur oxides (SOx) and particle material (PM) emissions shall be in negligible level.

Flue and mass flow rates in the facility have been provided in **Table 83**.

Table 83. Facility Flue Information and Combustion Gas Specifications

		Heat Recovery Steam Generator Stack*		Pre-heating Boiler Stack	
Flue Height (m)		75		15	
Flue Diameter (m)		5.5		0.75	
Flue Cross Section Area (m^2)		23.8		0.4	
Flue Gas Rate (m/s)		31.2		5	
Flue Gas Volumetric Flow Rate= (m3/h)		3,065,000		8,250	
Flue Gas Temperature (^0C)		87		180	
Flue Gas Temperature (^0K)		360.15		453.15	
Vg (Nm^3)= Tg * (Vn/Tn) (m^3)		1.32		1.66	
Flue Gas Volumetric Flow Rate= (Nm^3/h)		2,322,000		4,973	
Emission Parameters	Emission Concentration Limit Value (mg/Nm^3)**	HRSG Stack*		Pre-heating Boiler Stack	
		Mass Emission Flow Rate (kg/h)	Mass Emission Flow Rate (g/h)	Mass Emission Flow Rate (kg/h)	Mass Emission Flow Rate (g/h)
CO	100	**232.2**	64.5	0.490	**0.136**
NO_x	50	**116.1**	32.2	0.245	**0.068**

** The values given in table are per stack values for heat recovery steam generator stacks.*
*** Limit Values of Large Combustion Facilities Regulation*
**** All (100%) NO_x emission are assumed as NO_2 emissions*

Table 84. SKHKKY Table 2.1 Mass Flow Rates

Emissions	Mass flow rates for operating hours in weekly working hours and under normal operating conditions (kg/hour)	
	From Flue	From the Points Outside of Flue
Carbon Monoxide	500	50
Nitrogen Dioxide [NOx (NO2 type)]	40	4
NOTE: Emissions in the table are hourly mass flow rates emitted throughout of the enterprise. (total of flues)		

When hourly mass flow rate value (kg/hour) calculated is compared with mass flow rate values (from flue) provided for operating hours in weekly working days and under normal operating conditions set out in Annex-2 Table 2.1 "Control Regulation of Industrial Air Pollution", it has been seen that mass flow rate calculated for NOx in hourly mass flow rates emitted throughout the power plant (total of flues) exceed limit values (40 kg/hour) provided in the regulation. Thus, modeling of air quality has been performed by using mass flow rates calculated for NOx and modeling results have been provided below and modeling outputs have been provided in Annex-9. In addition to this, modeling studies for CO have been conducted.

The results obtained from modeling studies have been assessed according to "Assessment and Management Regulation of Air Quality" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898. (HKDYY).

Purpose of HKDYY is to define and form objectives of air quality to prevent or reduce hazardous effects of air pollution on environment and human health, assess air quality by taking as a basis defined methods and criteria, to protect existing situation in the places where air quality is well-preserved and to rehabilitate in other conditions, to collect sufficient information relating to air quality and to ensure public to be aware of this process via warning thresholds.

Target Limit Values to be valid as of 01/01/2014 in HKDYY have been provided in **Table 85**.

Table 85. Limit Values Specified in HKDYY Annex-1.

Pollutant	Average period	Limit value	Tolerance share	Date to reach limit value
SO2	hourly -for protecting human health-	350 µg/m3 (it may not be exceeded more than 24 times in a year)	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2019 and 150 µg/m3 (43 % of limit value) on 01/01/2014.	01.01.2019
	24 hours -for protecting human health-	125 µg/m3 (it may not be exceeded more than 3 times in a year)	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2019 and 125 µg/m3 (100 %) on 01/01/2014.	
	annual and winter season Protection of ecosystem (from 1 October to 31 March)	20 µg/m3		
NO2	hourly -for protecting human health-	200 µg/m3 (it may not be exceeded more than 18 times in a year)	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2024 and 125 µg/m3 (50 %) on 01/01/2014.	01.01.2024
	annual -for protecting human health-	40µg/m^3	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2024 and 20 µg/m^3 (50 %) on 01/01/2014.	
PM(10)	24 hours -for protecting human health-	50 µg/m^3 (it may not be exceeded more than 35 times in a year)	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2024 and 50 µg/m^3 (100 %) on 01/01/2019.	01.01.2019
	annual -for protecting human health-	40 µg/m^3	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2019 and 20 µg/m3 (50 %) on 01/01/2014.	
Carbon Monoxide	maximum daily 8 hours average -for protecting human health-	10 mg/m^3	It is reduced annually on equal basis in each 12 months in a way which shall reset tolerance share until 01/01/2017 and 6 µg/m3 (60 %) on 01/01/2014.	01.01.2017

Method Used in the Study

In what way pollutants arising from facility via air quality distribution modeling study shall emit under existing meteorological conditions within impact area of pollutants arising from the facility and potential location level concentrations caused by the said pollutants as a result of this emission have been examined. Spread calculations have been carried out by using AERMOD model (VERSION 12345).

Description of Used Spread Model

AERMOD atmospheric distribution modeling system contains 3 modules.

These are;

- AERMOD
- AERMAP
- AERMET systems.

AERMOMD is linear, stable state Plume modeling. It also has Gaussian Plume characteristics. AERMOD Modeling system can be implemented in several types. Plume rising and non-submersion incorporate developed algorithms such as penetration within rising inversion, surface level at source, vertical profile of winds, turbulence and heating, terrain effect. Performance of AERMOD program may vary according to different emission sources and terrain structure. It may yield results similar to reality in high concentrations.

AERMAP is area pre-processor. Its primary purpose is to ensure physical relationship between area properties and air quality behaviors. It forms location and height data for each peak point.

AERMET is meteorological data preprocessor. It accepts surface meteorological data and upper atmosphere layer data. AERMET calculates required atmospheric parameters for distribution model such as atmospheric turbulence characteristics, friction rate and heights. AERMOD needs hourly meteorological observations on upper atmosphere layer for simulating pollutant distribution.

Model is one of the most advanced computer models forecasting hourly, daily and annual ground level concentrations by taking as a basis real time data changing by time. Models incorporates different propagation model calculations for different sources until leakage pollutants from insulated stacks (point, volume, area) and considers a source of any pollutants that might be incurred aerodynamic waves, turbulence etc. released from one source.

Model is operated in a network system defined by the user and calculations shall be made for corner points of receiving environment element comprising network system. Network system used by the model can be defined as polar or Cartesian and also, discrete receiving points shall be determined apart from network system and more detailed calculations shall be made on these points.

Model program provides output for preparing distribution maps on whole investigation area. In this way, distribution maps for different scenarios can be prepared. (as in hourly, daily, monthly, seasonal, annual time frames or co-existence of different pollutant sources)

Determination of Modeling Area

As mentioned above, modeling study area and receiving environment elements should be determined.

Calculation of the facilities to be newly installed by using distribution modeling of Contribution Value to Air Pollution (HKKD) as well as measurement of air quality on the facility impact area and measurement methods shall be performed in accordance with the principles set out in Annex-2 SKHKKY.

Determination of Area where b) Contribution Value to Air Pollution shall be calculated and Air Quality shall be measured according to SKHKKY Annex-2:

The facility impact area, investigation area and peak points are taken into account in conducting air quality measurements or calculations of Air Pollution Contribution Values (HKKD) of emissions provided to open air from the facility.

1) Facility Impact Area The area having diameter 50 (fifty) times of the flue heights determined as to Annex 4 of the Regulation is facility impact area according to the principles set out in Annex-4 in this regulation as of center of emissions. Square area whose edge length is 2 km and facility impact area in the facilities where effective height of emissions as of ground are less than (∆h+h) 30 m. If non-flue emissions sources (area source) surface distribution is more than 0,04 km2, facility impact area is a square shape with 2 corner length as being below middle of area source square. Impact area of the facility is taken as a basis in determination of distribution on the surface of emissions sources.

2) Investigation Area: Edge lengths inside facility impact area are the area in 1 km square shapes. Where decision regarding pollution cannot be given, edge lengths of investigation area are taken as 0,5 km.

3) Peak Point: Peak points where circle in R m diameter drawn to emission source with consecutive angles with 10 degrees in clockwise as of emission source intersects the arc remaining inside investigation area.

Flue height at facility is 75 m and facility impact area is an area in 3750 m diameter. A square area in 16 km corner length has been determined for air quality distribution model by considering the project site and vicinity topography and other near NGCCPP and the nearest residential areas.

Investigation areas have been reserved to 500 m square. Corner points of these squares are peak points and latitude and longitude information of peak points are processed by AERMAP pre-processor and are transferred into AERMOD program. Facility impact area, modeling area, peak points and impact area height maps have been provided in **Figure 69** and **Figure 70**.

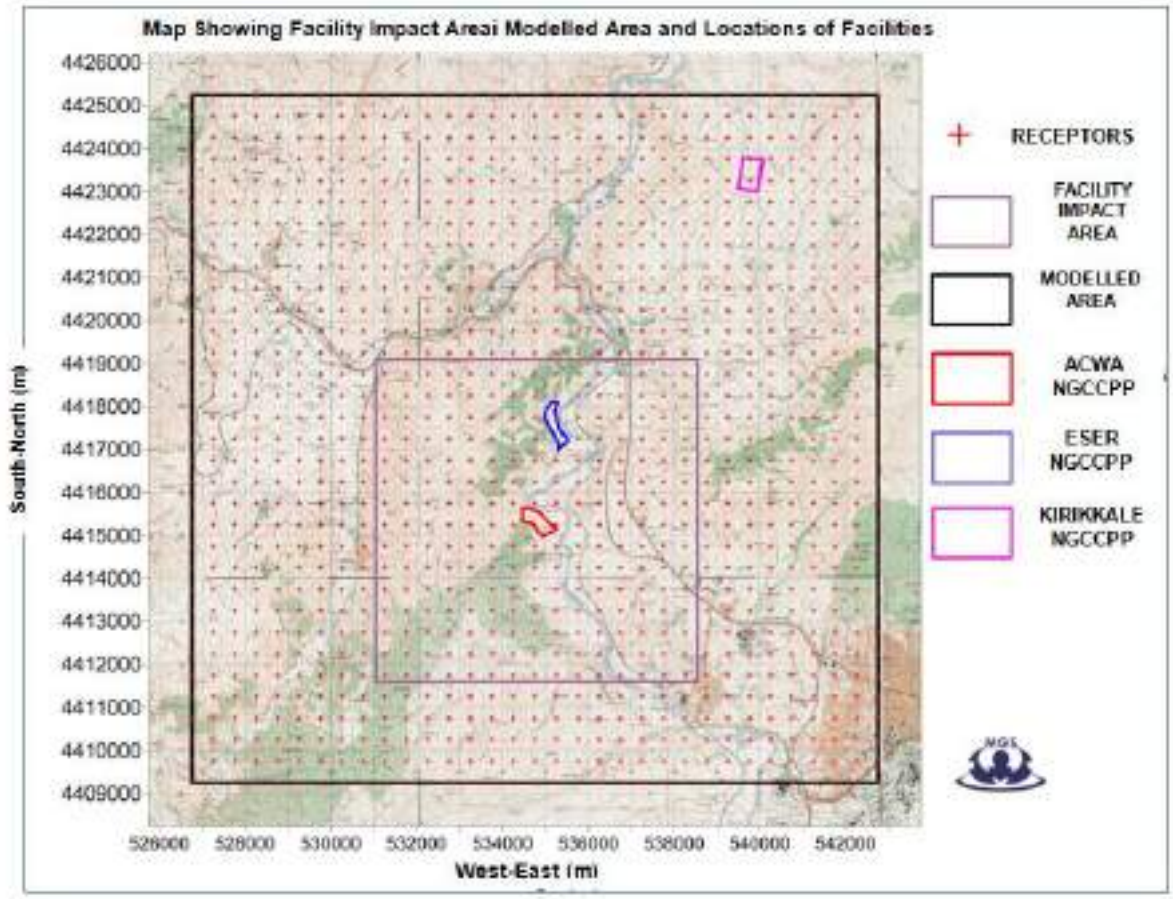
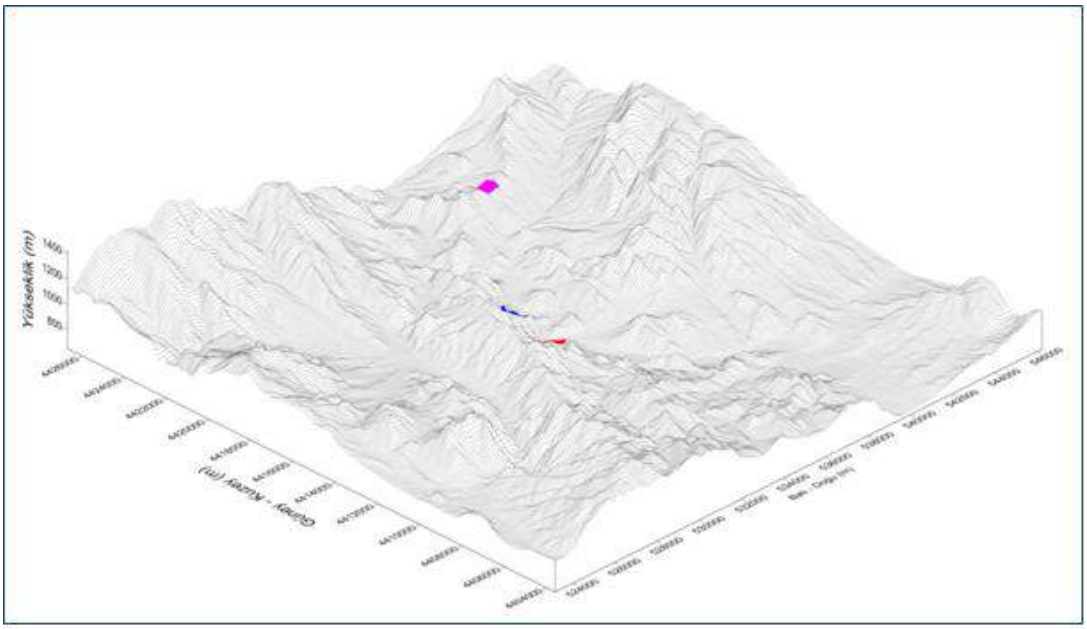


Figure 69. Map showing Facility Impact Area, Modeled Area and Locations of Facilities and Receptors



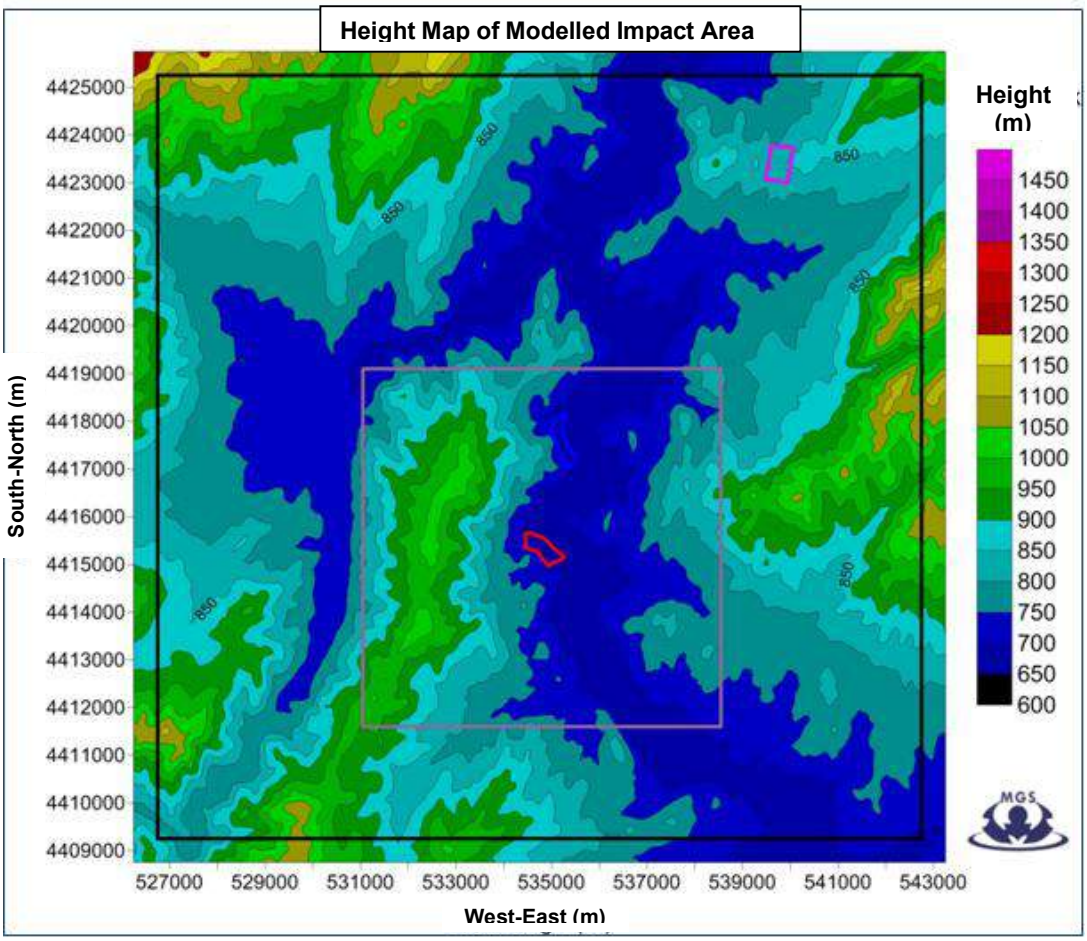


Figure 70. Modeling Area Height Maps

Meteorological Data Set

Determination of Meteorological Data Year

Long term meteorological data required for modeling studies are provided from existing meteorological stations on the region. Hourly surface station data measures in air conditioning, synoptic or automatic type stations for AERMOD model and meteorological drilling data measured in radiosonde type stations shall be required. In discussions with the General Directorate of Meteorology, the required hourly meteorological data set shall be taken from KIRIKKALE Meteorology (17135-38,84N, 33,51E) Station which is the nearest station to the project site and Drilling data shall be taken from ANKARA REGION (17130-39,97N, 32,86E), one of radiosonde stations being 8 in Turkey.

AERMOD model uses a 1-year meteorological data. For this reason, year selection of meteorological data used in model year should be made. Using meteorological data of the year representing wind profile of the region increases accuracy of modeling study. Wind profile of the region has been issued by making use of long term meteorological bulletin incorporating data obtained between 1960-2012 in Kırıkkale Meteorology Station in modeling studies. Annual wind profiles pertaining to recent 10 years (2003-2013) have been examined and year matching with long years has been determined as 2012. (See **Table 86**).

Table 86. Table of Long Term and 2003-2012 Years Wind Blowing Numbers

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Long Years
N	294	291	505	403	275	235	226	274	247	229	18262
NNE	596	1167	902	1033	391	378	327	395	489	438	18341
NE	1522	1585	1626	1689	1114	1157	1066	1380	1515	1340	64190
ENE	1730	1180	1037	1034	1531	1827	1887	1763	1940	1759	55029
E	753	405	470	312	1069	1381	1356	784	1056	1157	46089
ESE	359	178	212	239	388	465	394	297	310	421	10026
SE	173	161	173	238	160	246	203	167	174	223	11859
SSE	148	221	188	195	107	183	182	168	147	197	5720
S	129	415	698	651	202	283	249	307	226	282	17782
SSW	656	934	751	745	569	610	781	720	642	794	25813
SW	921	592	587	678	628	729	810	984	717	797	42845
WSW	567	604	563	529	340	521	467	609	439	424	19762
W	288	362	478	420	264	360	293	415	292	241	23310
WNW	301	213	191	201	182	208	245	223	204	218	8895
NW	120	151	149	197	92	96	140	142	138	113	9916
NNW	202	322	229	194	156	105	108	131	125	150	7333
	1. Prevailing Direction				2. Prevailing Direction				3. Prevailing Direction		

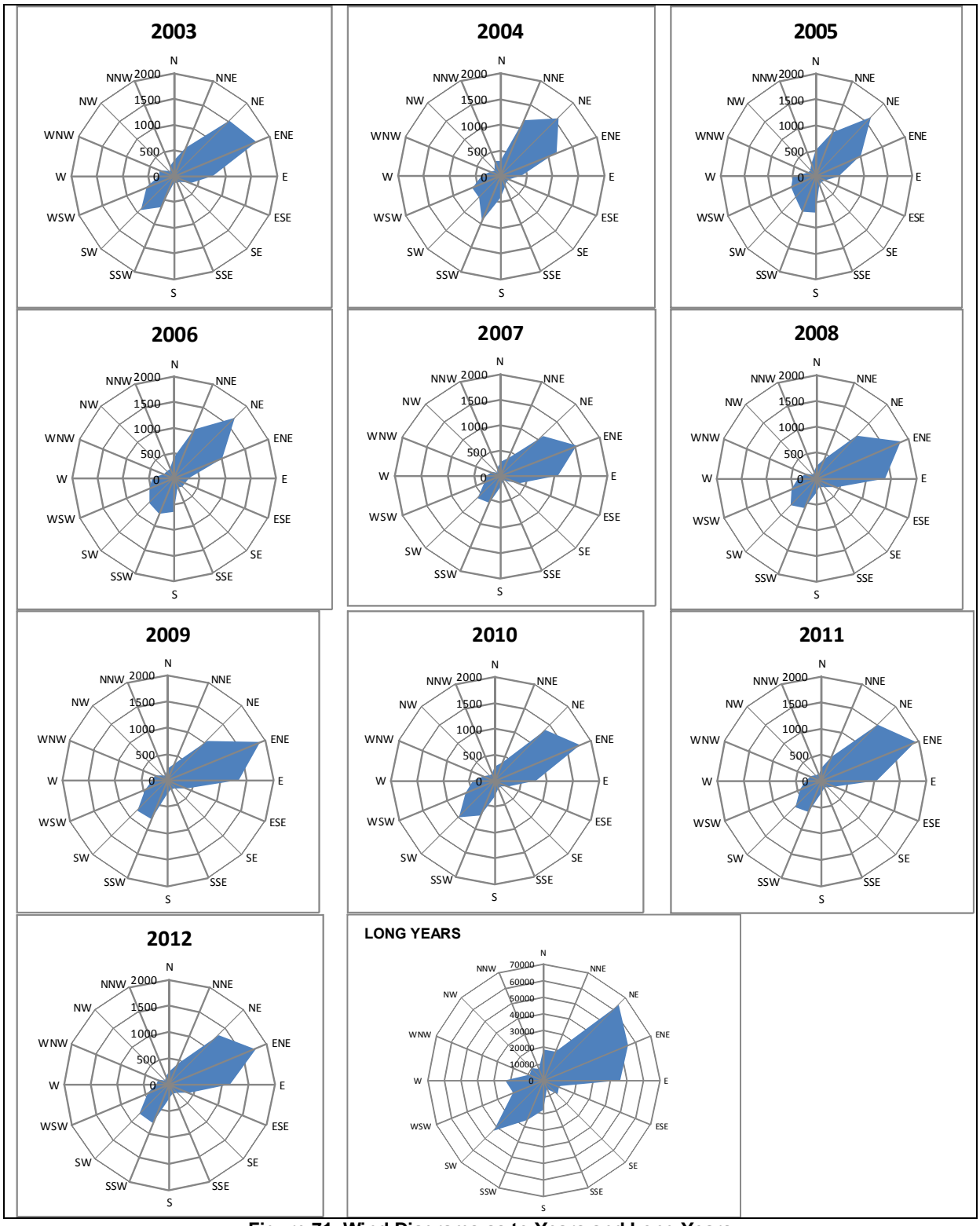


Figure 71. Wind Diagrams as to Years and Long Years

2012 year of Kırıkkale Meteorology Stations in air quality distribution modeling:

- Hourly wind rate and direction
- Hourly pressure
- Hourly cloud base height
- Hourly general cloud overcast
- Hourly temperature

Wind diagram and wind classes frequency distribution of meteorology file occurred as a result of compilation of 2012 drilling data of Ankara-Regional Meteorology Stations with surface data by AERMET preprocessor are as follows.

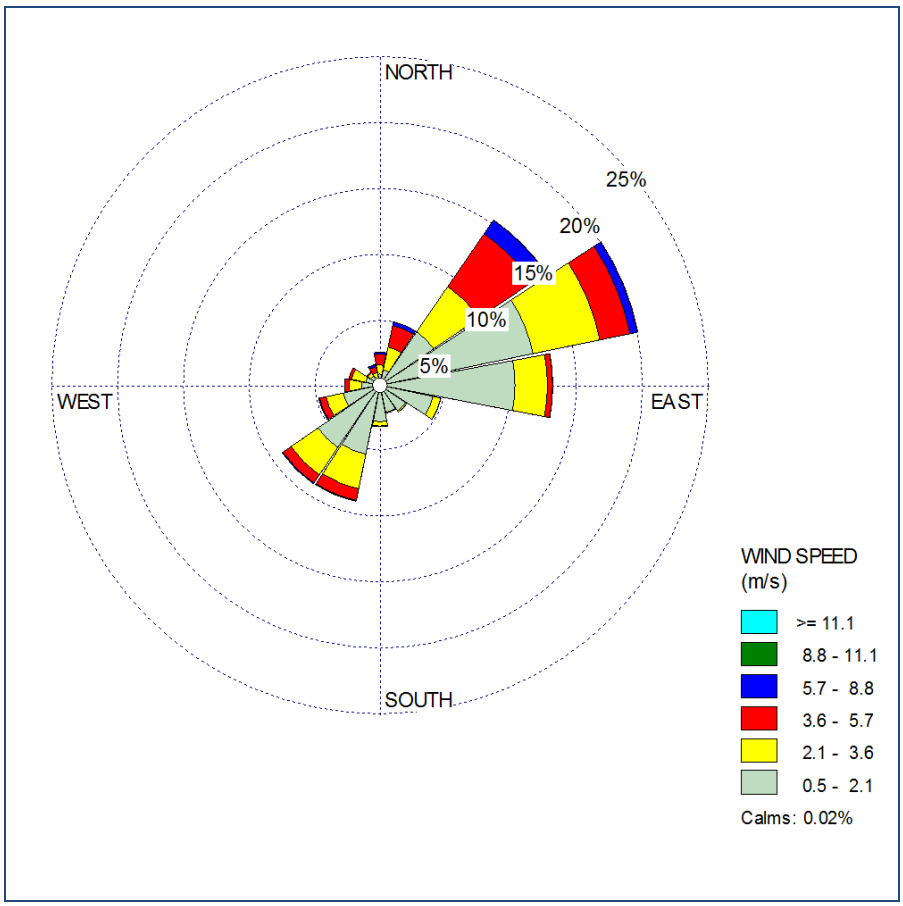


Figure 72. 2012 Year Wind Diagram pertinent to Kırıkkale Meteorology Station

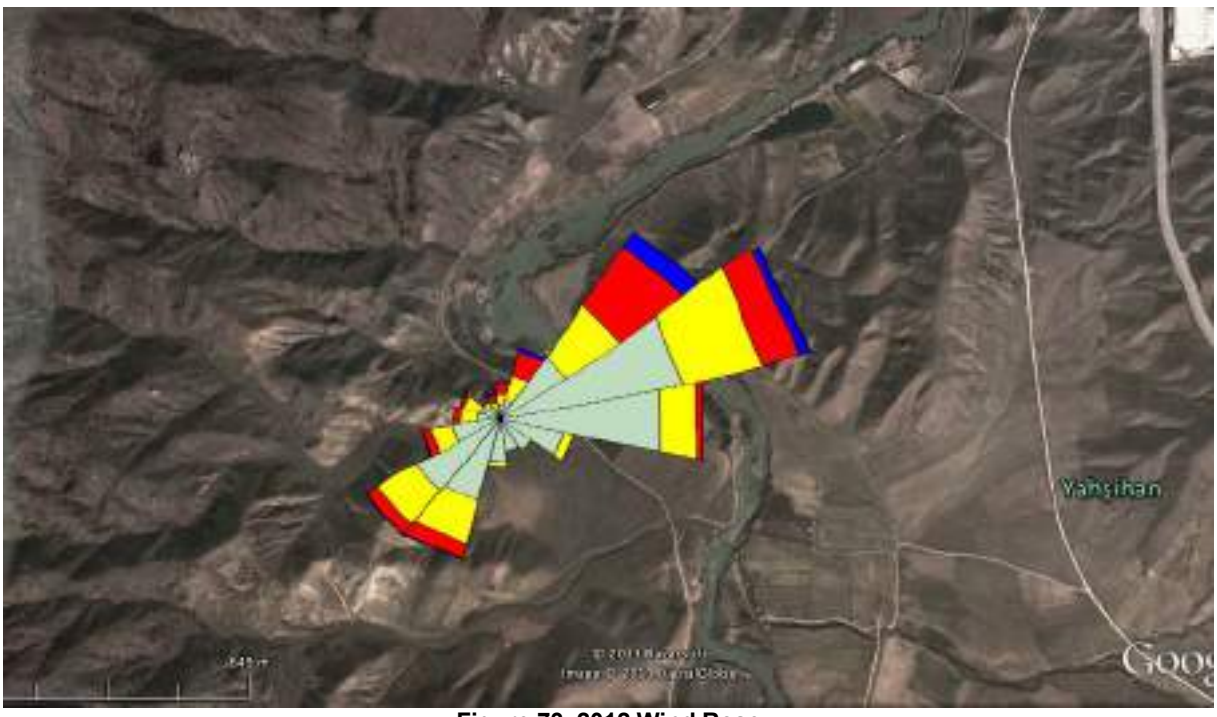


Figure 73. 2012 Wind Rose

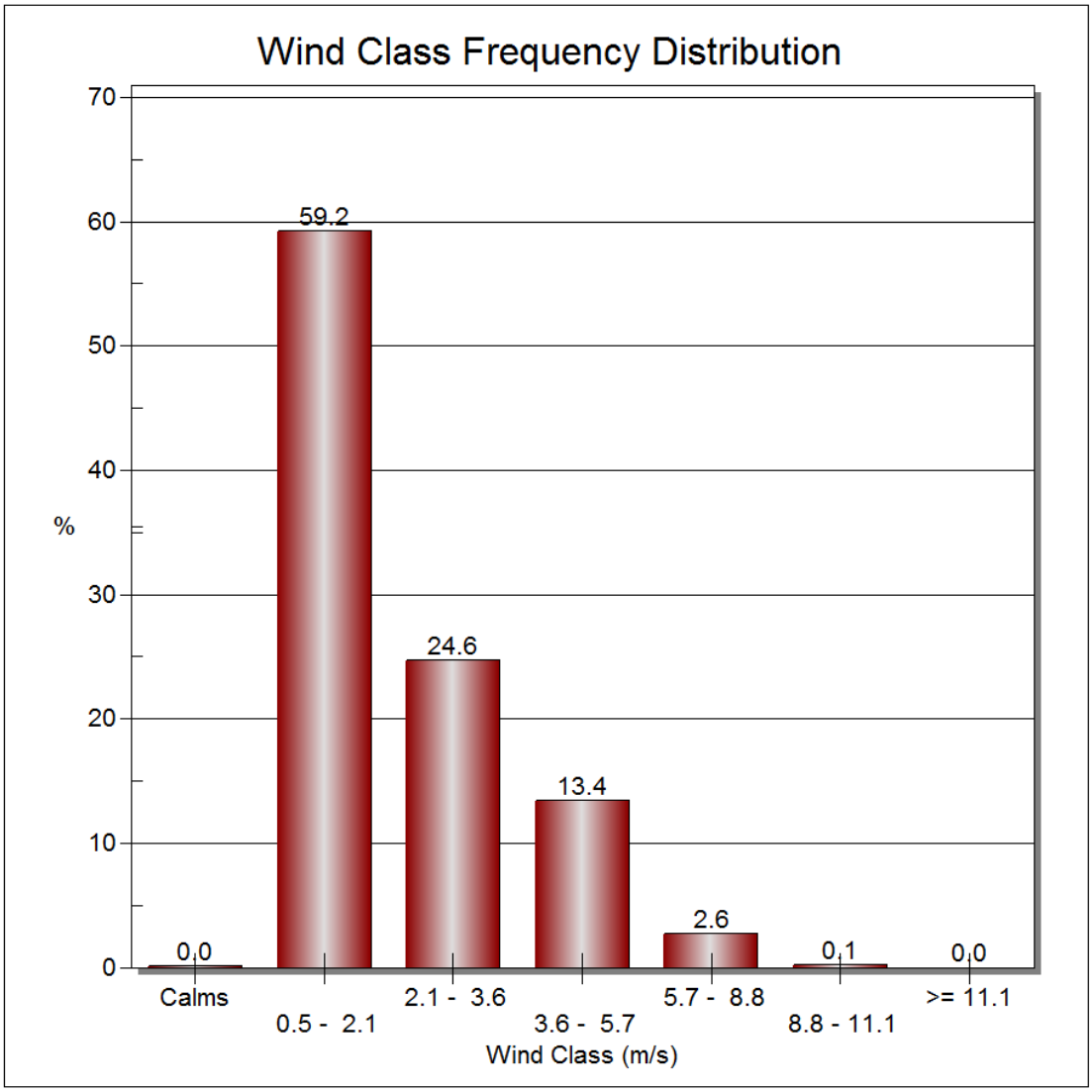


Figure 74. 2012 Year Wind Class Frequency Distribution pertinent to Kırıkkale Meteorology Station

Scenarios in Modeling Studies

Modeling studies have been operated for two scenarios.

Scenario 1: Modeling of Pollutants Arising From Operation Phase of ACWA Power NGCCPP

Scenario 2: Modeling Pollutants Arising From ACWA Power NGCCPP – ESER NGCCPP – GAP KIRIKKALE NGCCPP Operation Phase (Cumulative Evaluation)

Table 87. Model Results for Scenario-1 (Residential Locations)

	NO_2		CO
Settlement	Hourly (Limit Value 200 µg/m3)	Annual (Limit Value 40 µg/m3)	8 Hours (Limit Value 10,000 µg/m3)
Kayadibi -1 (528142,3; 4424000)	86.09	0.29	33.36
Kayadibi-2 (528641,5; 4421424)	18.16	0.14	6.22
Kılıçlar (530578,2; 4414422)	15.20	0.38	10.15
Irmak (533199,9; 4420647)	13.44	0.18	8.25
Hacıbalı (537336,4; 4419481)	12.16	0.30	9.69
Yenişehir (538624,8; 4413867)	12.10	0.18	6.81
Yahşihan (538699; 4411952)	8.42	0.11	6.28
Kırıkkale Sanayi (539685,2;4412636)	10.23	0.12	6.34
Mahmutlar (540884,8; 4419540)	122.64	0.77	48.12

As seen at above table, annual NO_2 emissions from ACWA Power Kırıkkale NGCCPP will not contributed more than 25% of the applicable ambient air quality standards at residential areas located at the area of effect.

NO_2 Distribution Modeling Results

a. Hourly Distribution

Contribution values of hourly air pollution for nitrogen dioxide (NO2) emissions during operation phase as a result of the works of air quality distribution modeling realized have been found out as follows.

The Highest 1. Value 377.62 µg/m^3 (533250, 4415250)
The Highest 2. Value 371.12 µg/m^3 (533250, 4415750)
The Highest 3. Value 301.46 µg/m^3 (532750, 4415250)
The Highest 4. Value 295.41 µg/m^3 (533250, 4414750)
The Highest 5. Value 226.72 µg/m^3 (533750, 4416250)
The Highest 6. Value 214.17 µg/m^3 (533750, 4417750)
The Highest 7. Value 205.95 µg/m^3 (532250, 4416250)
The Highest 8. Value 201.11 µg/m^3 (533250, 4417250)
The Highest 9. Value 199.29 µg/m^3 (532750, 4414250)

It is worth to note that in all of the above points, no sensitive receptors where located and all of the above points are located on a rural and unurbanised area.

Limit value to be valid as of the date of 01/01/2024 for hourly nitrogen dioxide (NO2) emissions within the scope of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 shall be 200 µg/m^3 and the said limit value may not be exceeded more than 18 times in a year. As understood from contribution values to air quality pollution pertaining to hourly nitrogen dioxide (NO2) emissions included hereinabove, the said limit value on impact area is exceeded 8 times and the requirements of the Regulation are met hereof.

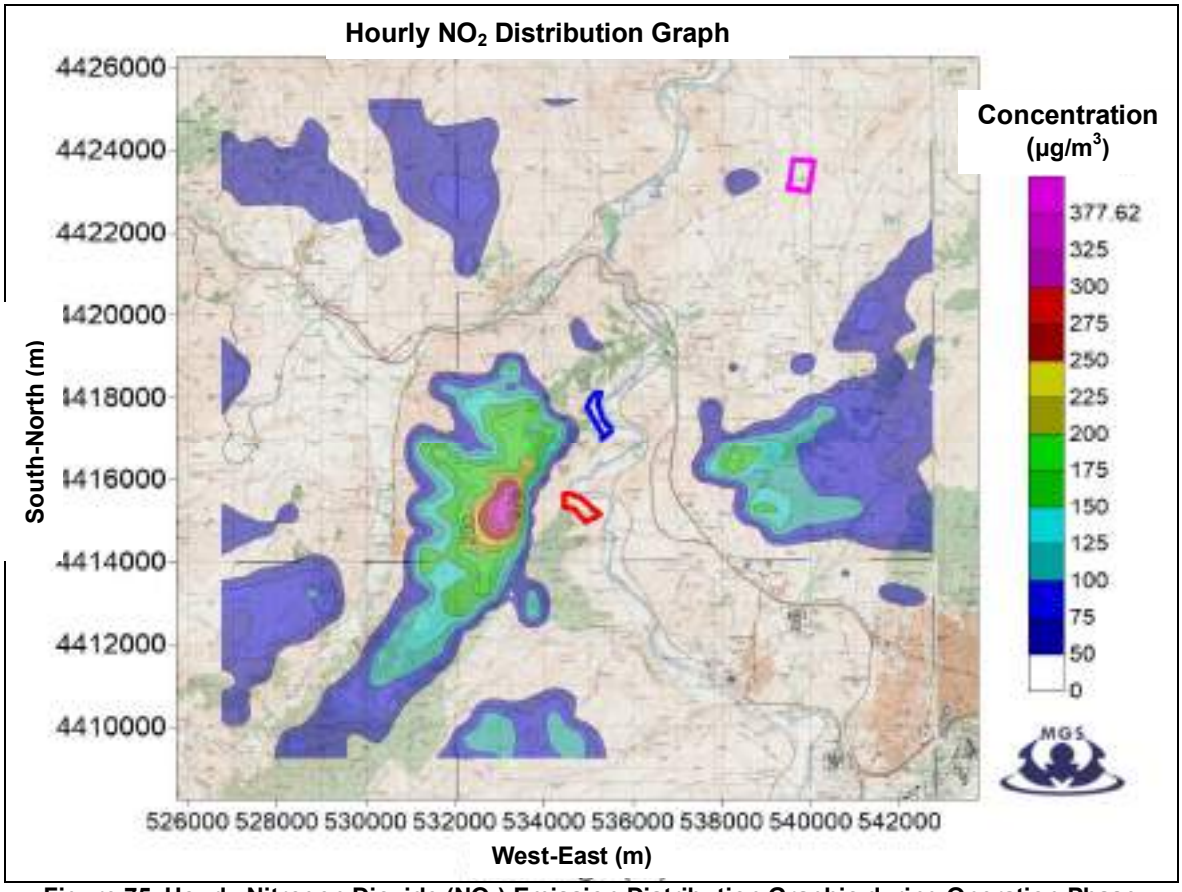


Figure 75. Hourly Nitrogen Dioxide (NO_2) Emission Distribution Graphic during Operation Phase

b. Annual Distribution

Contribution values of annual air pollution for nitrogen dioxide (NO_2) emissions during operation phase as a result of the works of air quality distribution modeling realized have been found out as follows.

The Highest Value 18.66 µg/m^3 (533250, 4414750)

Target value to be valid as of the date of 01/01/2014 for annual nitrogen dioxide (NO_2) emissions within the scope of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 shall be 40 µg/m^3 and the said limit value it met.

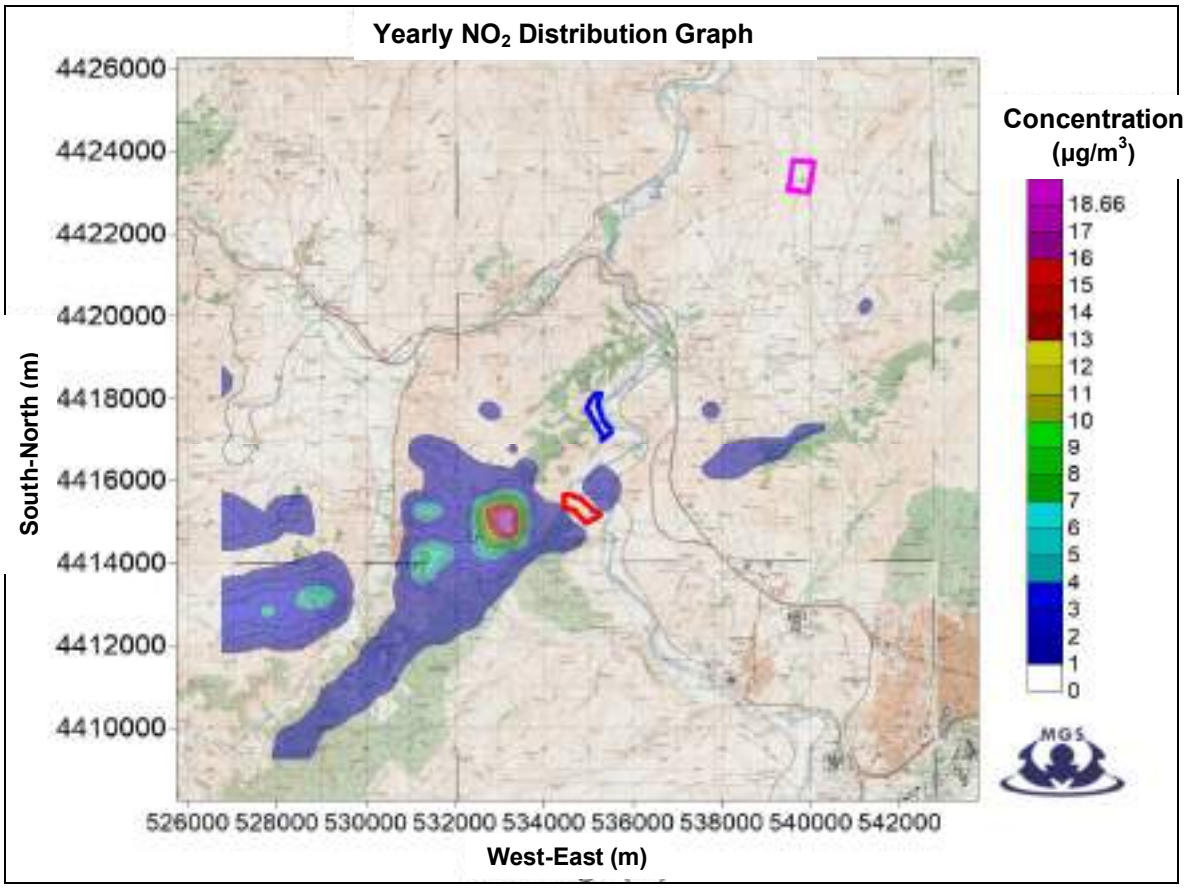


Figure 76. Annual Nitrogen Dioxide (NO_2) Emission Distribution Graphic during Operation Phase

CO Distribution Model Results

a. 8 Hours Distribution

Contribution values of hourly air pollution for nitrogen dioxide (CO) emissions during operation phase as a result of the works of air quality distribution modeling realized have been found out as follows.

The Highest Value 339.36 µg/m^3 (533250, 4415250)

Target value to be valid as of the date of 01/01/2017 for 8 hours carbon monoxide (CO) emissions within the scope of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 shall be 10,000 µg/m3 and the said limit value it met.

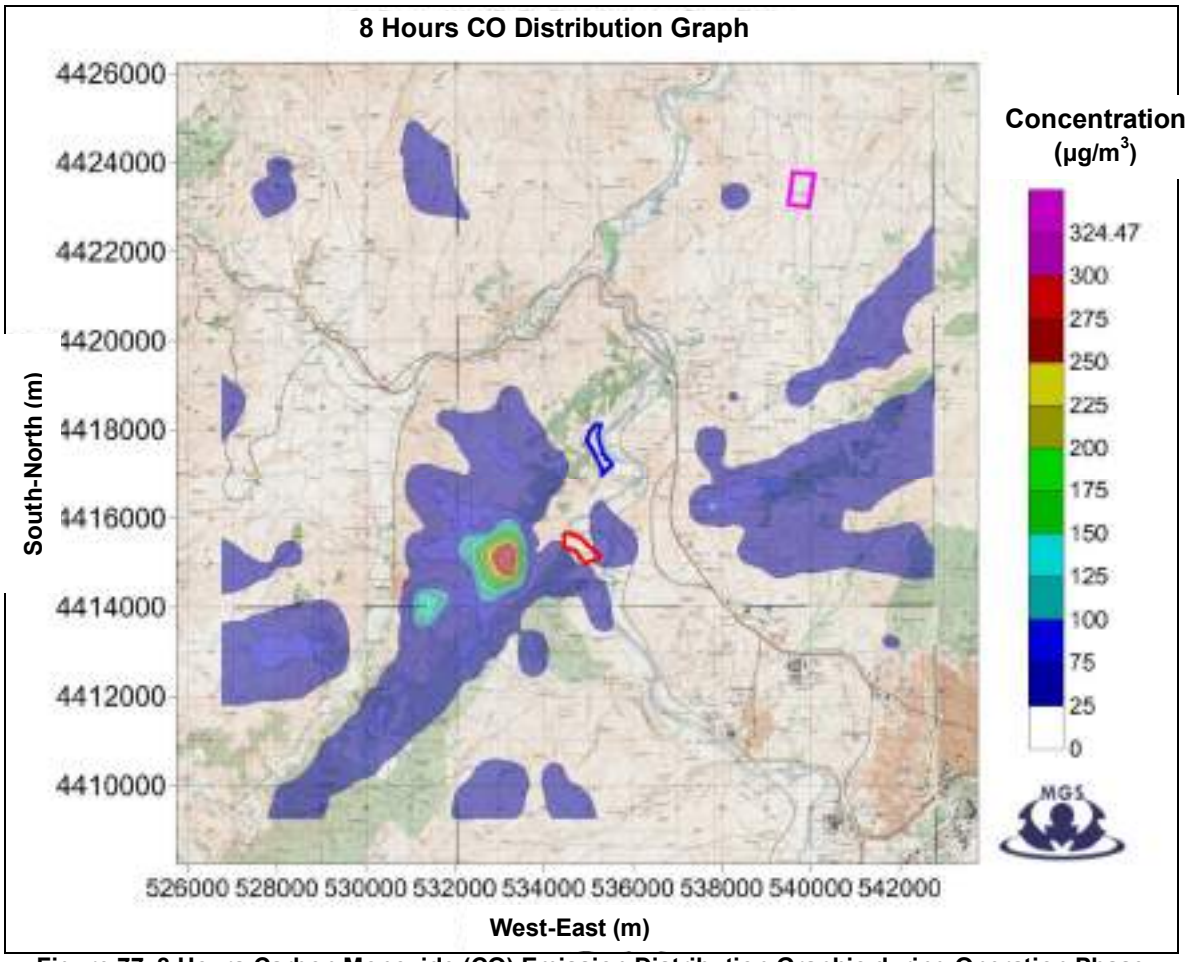


Figure 77. 8 Hours Carbon Monoxide (CO) Emission Distribution Graphic during Operation Phase

Table 88. Modeling Results for Scenario-2 (Residential Locations)

	NO_2		CO
Settlement	**Hourly (Limit Value 200 µg/m3)**	**Annual (Limit Value 40 µg/m3)**	**8 Hours (Limit Value 10,000 µg/m3)**
Kayadibi -1 (528142,3; 4424000)	137.14	0.73	60.24
Kayadibi-2 (528641,5; 4421424)	28.11	0.41	10.65
Kılıçlar (530578,2; 4414422)	26.11	0.90	17.17
Irmak (533199,9; 4420647)	25.33	0.60	18.22
Hacıbalı (537336,4; 4419481)	25.33	0.91	19.51
Yenişehir (538624,8; 4413867)	18.32	0.37	12.43
Yahşihan (538699; 4411952)	15.25	0.27	10.52
Kırıkkale Sanayi (539685,2;4412636)	14.14	0.27	11.31
Mahmutlar (540884,8; 4419540)	122.71	1.74	65.62

As seen at above table, annual NO_2 emissions from ACWA Power Kırıkkale NGCCPP will not contributed more than 25% of the applicable ambient air quality standards at residential areas located at the area of effect.

NO_2 Distribution Modeling Results

a. Hourly Distribution

Contribution values of hourly air pollution for nitrogen dioxide (NO2) emissions during operation phase as a result of the works of air quality distribution modeling realized have been found out as follows.

The Highest 1. Value 377.73 µg/m^3 (533250, 4415250)
The Highest 2. Value 371.19 µg/m^3 (533250, 4415750)
The Highest 3. Value 313.43 µg/m^3 (533750, 4416250)
The Highest 4. Value 312.60 µg/m^3 (534250, 4417250)
The Highest 5. Value 301.56 µg/m^3 (533750, 4415250)
The Highest 6. Value 296.94 µg/m^3 (532250, 4416750)
The Highest 7. Value 295.45 µg/m^3 (533250, 4414750)
The Highest 8. Value 251.12 µg/m^3 (533750, 4417250)
The Highest 9. Value 244.04 µg/m^3 (533250, 4418250)
The Highest 10. Value 228.30 µg/m^3 (533250, 4417250)
The Highest 11. Value 226.79 µg/m^3 (533250, 4417750)
The Highest 12. Value 214.24 µg/m^3 (533750, 4417750)
The Highest 13. Value 209.96 µg/m^3 (532250, 4417750)
The Highest 14. Value 207.92 µg/m^3 (533250, 4416250)
The Highest 15. Value 207.90 µg/m^3 (532250, 4416250)
The Highest 16. Value 205.86 µg/m^3 (532750, 4413250)
The Highest 17. Value 200.59 µg/m^3 (533250, 4414250)
The Highest 18. Value 199.49 µg/m^3 (532750, 4416750)

It is worth to note that in all of the above points, no sensitive receptors where located and all of the above points are located on a rural and unurbanised area.

Limit value to be valid as of the date of 01/01/2024 for hourly nitrogen dioxide (NO_2) emissions within the scope of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 shall be 200 µg/m^3 and the said limit value may not be exceeded more than 18 times. As understood from contribution values to air quality pollution pertaining to hourly nitrogen dioxide (NO_2) emissions included hereinabove, the said limit value on impact area is exceeded 17 times and the requirements of the Regulation are met hereof.

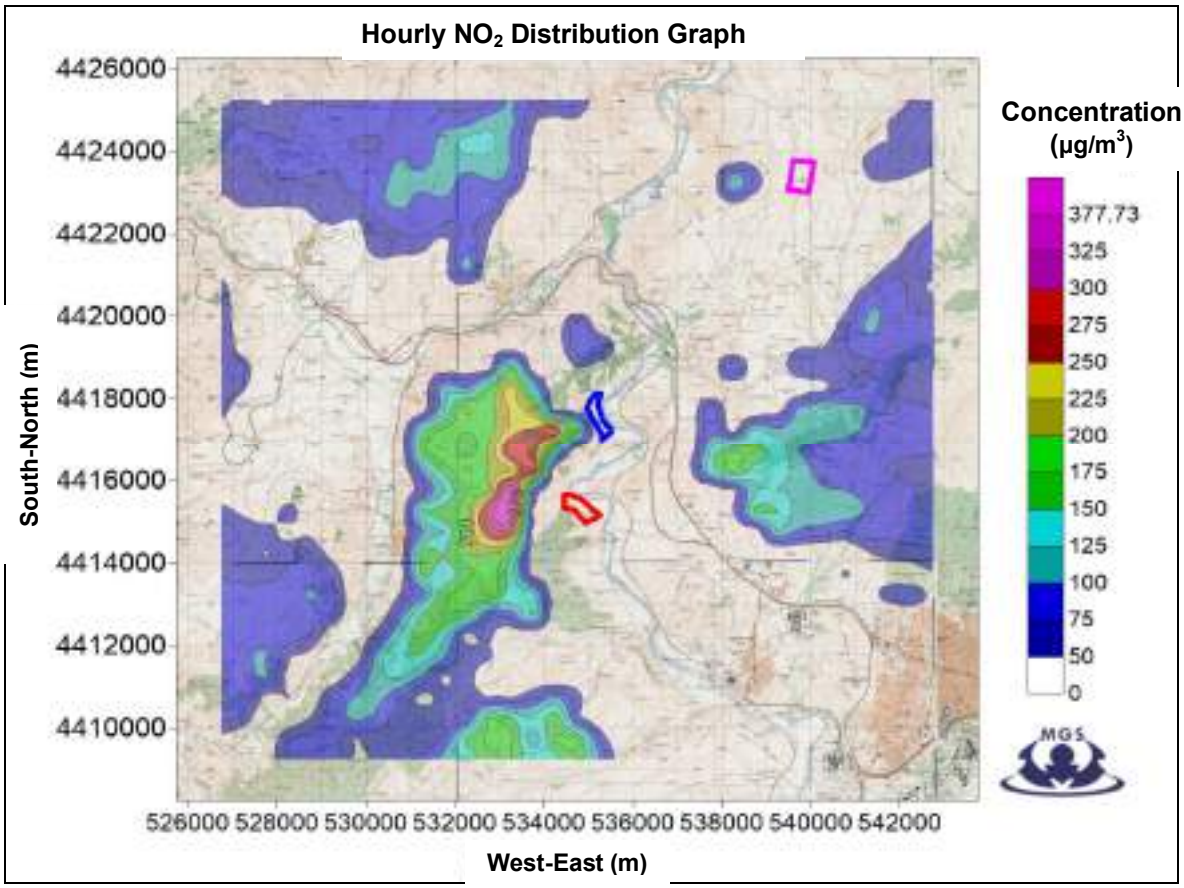


Figure 78. Hourly Nitrogen Dioxide (NO_2) Emission Distribution Graphic during Operation Phase (Cumulative Scenario)

b. Annual Distribution

Contribution values of annual air pollution for nitrogen dioxide (NO_2) emissions during operation phase as a result of the works of air quality distribution modeling realized have been found out as follows.

The Highest Value 19.82 µg/m^3 (533250, 4415250)

Target value to be valid as of the date of 01/01/2014 for annual nitrogen dioxide (NO_2) emissions within the scope of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 shall be 40 µg/m^3 and the said limit value it met.

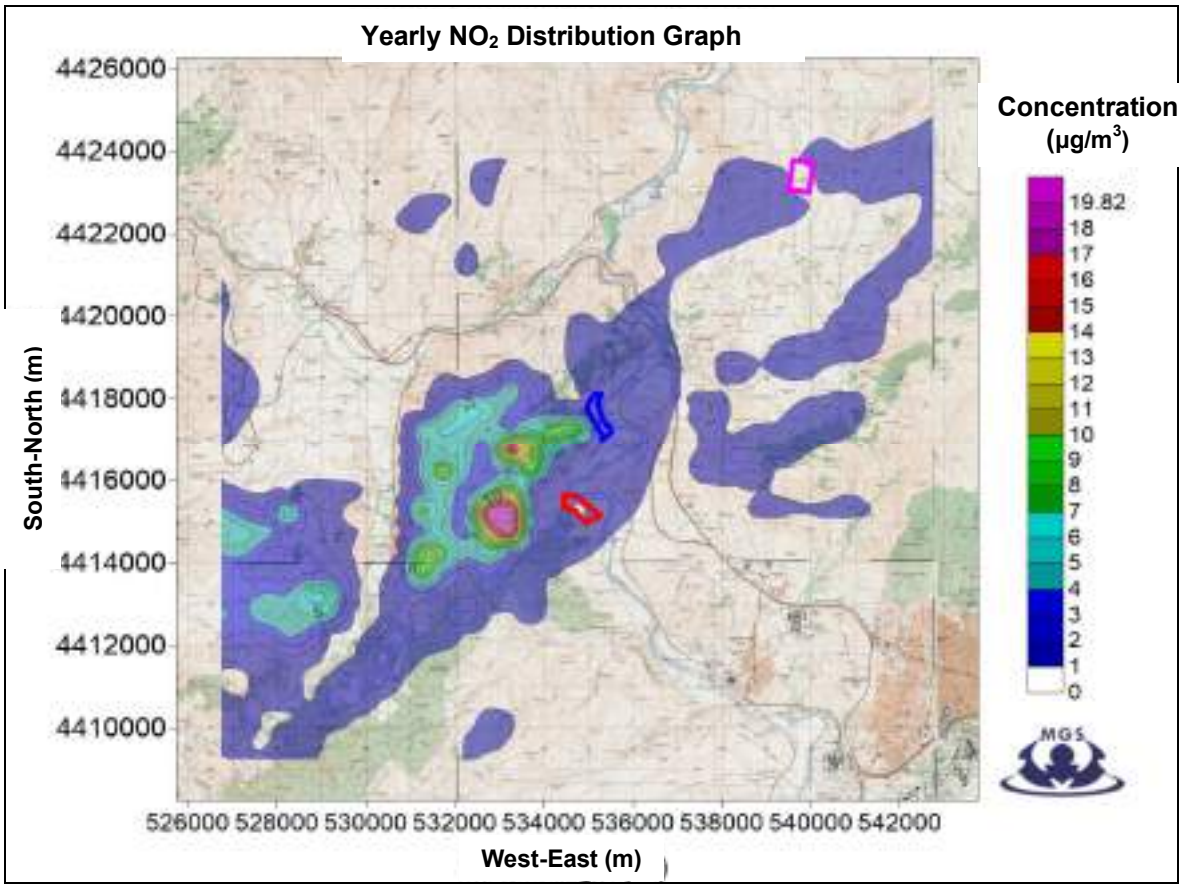


Figure 79. Annual Nitrogen Dioxide (NO_2) Emission Distribution Graphic during Operation Phase (Cumulative Scenario)

CO Distribution Model Results

a. 8 Hours Distribution

Contribution values of hourly air pollution for nitrogen dioxide (CO) emissions during operation phase as a result of the works of air quality distribution modeling realized have been found out as follows.

The Highest Value 339.55 µg/m^3 (533250, 4415250)

Target value to be valid as of the date of 01/01/2017 for 8 hours carbon monoxide (CO) emissions within the scope of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 shall be 10,000 µg/m^3 and the said limit value it met.

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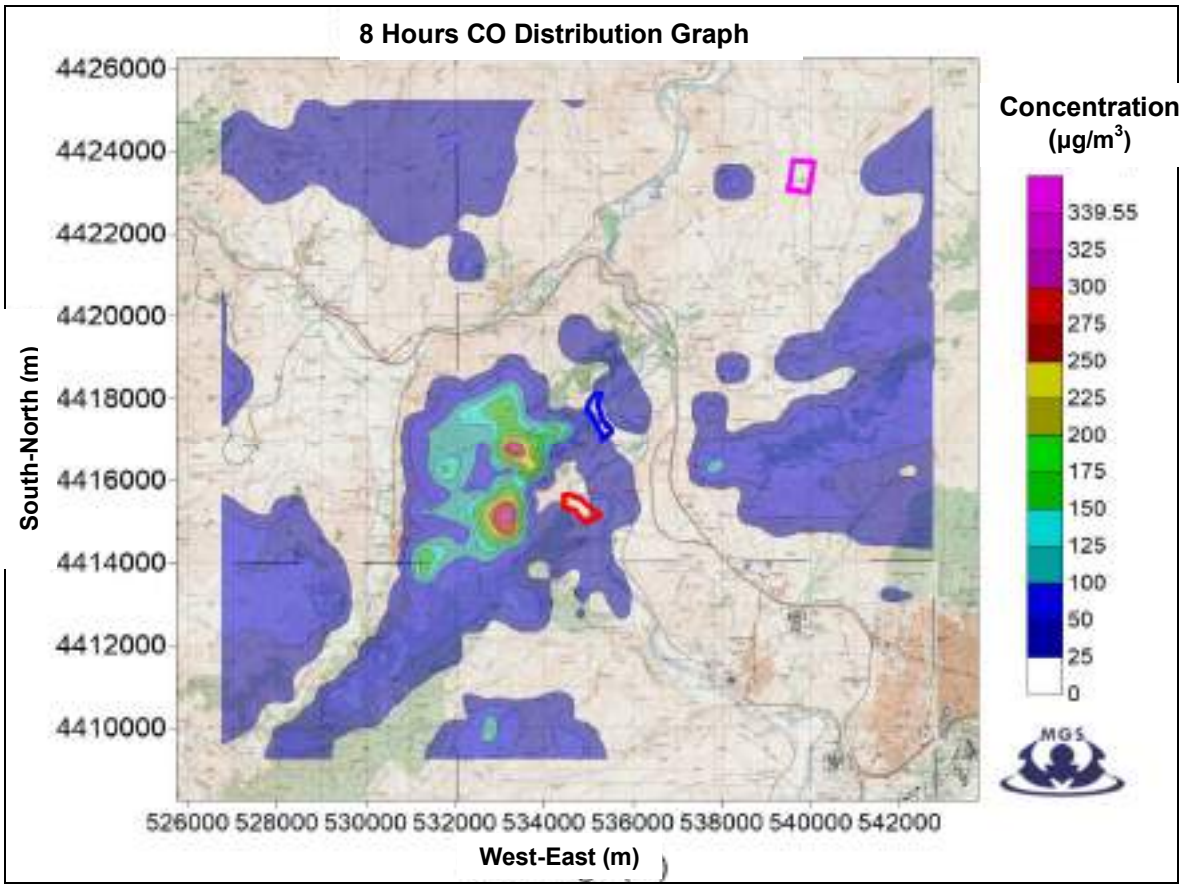

Figure 80. 8 Hours Carbon Monoxide (CO) Emission Distribution Graphic (Cumulative Scenario)

When modeling results are analyzed, primary reasons why contribution values to air quality of NGCCPP are such in less amount are that natural gas known as clean fuel within the scope of the power plant is to be used and selected flue height and rate emission distributions have been performed properly and satisfactorily and are in high amount.

For determination of emissions arising from combustion system when the power plant is commissioned, flue gas shall be continuously monitored; volumetric flue gas flow rate shall be measured at all times via measurement instruments for determination of CO, NOx temperature and mass flow rate in waste gases.

The provisions of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 (amended: the Official Gazette dated 05/05/2009 and no. 27219) and "Industrial Air Pollution Control Regulation" published and enacted in the Official Gazette dated 03/07/2009 and no.27277 shall be complied with in each phase of the said project.

In addition to this, the power plant shall be designed and operated in compliance with European Parliament and Council Directive (Industrial Emission Directive).

Upon putting the facility into operation, emission measurement shall cause to be conducted by an organization licensed by the Ministry of Environment and Urbanization and environmental permit and license on the basis of emission permit shall be obtained in accordance with the provisions of "Industrial Air Pollution Control Management Regulation (SKHKKY)" published and enacted in the Official Gazette dated 03 July 2009 and no. 27277.

The project owner undertakes that it shall comply with the provisions of "Air Quality Assessment and Management Regulation" published and enacted in the Official Gazette dated 06/06/2008 and no. 26898 and "Industrial Air Pollution Control Regulation" published and enacted in the Official Gazette dated 03/07/2009 and no. 27277.

V.2.9.7 Assessment of the facility within the scope of Annex-4 control regulation of industrial based air pollution

Flue Gas Rate

Waste gases shall be provided to atmosphere in vertical direction in a way that shall be transported without any obstacle by free air flow. Discharge rates of gases should be minimum 4 m/s since nominal calorific power of the said facility is over 500 kW.

Waste gases arising from process shall be provided to atmosphere in a way that shall be transported without any obstacle by free air flow. For this purpose, flue should be used; discharge rates of gases from flue should be minimum 4 m/s in the facility where induced draught is applied and it should be 3 m/s in non-applicable circumstances. As per generation type and generation process of the facility, flue gas rate should be minimum 2 m/s in cases where flue diameter cannot be narrowed and induced draught cannot be applied and this case is approved with a report to be obtained from a scientific institution.

Flue gas rate in the said facility is 23.8 m/s and flue gas rate is more than 4 m/s. For this reason, the provision set out in Annex-2 Table 2.1 Regulation on Controlling Industrial Based Air Pollution effectuated by being published in the Official Gazette numbered 27277 and dated 03/07/2009 shall be met hereof.

Flue Height

Flue height shall be determined by using abac and according to the principles set out below in the facility whose nominal calorific power is 1.2 MW and over as set out in "Industrial Air Pollution Control Regulation". *In cases where volumetric flow rate value from abac (R) is not sufficient for Q/S (kg/hour) value and flue height is not determined from abac, if there are not buildings and heights stipulated to be constructed or existing or rugged terrain on the facility impact area, (if J' value is determined as zero), actual flue height should be minimum 10 m from base and its height from roof top should be minimum 3 m.* It is stated as if J' value is different from zero, it is taken as H' 10 and flue height is determined by using abac.

If roof inclination is below 200, flue height calculation shall be conducted by accepting roof height as 200 inclination.

The values provided in abac height,

H' [m] : Flue height determined by using abac,
d [m] : Flue inner diameter or flue cross section area equivalent diameter
t [^{o}C] : Waste Gas Temperature at Flue Inlet
R [Nm^{3}/h] : Volumetric flow rate of waste flue gas under normal conditions away from moisture status,
Q [kg /h] : Mass flow rate of air pollutants materials from their sources
S : Factor used in determination of flue height (S values in Table 4.1 and Table 4.2 shall be used).

Since the said facility is not existing, S values set out in in Table 89 have been used.

Table 89. S Value for New Facilities

EMISSIONS			S – VALUES
Suspended Dust			0.08
Hydrogen chloride (shown as Cl)			0.1
Chloride			0.09
Inorganic fluoride compounds in hydrogen fluoride and gas form			0.0018
Carbon Monoxide			7.5
Sulphur dioxide			0.14
Hydrogen Sulphur			0.003
Nitrogen dioxide			0.1
Items set out in Table 1.1			
	Class	I	0.02
	Class	II	0.1
	Class	III	0.2
	Lead	:	0.005
	Cadmium	:	0.0005
	Mercury	:	0.005
	Thallium	:	0.005
Items set out in Table 1.2			
	Class	I	0.05
	Class	II	0.2
	Class	III	1.0
Items set out in Table 1.3			
	Class	I	0.0001
	Class	II	0.001
	Class	III	0.01

NOx has been taken as a basis as determinant in determination of flue height and calculations made and results have been provided below.

R = 2,322,000 Nm^3/h
t = 80 ^0C
d = 515 m

Mass flow rate calculated for NO_x (single flue) 116.1 kg/hour
Q/S = 116.1 / 0.10 (S value has been taken as 0,10 from the regulation)
= 1.161 kg/hour = 1.161 x 10^3 kg /hour

Mass flow rate calculated for CO (single flue) : 232.2 kg/hour
Q/S = 232.2 / 7.5 (S value has been taken as 7.5 from the regulation)
= 30.96 kg/hour

Since Q/S rate calculated for NO_x is higher, NO_x has been used in calculation of abac.

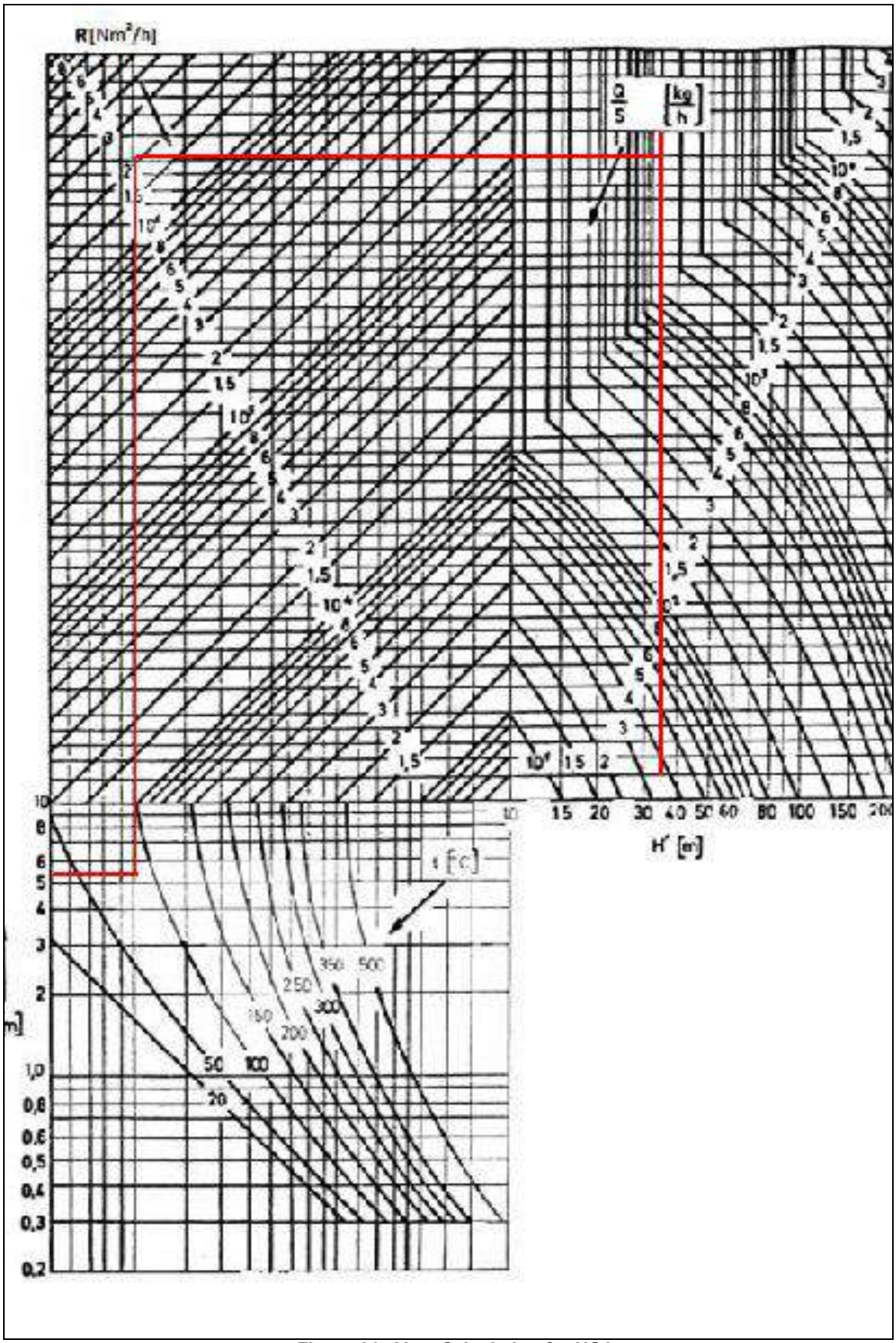

Figure 81. Abac Calculation for NO2

Flue height determined by using abac is (H') 35 m. Height average J' has been taken as 10 (J') as to facility ground inside the site in 35H' radius of maximum building heights determined as to zoning plan or average height from facility ground of rugged land in 10 H' (350 m) radius. J '/ H' = 10/35 = 0.35 has been calculated in this way and J/J' value has been found as 1 with the help of the following figure.

J/JI = 1
J = 1 x J'
J = 10

Adjusted flue height is found as

H = HI + J
= 35 m + 10 m
= 45 m.

Height of flues to be included within the scope of the project is 45 m; height calculated from the table is 45 and for this reason, it ensures standard values of the regulation.

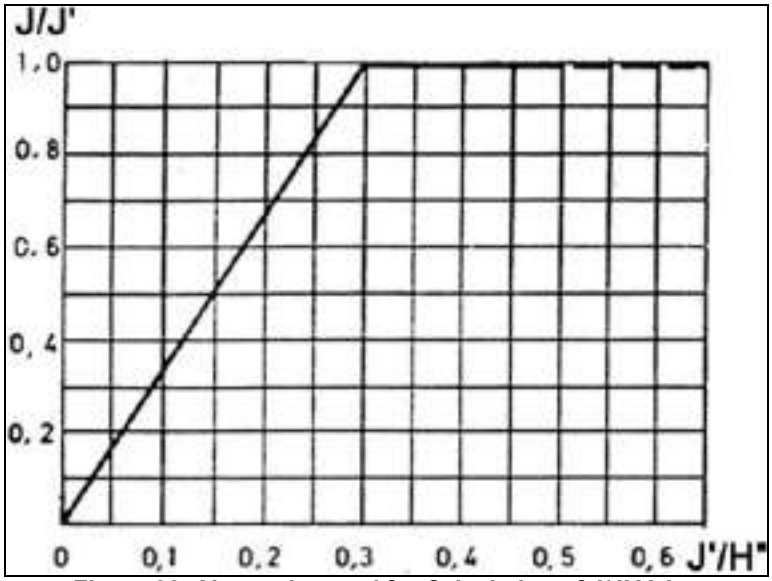

Figure 82. Abac to be used for Calculation of J/JI Value

Height of flues to be included within the scope of the project is 45 m; height calculated from the table is 75 and for this reason, it ensures standard values of the regulation.

Emissions, mitigation measures, and their yields, tools and systems to be used for the measurements (systems to be installed for instantaneous measurement and assessment of flue gas emissions (online) and the procedures conducted for measurement of existing air quality).

Natural gas known as the cleanest fuel type among fossil fuels in the said energy power plant shall be used. The most important parameter among air emissions likely to occur as a result of combustion of natural gas is NO_x emission formation. NO_x emissions fundamentally depend on thermal NO_x formation in gas operated burning facilities, especially in gas turbines.

Burning of natural gas is not an important dust emission source. Sulphur oxide emissions mostly results from sulphur existence in fuel. Since natural gas is non-sulphuric fuel, SO2 formation resulting from the facility is not expected.

Carbon monoxide (CO) always appears as an intermediate product of combustion process. The best available techniques to minimize emissions of CO is a full combustion procedure ensured by a good furnace design, high-performance monitoring and process control techniques. A well-developed system in reducing NOx emissions alongside combustion conditions shall ensure reduction of CO levels.

In the Reference Document on Best Available Techniques for Large Combustion Plants within the scope of Integrated Pollution Prevention and Control - IPPC, it is stated that dry low NOx premixing boilers (DLN) is the best available technique as the best available technique for reduction of nitrogen oxides (NOx) in steam boilers working with gas and gas engines and gas turbines. In the same document, water or steam injection, dry low NOx (DLN) technologies and selective catalytic reduction (SCR) are available among prevention technologies used in reduction of NOx emissions. Dry low NOx boilers shall be used within the scope of the said ACWA Power Kırıkkale NGCCPP.

Impacts on Climate

According to UNFCCC, there are six greenhouse gases which are listed below;

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Perfluorocarbons (PFCs)
- Hydrofluorocarbons (HFCs)
- Sulphur Hexafluoride (SF_6)

In Natural Gas Combined Cycle Power Plants, the main impact on climate change is CO_2 emissions.

Estimated CO_2-equivalent emission value which will be produced due to combustion of natural gas in ACWA Kırıkkale NGCCPP is given below;

CO_2 Emission Factor* : 2.693 CO_2 ton/ fuel ton (for CO_2)
(*IFC Carbon Emission Estimator Tool,12.02.2014)
Natural Gas Consumption Amount : 896,250 ton/year
(Density of natural gas is considered as 0.717 kg/m^3)
CO_2-equivalent Emission Amount : 2,454,334 ton/year (CO_2 + CH_4 + N_2O)

Turkish total CO_2 emission produced for public electiricty and heat production is determined as 278,330,840 ton/year (National Greenhouse Gas Index 1990-2009). According to data, ACWA Kırıkkale NGCCPP contributes only 0.8% to the Turkey's CO_2 emission rate in energy sector.

At the proposed power plant, in burning chamber, hot burning gases will be produced as a result of natural gas burning and they will rotate the turbine blades by condensing and passing by the gas turbine. With the rotation of the blades, the shaft connected to an electric generator will rotate to produce electricity.

The energy of the hot exhaust gases coming out of the gas turbine will be collected in a waste heat boiler (HRSG) to be re-used, to vaporize the water in the boiler. The

steam obtained under the high pressure will actuate the steam turbine to produce additional electricity power.

The plant efficiency is estimated at the level of 58.6 % within the activity scope, due to the combined cycle power plant process, the waste heats going out from the Gas Turbine shall be utilized, and vapor will be produced in the Heat Recovery Steam Generator, and then electricity energy will be produced by the vapor turbine. The temperature of the smokestack gas is expected to be approximately 87^0 C which will be released to the atmosphere at the speed of 31.2 m/s from the Heat Recovery Steam Generator after the production of vapor from the gas at the temperature of 586.5^0 C at the exit of the Gas Turbine.

As a summary Power plant operation is not expected to be created any significant effect to the region.

V.2.10 Dangerous, toxic, inflammable substances and explosives to be used in project units during production, their transportation and storage, usage purposes, potential dangers during their usage and measures to be taken

Main fuel included under the classification of explosive, inflammable materials to be used throughout the facility is natural gas. Natural gas to be used throughout the power plant shall be used by way of not being supplied from BOTAŞ Natural Gas Transmission Line and no storage shall be made within the facility area. All necessary safety measures shall be taken against leakage and corrosion during natural gas connection.

Some sort of chemicals shall be used within the site during operation phase of the power plant envisaged to be constructed. These chemicals shall be brought to the facility via an experienced personnel by way of on-site delivery and clothing and equipment of personnel shall be in conformity with all health and safety measures. Filling and emptying measures shall be taken to ensure safety. There shall be some solvents used for cleaning up and painting various equipment in the facility.

Gas turbines shall be periodically washed within the scope of the said project. Chemicals to be used in washing procedure shall be stored by taking required measures on separate areas within the facility and only responsible supervisors shall access and use the chemicals. Likewise, the chemicals to be used in Water Treatment Facility, Domestic Natured Package Wastewater Treatment Facility and Cooling System, after being brought to the facility, shall be stored in suitable environments by taking necessary measures as stated in Material Safety information Form; their access to and usage shall be prohibited except for the responsible ones.

The Provisions of "Hazardous Chemicals Regulations "amended with the regulation published in the Official Gazette dated 18/01/2008 and no. 26760) published and enacted in the Official Gazette dated 11/07/1993 and no. 21634 and "Hazardous Wastes Control Regulation" published and enacted in the Official Gazette dated 14/03/2005 and no. 25755 (amended with the regulation published in the Official Gazette dated 30/10/2010 and no. 27744) shall be complied with.

V.2.11 Possible impacts over forest areas and measures to be taken, measures to be taken against forest fires

V.2.11.1 Possible impacts over forest areas and measures to be taken

There shall be fire extinguishing equipment in sufficient number against potential fires likely to occur within the facility. (pick, shovel, axe, water bucket, fire tubes etc.) "Safety Measures to be Taken Against Fires in Workplaces" 1st Section 5th Part of the Bylaw on Worker Health and Work Safety published and enacted in the Official Gazette dated 11/04/1974 and no. 14765 and relevant provisions shall be complied with. Facility personnel shall be trained for impacts and duties likely to be required in case of occurrence of fire. The incident shall be attempted to be eliminated with immediate effect by making use of fire extinguishing equipment kept available in specific locations following noticing fire and issuing alarm and the following matters shall be fulfilled.

- Natural gas valves shall be closed and gas flow shall be interrupted.
- When fire is discovered, personnel working in the building and the people in the vicinity shall be informed.
- The nearest safety and fire brigade units shall be informed.
- Environmental safety shall be ensured by emergency team.
- Fire-fighting teams shall intervene the fire immediately.
- Inflammable material sources in the vicinity of fire shall be immediate isolated in fires due to liquid gas and electrical causes.
- "Saving life" shall be the first work to be made in fire. In such case, persons shall not jeopardize their own lives and other persons' lives.
- Fire shall be extinguished with the help of the nearest fire extinguishing equipment.
- Mouths and noses shall be closed with wet cloth against burning and suffocating effect of smog.
- While extinguishing fire, unnecessary destructions, breakage and demolitions shall be avoided.
- Personnel in sufficient number and foam fire extinguishers shall be kept available for immediate use. Fire brigade vehicle shall be in a grounded structure conducting static electricity.
- Emergency response teams in charge with extinguishing fire shall be in contact with local fire brigade.
- Ambulance shall arrive at each fire location.

V.2.11.2 Measures to be taken against forest fires

In case of forest fire in any location within the scope of the proposed project area, fire shall be intervened as rapidly as possible with existing machinery, equipment and human force.

Fire extinguishing equipment shall be kept available in the facility and a fire alarm system consisting of heat, smoke and flame detectors shall be installed. Training shall be provided to personnel working in the facility and trainings shall be reinforced with exercises to be conducted periodically. In case of fire on the site, fire shall be intervened with immediate effect and the nearest fire brigade units shall be duly informed.

V.2.12 Impacts of project on agricultural products and soil acidification, methods used for estimation of soil acidification and measures to be taken

V.2.12.1 Impacts of project on agricultural products

No agricultural activity is performed on the land where the facility envisaged to be constructed is established. However, there are agricultural fields within impact area designated according to SKHKKY and dry agricultural activities are generally performed over these lands. There are slope and erosion damages in a great majority of agricultural lands within the project impact area.

Air quality distribution modeling study has been conducted for emissions arising from flue during operation phase of the facility. Concentration values of emissions from the project generated on ground level are calculated and they are below regulation limit values. (See **Annex-9**) In the calculations performed, it is seen that the highest concentration values stay at unoccupied hilly terrain to the west and the facility that these terrains have the characteristics of step flora in general. In addition to this, low-NOx boilers shall be used for keeping NOx emissions occurred due to operation activities of the facility under control and flue gas emissions shall be measured at all times when the project is put into operation. For this reason, an adverse effect is not expected to occur on existing agricultural lands in the area.

V.2.12.2 Soil acidification

Primary pollutants causing soil acidification in nature are sulphur oxide (SO2) and nitrogen oxides (NOx) and ammonium roots. After these acid forming substances spread to atmosphere from polluting source, they deposit on soli with two different procedures as dry and wet. That the said acid forming materials are added to soil lead an increase in H+ion concentration on soil. In this way, Ca^{++} , Mg^{++} , Na^{+}, K^{+} and NH_4^{+} ions shall abandon their places on soil surface and H+ ions shall settle on these areas and these cations shall penetrate soil solution and shall be ready for leakage. As a result of abandoning the soil by the said ions, fertility of soil shall decrease and it shall cause situation of adding H+ ion to soil in more degrees.

Flue gases causing soil acidification are SO_2, NO_x and H_2S. NOx occurred as a result of combustion of natural gas within the scope of the facility is in measurable values and when the facility is put into operation, SO2 and H2S shall not be formed as a result of combustion of natural gas. Therefore, when possibility of forming nitric acid rails in Turkey is examined, acidification on soil arising from the power plant shall not occur.

V.2.13 Impacts on ground and surface waters and measures to be taken (Protection Band to Existing Water Sources and River)

It is envisaged that some sort of chemical materials shall be used within the scope of proposed project. The said chemical materials shall be stored over the grounds whose insulation has been ensured and these materials have no possibility of mixing to underground and surface waters.

Likewise, all wastes occurred during both construction and operation activities of the project shall be disposed of in line with relevant regulations. Consequently, underground and surface waters shall not be adversely affected due to wastes occurred within the scope of the facility.

V.2.14 Impacts on Marine Environment and Measures to be Taken

Water for ACWA Power Kırıkkale NGCCPP shall be used for two purposes as process and domestic purpose.

Process water to be used in the power plant shall be supplied from caisson wells to be opened in the vicinity of Kızılırmak River. Water supplied from caisson wells shall be used in closed-cycle cooling system technology so that minimum blowdown discharge will be happen.

Likewise, domestic waters to be used within the scope of the facility shall be supplied from caisson wells to be opened in the vicinity of Kızılırmak River. After implementing required treatment procedures, these waters shall be used and shall be discharged to Kızılırmak River after ensuring discharge criteria required following use. Therefore, no adverse impact arising from discharge procedures into Kızılırmak River is expected.

V.2.15 Cumulative Assessment of Potential Impacts of the Power Plants to Existing Pollution Load of the Region and Other Thermal Power Plants Envisaged to be Installed in the same Region (To Receiving Environment such as Living Organism, Water and Soil)

V.2.15.1 Existing pollution load of the region

Detailed information relating to measurement and analysis studies conducted in regard to determination of existing case (underground water, surface water, soil quality, air quality) in the power plant and nearby environment has been provided in **Section IV.2.18**.

V.2.15.2 Impacts over living organisms

Detailed information relating to potential impacts likely to occur over flora and fauna and measures to be taken of proposed ACWA Power Kırıkkale NGCCPP project have been analyzed in **Section V.1.15** and **V.2.20.**

V.2.15.3 Impacts over air quality and cumulative assessment

Low-NOx boiler shall be used for NOx arising from flue within the scope of the facility envisaged to be constructed.

A study of air quality distribution whereby emissions arising from the facility within the scope of the project is calculated have been conducted and have been provided in **Annex-3**. In this study, potential impacts of ACWA Power Kırıkkale NGCCPP Project in approximately 1 km distance together with the facility in the scope of ESIA Report have been analyzed on cumulative basis. As a result of calculations conducted, it has been determined that ground level concentration value of NOx and CO emissions remain below limit values specified in the regulation.

V.2.15.4 Impacts over Soil

Impact of the proposed ACWA Power Kırıkkale NGCCPP project causing over soil is soil acidification. As described in **Section V.2.12**, the most important emission causing soil acidification is NOx. Since natural gas is to be used as raw material in the facility envisaged being installed (containing sulphur in negligible level), sulphur oxide emissions

arising from the facility shall be in negligible level. Since NOx emission limit values are ensured, no impact is expected over soil.

V.2.15.5 Impacts over Water Resources

No adverse impact is expected on groundwater and surface water of the proposed ACWA Power Kırıkkale NGCCPP project. (See **Section V.2.13**)

V.2.16 Specifications and Amounts of Machineries, Vehicles, Tools and Equipment to be Used in Activity Units

Detailed information in relation to list of machinery and equipment to be used during operation activities of the facility and specifications of this equipment and their number have been provided in **Section V.2.1**.

V.2.17 Goods and/or Services to be Generated in Activity Units, Generation Amounts of End and Byproducts, Where, How Much and How They Shall be Marketed, Where, How and How Much Population and/or Area Services to be Generates shall be Provided

Main yield to be generated within the scope of the project is electricity energy. Proposed power plant is in 924.4 MWe installed power and its annual net electricity generation shall be approximately 7,557 GWh.

OHTL in 380 kV shall be performed in order for electrical energy to be generated in ACWA Power Kırıkkale NGCCPP to be connected to national interconnected system.

V.2.18 In What Amounts Boiler and/or Cooling Waters to be Used in Activity Units shall be used, How These Water shall be provided to What Receiving Water Environment After Which Procedures and Properties of Waters to be Provided

Cooling system within the scope of the project has been designed as a closed cycle fan cooling tower. In this system, approximately 400 liter/sec water circulation is necessary to be available The amount of water to be reinforced for cooling water is 1045 ton/hour. In the system, heat recovery steam generator blowdown water volume is 600 m^3/day.

Water volume to be used within the system and detailed information in relation with to what receiving environment these water shall be provided after what procedures have been provided in **Section V.2.2** and **V.2.5**.

V.2.19 Determination of the intensity and spread effects on the underground and over-ground culture and natural assets in and close surroundings of the project (effects on the traditional urban tissue, archaeological remnants, and on the natural values to be protected)

As a result of investigations conducted over existing 1/25,000 scale maps and literature scans covering the proposed power plant area and its near environment, there are no registered protected areas on the facility area such as archaeological, historical, urban site and natural park, natural protection areas, national parks etc.

V.2.20 Possible impacts on terrestrial flora/fauna and measures to be taken,

The measures to be taken over possible impacts over terrestrial and hydrophilic flora/fauna included in **Section V.1.15** and during construction phase of the project shall be duly adhered to in operation phase of the facility as well.

There are no endangered, endemic, rare, extinct species or habitat within the facility area. It shall be duly considered that outside borders of the facility shall not be exceeded during operation phase as in construction phase in order not to destruct natural vegetation structure.

V.2.21 The productivity of the thermal power station, how shall the waste heat be utilized (due to the energy loss arising from not being able to transform all of the fuel to energy), how will the heat to be given to the atmosphere due to energy loss affect the meteorological conditions (relative humidity, temperature, pressure etc.) and the precautions to be taken

V.2.21.1 Efficiency of the facility

Efficiency of the power plant envisaged to be installed is 58.6 %. It is expected that flue gas temperature to be given to atmosphere in 31.2 m/s in HRSG following steam generation from gas in 586.5 ^{o}C temperature in gas turbine output is approximately 87 ^{o}C.

Natural gas is an energy source not polluting air and not harming environment. Since there are no sulphur oxides and particle matters (PM) in components of natural gas, air pollutant combustion products such as sulphur oxides and PM shall not occur as a result of combustion reactions. Since natural gas is an efficient fuel and is in gas state and inflammable and caustic molecules have chance of merging, it provides a possibility of combustion in higher efficiency.

V.2.21.2 Waste heat

Waste gas occurred as a result of combustion procedure shall be provided to atmosphere from flue. Gases coming out of flue move generally horizontally and upwardly. Temperature of these gases reaches ambient temperature after a specific distance. While distance of hot gases taken in horizontal direction on the areas where wind rate is high extends a little bit more, distance of hot gases on the areas where wind rate is low becomes shorter in horizontal direction.

Heat provided to atmosphere from flue of envisaged facility shall not be spread to large areas. High flue gas temperature at flue outlet shall reach ambient temperature within short period and distance. Thus, additional heat value of waste heat arising the facility that is 87 ^{0}C flue gas outlet temperature created at atmosphere is in negligible level.

V.2.22 Assessment of the traffic load of all in-site and out-site transports to be made within the scope of the project on and its effects.

Access to the project site is possible via the stabilized road located after the junction situated near Irmak Municipality over Ankara-Kırıkkale Highway.

Personnel to be employed during operation phase of the envisaged project shall be supplied from locals as far as possible. As in construction phase, service busses shall be provided for ensuring local employees to access to the site during operation phase. 2-3

minibuses shall work in the morning and in the evening for transporting 60 personnel working in the project during operation phase to the facility. It is not expected that these vehicles to be used shall cause excessive traffic load. Any adverse impact is not expected for region roads of additional traffic load occurred during construction and operation of the power plant.

Carries during transportation of all materials to be used within the scope of the project shall take all safety and security measures in force and they shall comply with traffic rules.

V.2.23 From where and how will the houses and the other technical/social infrastructure requirements of the staff and their dependents who will work during the activity of the facility be met (how transportation of personnel shall be provided, transportation type to be used and vehicles)

It is envisaged that approximately 60 persons shall work in operation period. Social units such as changing/dressing building, infirmary etc. for personnel working within the scope of the project shall be constructed. Social requirements rather than these requirements shall be met from the nearest residential areas.

During operation phase of the project, no adverse impact is expected over social and technical infrastructure services on residential unit close to the facility.

V.2.24 The risky and dangerous activities for the human health and the environment, among the activities in the operational phase of the project (Including Cancer Effects)

All required measures within the framework of legislation in force shall be taken during both construction and operation phase of the envisaged project. The power plant envisaged to be installed shall comply with internationally accepted standards and the most appropriate methods and technologies shall be implemented in terms of human and environmental health.

All measures relating to health and work safety of personnel working within the scope of the project shall be taken and trainings shall be provided to personnel in this regard. Within this context, all provisions relating to Labor Law no. 4857 and "Work Health and Safety Law" published and enacted in the Official Gazette dated 30/06/2012 and no. 28339 shall be complied with.

V.2.25 Creating landscaping elements on the project area or site arrangements to be performed for other purposes

Landscaping works shall be performed on required areas following installation of facility units over activity area in the scope of the project. Species reflecting natural vegetation of the region shall be used in the landscaping works. Selection of appropriate tree species for the related region in line with the landscaping project to be prepared hereof shall be taken into account; cooperation shall be established with relevant units of the Department of Forestation of Forestry General Directorate.

V.2.26 Recommended distance for health protection band

The facility proposed to be constructed is within the scope of "1st Class Non-Sanitary Institution" under the scope of "Regulation on Workplace Opening and Working Licenses" published and enacted in the Official Gazette dated 10/08/2005 and no. 25902.

Determination of health protection band distance shall be conducted via investigation boards established and "Directive on Determination of Health Protection Distance to be Left Around Non-Sanitary Institutions Likely to Adversely Affect Environmental and Social Health" dated 17/02/2011 and no. 6359 issued by cancelled General Directorate of Core Health Services, the Ministry of Health. Thus, following completion of construction works of ACWA Power Kırıkkale NGCCPP project envisaged hereof, an application shall be filed to Kırıkkale Municipality and/or Kırıkkale Provincial Special Administration so as to obtain Non-Sanitary Institution License within the scope of Regulation relating to Workplace Opening and Working Licenses no. 2005/9207 published in the Official Gazette dated 10/08/2005 and distance of health protection band designated by the commission to be formed for the facility shall be respected.

V.2.27 Other activities

There is no consideration to be handled under this headline.

V.3 The effects of the project on the socio-economic environment

V.3.1 The income increases expected with the project; the employment possibilities to be created, population movements, immigration, training, health, culture, other social and technical infrastructure services and the changes in the utilization conditions of those services etc.

V.3.1.1 Revenue growth

Vast majority of materials and services required in construction and operation phases and land preparations shall be met from the locality and wages to be paid for the services to be provided from work force, accommodation, material/equipment renting, fuel and local workplaces shall contribute to the economy of the region.

V.3.1.2 Employment opportunities, population and migration

It is projected that more than 1.000 personnel shall be employed at the same time during construction period. Approximately 60 persons shall work during operation phase within the scope of the project. Personnel with priority to be employed within the scope of the project shall be preferred from local people. Thanks to employment possibility to be created, migrations shall drop to vicinity settlements from the locality, and migrations from vicinity to the locality settlements shall be probable.

V.3.1.3 Education

Since vast majority of personnel to be employed consists of persons still living on that region, it is not expected that local schools and existing literacy profile shall be affected from this.

V.3.1.4 Health

An infirmary shall be installed on the facility area against small accidents and injuries likely to occur on the facility. In case heavy accidents occur, health organizations in Kırıkkale province and Yahşihan district shall be used. Thus, load of existing hospitals and healthcare units shall increase in small degree with activities of construction and operation activities of the proposed facility.

V.3.1.5 Social and technical infrastructure services and utilization conditions of those services

Potable and utility water requirement required for personnel and the water used in the process shall be supplied from caisson wells to be opened in the vicinity of Kızılırmak River. Water used shall be discharged to Kızılırmak River within the framework of legislation following being treated in treatment facilities. In this way, an additional load shall have been brought over existing infrastructure system.

V.3.2 Environmental benefit-cost analysis

The most important pollutant covered by the planned facility is NOx. Low-NOx boilers shall be used within the scope of the project envisaged to be constructed according to the project design criteria. In addition to this, when operation activities are commenced, online systems shall be activated in order for continuous monitoring of flue gas emissions.

Cooling water to be used within the scope of the facility shall be supplied from caisson wells. Since the said facility shall operate as closed cycle, cooling water to be used in the system shall be taken from caisson wells as for time only and shall be used in the system again. Thus, waste water discharge shall not be in question arising from process. Likewise, ecosystem of Kızılırmak River shall not be changed or temperature increases shall not be experienced.

The provisions of relevant regulation shall be respected in disposal of all kinds of wastes occurred within the scope of the project (construction and operation).

Noise formation arising from machinery and equipment during construction and operation phase shall remain below limit values of the regulation as calculated in acoustic report prepared within the scope of the project.

Continuous energy supply is aimed with the power plant envisaged to be installed. By an considerable profit towards local economy and country economy, the project shall cause rises in employment and drop in migrations.

Taking into account the benefits and costs as described above, implementation of the planned facility shall contribute benefit both in terms of both region and country.

V.3.3 The evaluation of the social effects in connection with the realization of the project (Impacts to agriculture, livestock, fishery, apiculture etc. activities on the project area and impact area, relationships of local persons with the persons working during construction and operation phase of the project, impacts of the same over human life and analysis regarding social-economic aspects, social responsibility projects to be implemented) (interviews shall be performed with locals likely to be affected due to construction of the project and revealing sociological effect)

Social-economic effects likely to occur depending of realization of the project have been analyzed under the headlines of rehabilitation of local economy, education, health, technical infrastructure services and employment possibilities and detailed information has been provided in **Section V.3.1**. No adverse impact is expected by the said project towards social-economic conditions of the region.

SECTION 6. THE EFFECTS WHICH MAY OCCUR AND CONTINUE AFTER THE OPERATIONS OF THE FACILITY ARE CLOSED AND THE PRECAUTIONS TO BE TAKEN AGAINST THOSE EFFECTS

VI.1 Land improvement and reclamation works

Upon completion of economic life of the project, all equipment and buildings installed on the site shall be dismantled and materials and equipment occurred hereof shall be considered as scrap. Following evacuation of the land after closure of the project to the operation, rehabilitation and reclamation works shall be performed on the site.

Works such as land rehabilitation, land leveling etc. shall be performed within the scope of reclamation works.

Environmental drainage system shall be implemented for possible leakages likely to occur from storm waters and units on the power plant site. Vegetal earth scraped from surface during construction phase and stored in compliance with the technique shall be re-used for landscaping purpose. Recreation and greening operations shall be carried out by considering existing soil profile, climate and vegetation of the region.

Conditions shall be created in a way that ecological balance shall be re-established on the land within the scope of rehabilitation works and lives of small and large communities shall be sustained.

VI.2 Impacts on existing water resources

It is envisaged that some sort of chemical materials shall be used within the scope of proposed project. The said chemical materials shall be stored over the grounds whose insulation has been ensured and these materials have no possibility of mixing to underground and surface waters.

Likewise, all wastes occurred during both construction and operation activities of the project shall be disposed of in line with relevant regulations. Consequently, underground and surface waters shall not be adversely affected due to wastes occurred within the scope of the facility.

Cooling water to be used within the scope of the facility shall be supplied from caisson wells to be opened in the vicinity of Kızılırmak River. Since the said facility shall operate as closed cycle, cooling water to be used in the system shall be taken from caisson wells as for time only and shall be used in the system again. Thus, waste water discharge shall not be in question arising from process. Likewise, ecosystem of Kızılırmak River shall not be changed or temperature increases shall not be experienced.

VI.3 Possible air emissions

No air emission shall occur arising from the facility upon completion of operation activities. Thus, no adverse impact is expected over air quality after closure of the facility for operation.

SECTION 7. ALTERNATIVES OF THE PROJECT

(In this section, the selection of the location, the technology, the comparison of the precautions to be taken and of the alternatives and the ranking of the preferences shall be described.)

VII.1 Alternative of location selection

The facility in the scope of this ESIA Report shall be installed within the borders of Kırıkkale Province, Yahşihan District, Kılıçlar Municipality. There is no restricted area in the said facility as mentioned in **Section IV.2.12**. The facility has topography with not much roughness. Due to the reasons such as geological and topographical conditions, ease of transportation, lack of environmental constraints, proximity to the Kızılırmak River, the said facility area has been reviewed as the most appropriate land.

Initially the project company has considered four locations for the project site in close proximity to the old site. The main criteria for the site selection was site usage and ownership in addition to proximity to gas connection point and water resources. During surveys two of the alternative sites were found to be agricultural lands and privately owned, and the third site was found to be mostly in the close vicinity of military protected zone. As per initially collected information which revealed that the current site was fully owned by the Treasury and is not an agricultural land, this site was selected as the best alternative site for the project.

VII.2 Cooling system alternative

Selection of cooling system technology is of high importance in NGCCPP projects. Two different cooling system alternatives have been reviewed as single pass and cooling tower for the proposed project. (See **Table 90**) and projecting has been performed in a way that it shall be wet type cooling tower.

Table 90. Comparison of Cooling System Alternatives

System	Description
Single Pass Cooling System ("Once-through")	In this system, cooling water is obtained from a surface water source (sea, river etc.) and is transmitted to condenser and from here, it is discharged to surface water source. Temperature of boiler water circulated between boiler and steam turbine in the condenser is transferred to cooling water.
Cooling Tower System	i. *Dry Type Cooling Tower* In this system, cooling water circulation is made within closed system between condenser and tower. Cooling water whose temperature rises in the condenser is processed from exchanger system on tower base and its temperature is dropped. Temperature of cooling water in the said heat exchange system is transferred to air flow provided with natural or mechanical drawing mechanism in the tower. ii. *Wet Type Cooling Tower* In this system, as in single pass system, cooling water taken from water source shall be sprayed over condenser line penetrated through tower and steam circulated on this line is evaporated. Meanwhile, some portion of cooling water is evaporated and is delivered from tower to atmosphere and reduced cooling water is compensated from the same source. In addition to this, as in dry type cooling tower, cooling via air is utilized through natural or mechanical drawing in wet type cooling tower.

The results of the comparison of the cooling technologies used in the energy power plants in California in terms of some parameters obtained from the study of the California Energy Commission which was prepared in 2002 are presented below;

Cooling System Types

Parameters	Once Through Cooling System	Water Cooling System Mechanical Draft Cooling Tower	Dry Type Cooled Condenser
Water Consumption	Lower	8-12 gallons/minute per MWe	Approximately 0-5 % of the Mechanical Draft Cooling System
The Costs of Investment	Reference	Reference	1.5 – 3 times of the systems considered as the reference
The Costs of Operations and Maintenance	The maintenance of the pumps, the Condenser of the Cooling System	It shows variations with the region, fans/ pump power, water decontamination, filling the cooling tower, cleaning of the condensers	Expanded cleaning of the surfaces, the maintenance of the gear boxes, the power of the fans
Performance Errors	The errors show variations based on the meteorology of the project area.	---	It shows variations with the region, 5-20 % of capacity deficiency arises in hot and windy weathers.
Water Intake from Natural Resource	Approximately 500 gallons/minute per MWe	Approximately 10-15 gallons/minute per MWe	---
Discharge	Approximately 500 gallons/minute per MWe Increase in the temperature of the discharged water and the residual chlorine contained in the discharged water	Approximately 2-5 gallons/minute per MWe	---

The selection of the cooling system to be used in the projects of natural gas combined cycle power plant is conducted by taking the following parameters into consideration;

- The Meteorological Conditions of the Project Area
- The Altitude of the Project Area
- The Supply of Water
- The Conditions of Wind
- Regional Environmental Limitations
- Other activities in the region

The costs and the productivity of the investment and the proximity of the area on which the facility will be established to the water resource are among the other important parameters during the evaluation of the cooling system alternatives to be used in ACWA Kırıkkale Natural Gas Combined Cycle Power plant.

Primarily, Once Through Cooling System was taken into consideration, the costs of investment of which are the lowest and the productivity of which is the highest, since Kızılırmak River, one of the largest water resources, is in close proximity to the project area. In addition to the Once Through Cooling System, Water Cooling System – Mechanical Draft Cooling Tower is evaluated as a cooling alternative of the mentioned project.

Once Through Cooling System was not selected within the scope of the project in the feasibility studies performed because that the amount of the water to be required during the life of the operation is too high and that it is possible for problems to arise with regard to the continuous supply of the water in the future when the variable conditions of the climate are taken into consideration in case that it is established.

In 2000, the U.S. Environmental Protection Agency conducted a comparative study of the environmental impacts of wet vs. dry cooling. Their conclusion was that the energy consumption per lb. condensate was higher for dry cooling than for wet cooling and that the atmospheric emissions associated with that energy consumption was also higher. The energy penalty also increases with the ambient air temperature. These disadvantages are offset by the cooling water intake flow being reduced by 99% over that required by a once-through system; or 4-7% over a closed cooling water system. They also noted that dry cooling eliminates visual plumes, fog, mineral drift and water treatment and waste disposal issues. However, their conclusion was that, 'dry cooling does not represent the "best available technology (BAT)" for minimizing environmental impact'. (Reference: EPA Rule316(b) New Facility Rule, Chapter3: Energy Penalties and Chapter4: Dry Cooling, published.EPA(2000))

Further, the area required by Dry Type cooling system is larger than that area required to install Mehanical draft cooling system, therefore, with a Mechanical draft cooling system the natural habitat of the site is preserved more than with Dry Type.

Dry cooling has the benefit of eliminating visual plumes, fog, mineral drift, and water treatment and disposal issues associated with wet cooling towers. The disadvantages of dry cooling include an increase in noise generation and decrease in efficiency of electricity generation which leed to an increase in air emissions as compared to wet cooling systems.

Since both dry and wet cooling systems will have impacts on the environment, then the constraints become economically based and are centered on reliable, cost effective performance and unit availability. Due to the above reasons and that their costs of investment are higher and that the project area is very close to the water resource, the Dry Type Condenser and the Natural Draft Cooling Tower were not evaluated within the scope of the project.

In the feasibility studies, Once Through Cooling System is not selected due to reason that continuous supply may create problems by taking into account too high water requirement and variable climatic conditions .

It was detected that lower amounts of water are required in the studies performed for the Water Cooling System Tower in comparison with the Once Through Cooling System. In that kind of systems, units such as Water Storage Units are needed to be established which do not exist in other systems. The establishment of those units causes extra costs. Despite those extra costs, the Mechanical Draft Cooling System has a lower cost of investment in comparison with the Dry Type Cooled Condenser and with the Natural Draft Cooling Towers.

The selection of the Water Cooling System is found to be the most feasible system for the project by taking the feasibility studies and the literature surveys conducted into consideration, and the Wet Type Cooling System will be established within the scope of the mentioned power plant. The use of wet cooling system shall not result in significant temperature increase in the river, both during summer and winter months. In order to minimize the temperature effect at discharge point, closed-cycle system wet cooling tower technology and diffuser discharge system will be used. Morever, continious montiroing system for temperature and pH will be established at wastewater discharge point and raw water intake at cassion wells.

VII.3 Combustion alternatives

High temperature and exhaust gas occurred during combustion procedure in gas turbines are released to atmosphere (Simple Cycle) or are directly directed for super-heated steam generation in high temperature, pressure and flow rate to heat recovery steam generator (HRSG). The Power plant envisaged to be constructed has been designed as "Combined Cycle Power Plant".

Low-NOx boilers shall be used for reducing NOx emissions within the scope of the said ACWA Power Kırıkkale NGCCPP. Primary property of low NOx boilers is mixture of air and fuel and both two combustions occur in two consecutive steps. Prior to combustion, low flame degrees and homogeneous distribution degrees resulted with low NOx emissions with mixture of air and fuel are obtained accordingly.

SECTION 8. MONITORING AND MITIGATION PROGRAM

VIII.1 Monitoring program proposed for the construction, operation and post-operating phases and emergency response plans

VIII.1.1 Monitoring program

VIII.1.1.1 Land preparation

Historical, Cultural and Archeological Assets: In case of having come across any cultural and archeological assets within scope of land preparation and excavation works, the excavation works will be immediately suspended and the nearest Directorate of Museum shall be notified accordingly.

Vegetable soil stripping: The contractor firm shall be responsible for the vegetal soil stripped to be stored separately and in accordance to its technic as to be reused in the landscaping Works without having been mixed with the excavation soil to prevent losing its characteristics.

Excavation Works: In order to prevent dusting during operations of stripping and excavation, watering shall be applied by a sprinkler and during the storage of surplus excavation material; its disposal shall be accomplished in accordance with the standards prescribed in the “Excavation, Construction and Demolition Waste Control Regulation”.

VIII.1.1.2 Construction phase

Air Emissions: During field operations, loading and unloading of surplus excavation materials shall be ensured without scattering and for the purpose of reducing and minimizing the formation of dust which might take place in the roads during its carriage, irrigation shall be made in the roads. In addition to this, the periodic maintenance and exhaust emission controls of all vehicles to be used will be gotten performed. The relevant provisions of “Regulation on Controlling Exhaust Gas Emissions Generated by Motorized Vehicles in Road Traffic” will be abided.

Wastewater: During construction process of the facility, the disposal of wastewaters to a surface water resource in an uncontrolled way shall be prevented and the domestic wastewaters will be discharged into Kızılırmak River only after having been purified at a package – wastewater purification plant in accordance with the pertinent provisions of “Water Pollution Control Regulation”.

Furthermore, the parameters of pH value and suspended solid agent (SSA), biological oxygen demand (BOD) and biochemical oxygen demand (BCD) of the domestic waste waters will be periodically measured and analyzed.

Wastewater will be generated due to mixer cleaning process at concrete plant. Concrete plant wastewater will be delivered to sedimentation tank. After settling process, wastewater which is treated of suspended solids will be used for cleaning activities again. Wastewater that will not be used shall be discharged to Kızılırmak River after physical treatment.

Domestic solid wastes: Domestic characteristic wastes to be generated as a result of fulfilling the personnel requirements will be collected in sealed impermeable containers separately from other wastes and arranged to be picked up by the municipality in certain

periods. Those ones from the solid wastes which can be recycled will be separately collected and arranged to be reused and / or delivered to the recycling plants.

Sludges formed in settling tank shall be sent to solid waste disposal facility after drying.

Packaging Wastes: The packaging wastes to arise within the scope of construction activities will be collected being separate from other wastes and delivered to the licensed firms.

Waste Vegetable Oils: The waste vegetal oils which would happen during fulfillment of staff needs will be collected in the impermeable containers and the wastes so collected will be arranged to be given to the licensed companies.

Waste Oils: The waste oils and engine oils which would emanate from all processes to be performed during construction operations and the construction machinery and equipment to be employed in these activities will be analyzed by the authorized laboratories and sent to the recycling and / or disposal facilities in accordance with the outcomes of the analysis.

Tires whose operating lives have expired: Disposal of the tires whose operating lives on the construction machinery and equipments have expired when being used in realizing all construction – related operations within the scope of Project shall be arranged to be sent to the authorized facilities.

Waste Dry Cells and Batteries (Accumulators): It shall be ensured that the waste accumulators which would emanate from the vehicles to be used during construction activities within the scope of Project are taken to the collection spots or transitional storage areas and it shall be arranged that all types of waste dry cells which would happen within the scope of the construction activities will be collected separately and disposed by being sent to the companies holding a license to collect the waste dry cells.

Medical Waste: The medical wastes to arise from the employees who would work in process of construction will be collected in special containers being separate from other wastes and disposed through executing a medical waste disposal agreement with the relevant municipality.

Noise: Starting from land preparation phase, to enable determine the noise level which would happen during the operations to be actualized in the entire constructional activities, the machines and equipments running at the construction site will be regularly inspected and the maintenance of said machines and equipments shall be performed in certain periods. In addition to this, noise measurements will be carried out in periodic intervals at the Project site and the settlement unit closest to the construction site.

VIII.1.1.3 Operation phase

Air Emissions: To enable whether or not the flue gases resulting from the combustion of natural gas at the plant exceed the limit values in the regulation is controlled, there shall be a continuous emission measurement system on the stack. As comprehensively told in **Section V.2.,** the low NO_x - producing burners will be used within the extent of the plant. Moreover, as a national legislation requirement, ambient air quality measurements will be done with diffusion tubes by authorized laboratory and results of the measurements will be submitted to the ministry in the scope of environmental permit.

Wastewater: During operational phase of the plant, personnel – originated formation of domestic nature wastewater and process – originated wastewaters will take place. Discharge of the wastewaters to happen shall be arranged to be effectuated upon having been purified from the wastewater purification plant. In this regard, the pertinent provisions of "Water Pollution Control Regulation" will be followed.

Furthermore, periodical sampling and analysis studies of treated wastewater which is discharged from the power plant will be performed by authorized laboratory according to wastewater category during the operation under the requirements of environmental permit.

Solid Wastes: During operational phase of the plant, domestic – nature solid wastes originating from personnel who would work in operation phase of the plant and purification plant – originated treatment sludge will take place. Said wastes being domestic nature comes will be arranged to be collected in the impermeable containers with lid, being separate from other wastes and be taken and disposed by the municipality at certain intervals.

Packaging Wastes: The packaging wastes which will happen in the operation phase of the plant will emanate from the needs of personnel and operational activities. The packaging wastes which shall develop will be arranged to be collected being separated from other wastes and disposed by being given to the licensed firms.

Waste Oils: Machinery and equipments – originating waste lubricants will be delivered to the recycling and / or disposal facilities.

Noise: In the phase of operation of the power station, the maintenance of the machinery and equipments shall be regularly arranged to be performed in order to maintain the noise intensity which would emanate from the machinery and equipments at the minimum level.

VIII.1.1.4 Post-operation phase (decommissioning)

Since there would not be any source of emissions following the finalization of activity, adverse impact to the air quality would not be in question either. Similarly, after termination of the operation, since there would not be any element of pollutants to the soil, resources of surface and underground water in question, neither would it be mentioned that an adverse impact have happened on these resources upon termination of the activity. Hence, a monitoring program is not envisaged following shutting off the operation of plant.

Above information is summarized at below tables;

Table 91. The Mitigation and Monitoring Program of Construction Phase

The Parameter to be Monitored	The Relevant Activity	The Mitigating Precaution	The Duration of the Monitoring	The Curator
The Historical, Cultural, and Archeological Assets	In case that any cultural and archeological asset is encountered within the scope of the land preparation and excavation works, the closest Museum Directorate or the Directorate of the Commission of the Protection of the Cultural and Natural Assets	The immediate stopping of the excavation works, and their continuation under the scrutiny of the relevant institution and/or with its permission,	During the land preparation and the excavation procedures	- The Contractor Firm, - Museum Directorate, - Protection Commission Directorate
The Scraping of the Vegetative Earth	Taking the vegetative earth over the surface earth by scraping it in accordance with its characteristics	The storage of the vegetative earth taken by scraping, without mixing it with the excavation earth in order for it not to lose its characteristics and to use it in the landscape works,	During the land preparation and the excavation procedures	-The Contractor Firm
Excavation Works	How are the scraping and the excavation procedures performed, the use and/or the storage of the excavation materials in a way not to damage the environment	- In order to prevent the dust clouds during the scraping and the excavation procedures, performing watering by watering truck, - The use of the materials obtained from the excavation procedures in filling procedures, - The storage of the excess excavation materials without damaging the surrounding land in accordance with the standards specified in the Control Regulations of the Excavation Earth, Construction and Wreckage Wastes in the area which Kılıçlar Municipality showed, IFC and EBRD guidelines and international best practices	During the land preparation and the excavation procedures	-The Contractor Firm
Air Emissions	Land Works	- Performing the loading and the unloading works without making any scattering during the land works, - covering loading trucks to prevent dust emissions. - Improving the roads used when necessary, - Watering the roads used with watering trucks in order to reduce and minimize the dust clouds on the roads during the carrying of the materials, - Holding the upper parts of the materials at 10 % humidity in order to prevent the dust clouds on the roads during the carrying of the materials, - Complying with the provisions specified in the Industrial Air Pollution Control Regulation(IAPCR), IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Vehicle Emissions	All work machinery and equipments to be used in all construction activities beginning from the vehicle organization phase	- Performing the regular routine maintenance of all the vehicles to be used, - Performing the regular exhaust emission measurements of all the vehicles to be used, - Complying with the relevant provisions of the Regulations with regard to the Control of the Emissions of the Exhaust Gases Arising from the Motorized Land Vehicles Driven in the Traffic, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
The Security of the Floor	Land preparation and construction works	Taking the projected security and the drainage precautions in order to provide the security of the floor specified in the Geological/Geotechnical Reports on which the development plan is based	During the construction procedures	-The Contractor Firm

The Parameter to be Monitored	The Relevant Activity	The Mitigating Precaution	The Duration of the Monitoring	The Curator
Waste water	The use of water having the household characteristic The use of water in the ready concrete facility	- The prevention of throwing wastes in a not controlled way into the surface water resources, - The use of the washing waste waters going out of the ready concrete facility in the washing procedures again in the concrete facility and/or as additive water after it is precipitated in the sedimentation pool, - The discharge of the household waste waters with their decontamination in the package waste water decontamination facility and with the compliance with the limit values, - Complying with the relevant provisions of the Control Regulations of the Water Pollution and with the minimum limit values, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Solid Wastes	Creation of the household wastes Construction and excavation wastes	- The accumulation of the household wastes which will occur as a result of meeting the requirements of the personnel in covered leak proof cases separated from other wastes, their collection in certain periods by the municipality and their disposals, - Complying with the relevant provisions of the Control Regulations of the Solid Wastes, IFC and EBRD guidelines and international best practices - The separate collection of the recyclable and/or the transformable materials, their reuse and/or their delivery to the licensed recycling facilities, - Conducting the analyses of the precipitated sludge and its disposal in accordance with the results of the analyses	During the construction procedures	-The Contractor Firm
Package Wastes	Personnel requirements and construction procedures	- The separate collection of the Package Wastes which will arise within the scope of the construction activities from other wastes, the disposal of the collected wastes by delivering them to licensed firms, - Preventing them from mixing with other wastes, and preventing their disposal with the household wastes, - Preventing their throws into the environment in a not controlled fashion, - Complying with the relevant provisions of the Control Regulations of the Packages and the Package Wastes, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Vegetative Waste Oils	Meeting the dining requirements of the personnel	- The separate collection of the wastes which will arise while meeting the requirements of the personnel in leak proof cases, and the disposal of the collected wastes by delivering them to licensed firms, - Preventing their throws into the environment in a not controlled fashion, - Complying with the relevant provisions of the Control Regulations of the Vegetative Waste Oils, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Waste Oils	All procedures to be performed in all construction activities beginning from the land organization phase and the work machinery and equipments to be used in those activities	- Conducting the analyses of all waste oils and motor oils by the authorized laboratories which will arise from all kinds of machinery and vehicles to be used within the scope of the construction activities, and their delivery to the licensed firms in order to dispose them in the Recycling and/or Disposal Facilities in accordance with the results of the analyses, - Complying with the relevant provisions of the Control Regulations of the	During the construction procedures	-The Contractor Firm

The Parameter to be Monitored	The Relevant Activity	The Mitigating Precaution	The Duration of the Monitoring	The Curator
		Waste Oils, IFC and EBRD guidelines and international best practices		
The tires which completed their lives	The work machinery and equipments to be used in construction activities beginning from the land organization phase	- Delivering the tires which completed their lives of the vehicles to be used during the construction works to the licensed disposal facilities, - Complying with the relevant provisions of the Control Regulations of the Tires, IFC and EBRD guidelines and international best practices Which Completed Their Lives,	During the construction procedures	-The Contractor Firm
Waste Batteries and Accumulator	All procedures to be performed in all construction activities beginning from the land organization phase and the work machinery and equipments to be used in those activities	- Transporting the waste batteries of the vehicles to be used during the construction works to the collection points or to the temporary storage areas, - The separate collection of all kinds of waste cells within the framework of the provisions of the regulations, - Sending the collected waste cells to the firms which have the License of Collecting the Waste Cells, - Complying with the relevant provisions of the Control Regulations of the Waste Cells and Batteries, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Medicinal Wastes	Personnel Requirements	- The medicinal wastes arising from the personnel who will work in the construction phase will be collected separately from other wastes and in special cases, - The collected medicinal wastes will be disposed of by signing a medicinal waste disposal agreement with the relevant municipality, - Complying with the relevant provisions of the Control Regulations of the Medicinal Wastes, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Noise	All procedures to be performed in all construction activities beginning from the land organization phase and the work machinery and equipments to be used in those activities	- Performing the regular maintenance of the equipments to be used in the construction works, - Complying with the relevant provisions of the Regulations of the Evaluation and the Management of the Environmental Noise, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm
Flora Fauna	All construction activities beginning from the land organization phase	- Laying out the vegetative earth again scraped for the preparation of the land during construction activities and vegetating it in compliance with the natural vegetation, - Preventing the hunting of the personnel during construction works,	During the construction procedures	-The Contractor Firm
Agricultural Areas	Transportation to the area of activity Excavation procedures	- The clouds of dust will be prevented by watering the gravel roads by watering trucks in order to prevent the agricultural lands around the road used during the transportation to the area of the activity be affected negatively. - During excavation works, the damages to the existing agricultural lands in the region will be prevented by taking the precautions preventing the clouds of dust (such as watering by the watering trucks).	During the construction procedures	-The Contractor Firm
Forest Areas	All construction activities beginning from the land organization phase	- Before the activity, the necessary permissions from Kırıkkale Forest Operation Chairmanship will be obtained, - No excess excavation materials will be poured into the forest areas.	During the construction procedures	-The Contractor Firm
Meeting the Personnel Requirements	Housing, Infrastructure requirements	- The staff who will be employed in the project shall be first selected from the persons who reside in the settlements in the project area and its surroundings. In that case, if the staff coming from close settlements require to reside in their own houses and/or if it is suitable in terms of operational activities, service	During the construction procedures	-The Contractor Firm

The Parameter to be Monitored	The Relevant Activity	The Mitigating Precaution	The Duration of the Monitoring	The Curator
		vehicles may be used for transportation, - The establishment of the temporary construction camp for the personnel who will come from outside, - Meeting all kinds of infrastructure requirements of the employed personnel by the social facilities to be constructed in the construction areas,		
Work Health and Security	All construction activities beginning from the land organization phase	- Working in accordance with the provisions of the Regulations of the Health and the Security in the Construction Works within the scope of the construction works	During the construction procedures	-The Contractor Firm
Transportation	All construction activities beginning from the land organization phase	- Complying with the tonnage limitations during the transportation of the materials, - Complying with the relevant provisions of the Land Ways Traffic Act, IFC and EBRD guidelines and international best practices	During the construction procedures	-The Contractor Firm

Table 92. The Mitigation and Monitoring Program of Operational Phase

The Parameter to be Monitored	The Relevant Activity	The Mitigating Precaution	The Duration of the Monitoring	The Curator
Air Emissions	The smokestack gases arising from the burning of the natural gas for the production of the electricity energy	- Performing continuous measurements during the operation of the power plant, - Ambient air quality measurements in every 2 years by authorized laboratory - Holding the emission values below the limit values in the regulations, - Using dry burners producing low NOx, - Complying with the relevant provisions of the Regulations of Large Combustion Facilities and Regulation of Industrial Source Air Pollution Control, IFC and EBRD guidelines and international best practices	During operation	- ACWA Power - Provincial Directorates of Environment and Urbanization
Waste water	Household waste waters Process waste waters	- Discharging the waste waters after decontaminating them in the Waste Water Decontamination Facility arising during the operation of the power plant, - Discharging the household waste waters after decontaminating them in the Package Waste Water Decontamination Facility - Wastewater will be sampled and analysed by authorized laboratory according to wastewater category and the report of the analysis will be submitted to the Ministry. - Complying with the relevant provisions of the Regulations of Water Pollution Control, IFC and EBRD guidelines and international best practices	During operation	- ACWA Power - Provincial Environment and Urbanization Directorates
Solid Wastes / Dangerous Wastes	Household solid wastes Solid wastes arising from repairs and maintenances of the operations Sludge of the decontamination facility	- The accumulation of the household wastes which will occur as a result of meeting the requirements of the personnel in covered leak proof cases separated from other wastes, their collection in certain periods by the municipality and their disposals, - Complying with the relevant provisions of the Control Regulations of the Solid Wastes, IFC and EBRD guidelines and international best practices - The separate collection of the recyclable and/or the transformable materials, their reuse and/or their delivery to the licensed recycling facilities, - Conducting the analyses of the precipitated sludge and its disposal in accordance with the results of the analyses,	During operation	- ACWA Power
		- Ensuring that Packing Wastes that shall come into existence within scope of Operating		

Packing Wastes	Personnel requirements and operating activities	Activities are collected separately from other wastes, ensuring collected wastes are disposed of by giving them to licensed firms. - Preventing them to be mixed up with other wastes, preventing them from being disposed of with domestic wastes, - Preventing them from being thrown away to environment uncontrollably, - Abiding by the relevant provisions of Directive on Control of Packing and Packing Wastes, IFC and EBRD guidelines and international best practices	During operation	- ACWA Power
Waste Oils	Engineering vehicles and equipments at operation stage.	- To deliver waste oils and motor oils that shall come into existence due to all kinds of machines and equipments to be used within scope of operating activities to licensed firms in order to ensure that they are analyzed by Authorized laboratories and disposed of in Recycling and/or Disposal facilities in accordance with results of analysis, - Abiding by the relevant provisions of Directive on Waste Oil Control, IFC and EBRD guidelines and international best practices	During operation	- ACWA Power - Provincial Directorates of Environment and Urbanization
Waste Batteries and Accumulators	Engineering vehicles and equipments at operation stage.	- To provide that waste accumulators to come into existence due to vehicles to be used during operating stage are taken away to collecting points or to temporary storage areas, - To provide that all kinds of waste batteries to come into existence within scope of operating activities are collected separately within frame of provisions of directives, - To ensure that collected waste batteries are delivered to firms having Waste Battery Collection License. - To abide by relevant provisions of Directive on control of Waste Battery and Accumulators	During operation	- ACWA Power - Provincial Directorates of Environment and Urbanization
Noise	Engineering vehicles and equipments at operation stage.	- Getting equipments to be used during operation maintained regularly, - Abiding by the relevant provisions of Directive on Evaluation and Management of Environmental Noise and ensuring limit values, IFC and EBRD guidelines and international best practices	During operation	- ACWA Power - Provincial Directorates of Environment and Urbanization

Table 93. The Mitigation and Monitoring Program of the Decommissioning Phase

The Parameter to be Monitored	The Relevant Activity	The Mitigating Precaution	The Duration of the Monitoring	The Curator
Air Emissions	Land Works	- Performing the loading and the unloading works without making any scattering during the land works, - covering loading trucks to prevent dust emissions. - Improving the roads used when necessary, - Watering the roads used with watering trucks in order to reduce and minimize the dust clouds on the roads during the carrying of the materials, - Holding the upper parts of the materials at 10 % humidity in order to prevent the dust clouds on the roads during the carrying of the materials, - Complying with the provisions specified in the Industrial Air Pollution Control Regulation(IAPCR), IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
Vehicle Emissions	All work machinery and equipments to be used in all decommissioning activities beginning from the vehicle organization phase	- Performing the regular routine maintenance of all the vehicles to be used, - Performing the regular exhaust emission measurements of all the vehicles to be used, - Complying with the relevant provisions of the Regulations with regard to the Control of the Emissions of the Exhaust Gases Arising from the Motorized Land Vehicles Driven in the Traffic, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
Waste water	The use of water having the	- The prevention of throwing wastes in a not controlled way into the surface water	During the	-The Contractor

	household characteristic The use of water in the ready concrete facility	resources, - The use of the washing waste waters going out of the ready concrete facility in the washing procedures again in the concrete facility and/or as additive water after it is precipitated in the sedimentation pool, - The discharge of the household waste waters with their decontamination in the package waste water decontamination facility and with the compliance with the limit values, - Complying with the relevant provisions of the Control Regulations of the Water Pollution and with the minimum limit values, IFC and EBRD guidelines and international best practices	decommissioning procedures	Firm
Solid Wastes	Creation of the household wastes	- The accumulation of the household wastes which will occur as a result of meeting the requirements of the personnel in covered leak proof cases separated from other wastes, their collection in certain periods by the municipality and their disposals, - Complying with the relevant provisions of the Control Regulations of the Solid Wastes, IFC and EBRD guidelines and international best practices - The separate collection of the recyclable and/or the transformable materials, their reuse and/or their delivery to the licensed recycling facilities, - Conducting the analyses of the precipitated sludge and its disposal in accordance with the results of the analyses	During the decommissioning procedures	-The Contractor Firm
Package Wastes	Personnel needs and decommissioning procedures	- The separate collection of the Package Wastes which will arise within the scope of the decommissioning activities from other wastes, the disposal of the collected wastes by delivering them to licensed firms, - Preventing them from mixing with other wastes, and preventing their disposal with the household wastes, - Preventing their throws into the environment in a not controlled fashion, - Complying with the relevant provisions of the Control Regulations of the Packages and the Package Wastes, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
Vegetative Waste Oils	Meeting the dining requirements of the personnel	- The separate collection of the wastes which will arise while meeting the requirements of the personnel in leak proof cases, and the disposal of the collected wastes by delivering them to licensed firms, - Preventing their throws into the environment in a not controlled fashion, - Complying with the relevant provisions of the Control Regulations of the Vegetative Waste Oils, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
Waste Oils	All procedures to be performed in all decommissioning activities The work machinery and equipments to be used in those activities	- Conducting the analyses of all waste oils and motor oils by the authorized laboratories which will arise from all kinds of machinery and vehicles to be used within the scope of the decommissioning activities, and their delivery to the licensed firms in order to dispose them in the Recycling and/or Disposal Facilities in accordance with the results of the analyses, - Complying with the relevant provisions of the Control Regulations of the Waste Oils, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
The tires which completed their lives	The work machinery and equipments to be used in decommissioning activities beginning from the land organization phase	- Delivering the tires which completed their lives of the vehicles to be used during the decommissioning works to the licensed disposal facilities, - Complying with the relevant provisions of the Control Regulations of the Tires Which Completed Their Lives, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
Waste Batteries and Accumulator	All procedures to be performed in all decommissioning activities The work machinery and equipments to be used in those activities	- Transporting the waste batteries of the vehicles to be used during the decommissioning works to the collection points or to the temporary storage areas, - The separate collection of all kinds of waste cells within the framework of the provisions of the regulations, - Sending the collected waste cells to the firms which have the License of Collecting the	During the decommissioning procedures	-The Contractor Firm

		Waste Cells, - Complying with the relevant provisions of the Control Regulations of the Waste Cells and Batteries, IFC and EBRD guidelines and international best practices		
Medicinal Wastes	Personnel Requirements	- The medicinal wastes arising from the personnel who will work in the decommissioning phase will be collected separately from other wastes and in special cases, - The collected medicinal wastes will be disposed of by signing a medicinal waste disposal agreement with the relevant municipality, - Complying with the relevant provisions of the Control Regulations of the Medicinal Wastes,	During the decommissioning procedures	-The Contractor Firm
Noise	All procedures to be performed in all decommissioning	- Performing the regular maintenance of the equipments to be used in the decommissioning works, - Complying with the relevant provisions of the Regulations of the Evaluation and the Management of the Environmental Noise, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm
Meeting the Personnel Needs	Housing, Infrastructure requirements	- The staff who will be employed in the project shall be first selected from the persons who reside in the settlements in the project area and its surroundings. In that case, if the staff coming from close settlements require to reside in their own houses and/or if it is suitable in terms of operational activities, service vehicles may be used for transportation, - The establishment of the temporary decommissioning camp for the personnel who will come from outside, - Meeting all kinds of infrastructure requirements of the employed personnel by the social facilities to be constructed in the decommissioning areas,	During the decommissioning procedures	-The Contractor Firm
Work Health and Security	All decommissioning activities	- Working in accordance with the provisions of the Regulations of the Health and the Security in the decommissioning Works within the scope of the decommissioning works	During the decommissioning procedures	-The Contractor Firm
Transportation	All decommissioning activities	- Complying with the tonnage limitations during the transportation of the materials, - Complying with the relevant provisions of the Land Ways Traffic Act, IFC and EBRD guidelines and international best practices	During the decommissioning procedures	-The Contractor Firm

VIII.1.2 Emergency response plan

Emergency response plan (ERP) is drawn up through monitoring the phases of – starting from the date of designing or establishment phase for all workplaces – identifying the emergency cases, taking the preventive and restrictive measures against adverse impacts thereof, designating the persons to be appointed, developing the emergency response and evacuation procedures, documentation, renewal of drill and emergency case plan **(See Figure – 83)**.

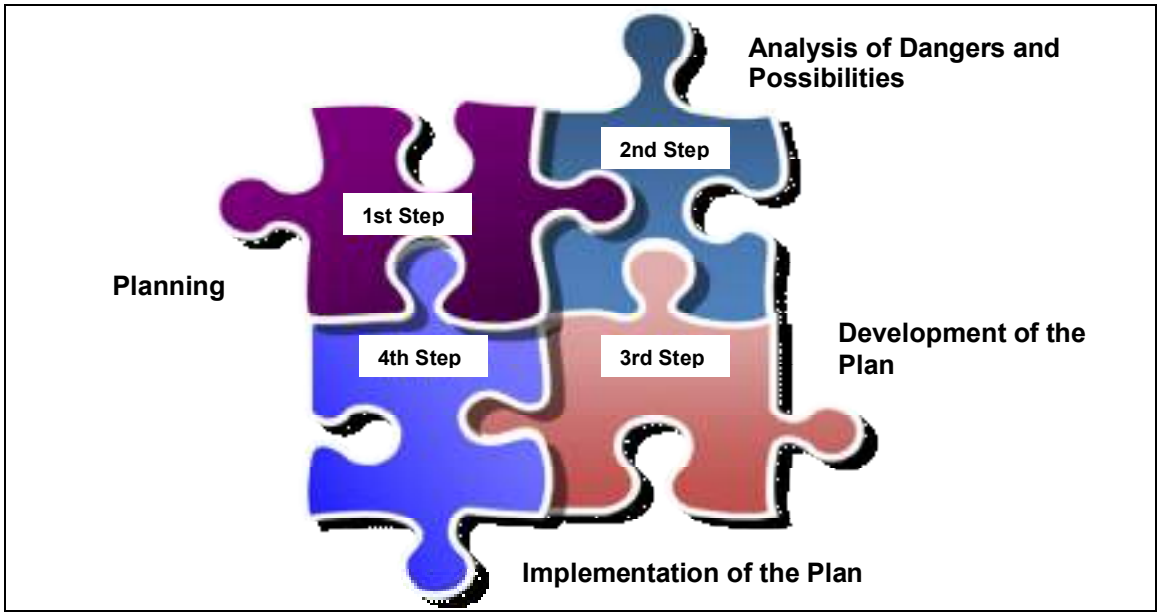

Figure 83. The Application to Be Considered in Planning Emergency Case

Emergency events are identified in consideration of the following points:

- Risk assessment results
- Possibility of fire and hazardous chemical substances – induced spread and explosion
- Events requiring first aid and evacuation
- Probability of the occurrence of natural disasters
- Possibility of sabotage

Preventive and restrictive measures

- The employer takes necessary measures in order to prevent and limit the effects of larger damages which might be created by the possible and potential emergency cases it has determined.
- While the measures were being taken in order to be protected against adverse impacts of the emergency events, when deemed necessary, measuring and assessments are accomplished.
- The measures to be taken will conform to the principles of protection from the risks and be based on collective protection.

Emergency response and evacuation methods

- The methods of emergency response such as alerting, search, rescue, evacuation, communication, first aid and fire-fighting emergency response

procedures to be implemented in occurrence of emergency events are set down and made in writing by the employer.

- Following the evacuation, including also the counting, necessary checks are carried out for determination of the employees who might have remained at the business place.
- In occurrence of emergency events at the workplace, the employer precisely points out in the emergency evacuation chart of the appropriate evacuation arrangements to enable the employees to go from the place where they are to a safer location in order to be protected from the adverse influences of such situation and gives the necessary instructions to the employees in advance.
- It there is the aged, disabled, pregnant or nursery at the business place, measures are taken for accompanying the children at the moment of evacuation.
- When the emergency response and evacuation methods are being set down, the provisions of Regulation on Protecting Buildings against Fire taken effect by the Decision of Council of Ministers dated 11.27.2007 and numbered 2007/12937 is taken into consideration.
- When the emergency response and evacuation methods are being set down, other than the employees, other persons like customers and visitors who might be present at the workplace should also be taken into consideration.

Renewal of emergency case plan

- In occurrence of changes which might lead to have effect on the set down emergency cases or emerging of new emergency events at the business place, according to the size of the impact, the emergency case plan is completely or partly renewed.
- Emergency case plans; are renewed respectively at latest once a year, four years and six years for the hazard classes, very dangerous, hazardous and less dangerous work places.

Adaptive Management Program (AMP) to be prepared within the scope of Project shall be drawn up in consideration of the risk factors described in "Work Health and Safety Law" taken effect upon having been published in the Official Gazette dated 06.30.2012 and numbered 28339. The core points and the measures required to be considered and determined in this plan to be prepared will be specified and necessary trainings on these matters will be given to the employees and their obedience to the emergency response plans through acting in line with such plan shall be ensured. As prescribed in "Work Health and Safety Law" taken effect upon having been published in the Official Gazette, the Employer;

Shall consider the points specified in **Table – 91** of said law to struggle with the emergency cases within the extent of the facility planned.

Table 94. Emergency Case Plan

FIRST AID – IMMEDIATE MEDICAL ATTENTION	Person who saw one in need of First aid / Immediate medical attention	Does not panic, reports the situation to the employer / employees.
	Employer / Agent of Employer	Calls up, other than business place, a health facility to perform first aid and immediate medical attention.
	Attendant / Trained employee	Picks up the first-aid kit and emergency medical equipment and goes to the scene. Intervenes in direction of its training. Accomplishes necessary preparation for transport of the person in need of first aid / immediate medical attention to the nearest health facility.
	Other employees at the workplace	Get ready to help the person performing the first aid / immediate medical attention. By giving and describing, the address of scene etc. to the teams of first aid / immediate medical attention to come from the health facilities, they facilitate the access. Remove the obstacles at the doors and exit routes which would ensure transport of the evacuation of the person in need of first aid / immediate medical attention. If the situation continues, the employees other than those ones who have required equipment and specifically appointed do not keep on doing their tasks.
FIRE	Person who saw the fire first	Does not panic. It loudly reports the fire to the Employer and the employees. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Employer / Agent of Employer	Gets the emergency siren activated. Notifies it to the security guard. It provides liaison with the establishments regarding the fire fighting other than the business place. If so required, it calls up the fire department, police, first aid, and emergency medical rescue teams. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Attendant / Trained employee	Without endangering itself, picking up the closest firefighting cylinder and intervenes the fire. It cuts off the electricity / natural gas supply of the workplace. It turns off the machinery, equipment, apparatus and devices at the workplace. It ensures (if any) safety of the chemicals and goes to fire zone and checks whether or not the fire department is required. If necessary, it calls up the fire department and maintains being in touch with the Employer. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Security guard	Once having heard of the fire, keeps the emergency exit routes open in line with the instructions.

	Other employees at the workplace	Do not use the lift as the emergency exit.
	Emergency Response Team	The emergency response team acts when needed, in line with their job descriptions.
OOZING – GAS LEAKAGE	Person who saw the oozing first	Does not panic. Loudly inform the gas leakage, oozing to the Employer and employees.
	Employer / Agent of Employer	Cuts off the natural gas using main valve or turns off the valve of the line where there is a gas oozing event. Gets the security guard informed. Using a telephone outside the building, it calls up specialist company. With a telephone outside the building, and notifies the case to IGDAS/IGDCO.
	Attendant / Trained employee	Examines the oozing zone. It turns off electricity / natural gas supply and shuts down power machinery, equipment, device and any apparatus which would produce spark nearby the oozing. Intervenes in line with its training and according to the instructions.
	Other employees at the workplace	Nobody uses electricity switches, electrical devices and equipments, lifts, doorbells and telephones. No smoking. Going out from the emergency exit pertaining to the zone, go to the emergency meeting area. If the situation continues, the employees other than those ones who have required equipment and specifically appointed do not keep on doing their tasks.
	Emergency Response Team	When needed, the emergency response teams act in line with their job description.
EARTHQUAKE	Employer / Agent of Employer	Gets the emergency siren activated. Going out from the emergency exit pertaining to the zone where it is, it goes to the emergency meeting area and takes refuge in a predetermined triangle of life. Upon termination of the earthquake, if necessary and possible, notifies the case to the fire department, police, first aid and immediate medical attention teams, AKUT (ERET), Civil Defense. Carries out Post – Earthquake fire, leakage etc. controls.
	Attendant / Trained employee	Cuts off electric, natural gas and water of the business place. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area. Carries out Post – Earthquake stability and leakage control at the electrical, Water and natural gas lines.
	Other employees at the workplace	Going out from the emergency exit pertaining to the zone where they are, go to the emergency meeting area. Takes refuge in a predetermined triangle of life.
	Employer / Employees	Even if the earthquake has finished, they do not use the lift or the stairs until termination of the earthquake. And they do not go out to the balcony and gaps in the apartment.

	Emergency Response Team	When needed, the emergency response teams act in line with their job description.
EXPLOSION	Employer / Agent of Employer	Gets the emergency siren activated. Warns the security guard. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Attendant / Trained employee	Cuts off electric, natural gas and water of the business place. **It t**urns off power of machinery and equipments, devices and apparatus and ensures safety of chemicals. Taking the necessary measures goes to the explosion zone. If necessary, it notifies the case to the fire department, police, first aid and immediate medical attention teams. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Other employees at the workplace	Shut down the machinery and equipments, devices and apparatus from the location where they are. The employees other than those ones who have required equipment and specifically appointed do not keep on doing their tasks. Going out from the emergency exit pertaining to the zone where it is, go to the emergency meeting area.
	Security guard	Taking the necessary measures, ensures that the doors and emergency exit routes of the apartment building is maintained open in line with the instructions. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Emergency Response Team	When needed, the emergency response teams act in line with their job description.
SABOTAGE	Person who noticed the sabotage first	Does not panic. It notifies the case to the Employer, employees and patients. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Employer / Agent of Employer	Gets the emergency siren activated. It notifies the case to the fire department, police, first aid and immediate medical attention teams and warns the security guard. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Attendant / Trained employee	Gets the emergency siren activated and cuts off electric, natural gas and water of the business place. Shuts down the machinery and equipments, devices and apparatus and ensures safety of the chemicals. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.

	Other employees at the workplace	Do not approach and intervene to person or persons. They move to safer area. They do not become audience. The employees other than those ones who have required equipment and specifically appointed do not keep on doing their tasks.
	Security guard	Once having heard of the sabotage, maintain the doors and emergency exit routes of the apartment building open in line with the instructions.
	Emergency Response Team	When needed, the emergency response teams act in line with their job description.
FLOOD	Employer / Agent of Employer	Gets the emergency siren activated. Notifies the case to the municipality, fire department, first aid and immediate medic al attention teams. When deemed necessary, it calls up police. Going out from the emergency exit pertaining to the zone where it is, it goes to the emergency meeting area.
	Attendant / Trained employee	Gets the emergency siren activated. It cuts off natural gas and electricity of the work place. It shuts down machinery and equipments, apparatus and devices. Going out from the emergency exit pertaining to the zone where it is, goes to the emergency meeting area.
	Other employees at the workplace	Turn off power to the machinery and equipments, apparatus and devices. Ensure safety of the chemicals. Going out from the emergency exit pertaining to the zone where it is, go to the emergency meeting area. The employees other than those ones who have required equipment and specifically appointed do not keep on doing their tasks.
	Emergency Response Team	When needed, the emergency response teams act in line with their job description.

Earthquake: At the moment of a probable earthquake;

- The items that are likely to turn over and fall at the working areas and indoor spaces will be fixed.
- The combustible materials and the chemicals stored in tightly closed container which would not turn over.
- A list of the machinery required to be shut down first and valves required to be turned to their closed position at the moment of an earthquake shall be drawn up.

Fire: In occurrence of a fire;

- Automatic fire alarm and extinguishing system shall be installed inside the facility and the personnel shall be trained on its periodic maintenance and usage.
- Control of the fire extinguishers shall be performed once a month and they will be maintained filled and clean their locations will be shown on the plan and never be changed.
- No work shall be carried out using a source of heat next to the flammable substances which might cause fire and cigarette smoking shall never happen at any place.
- Training shall be conferred to the staff regarding the locations and use of the fire extinguishers and their application shall be performed practice during exercise.
- Care shall be paid to the overheating which might happen with any machine due to operating continuously or requiring friction to run.
- Common fire safety measures will be taken for the works which can scatter sparks like welding / cutting processes and in presence of combustible materials in the vicinity, this process shall not be carried out within that area.
- Outer surfaces of the machinery will be grease – free and kept clean.
- Defective outlets and repaired cables will not be maintained at the working site, offices and rooms.
- Combustible materials will not be let stay on or nearby electrical stoves, radiators and other heaters at the offices, barracks and wards.
- At the end of working hours, the hot plates, ventilators and other electrical devices will be turned off and their power cables will be disconnected.
- Pursuant to service carried out, other than laboratories, restaurants, laundry services, buffets and workshops, electric stove, hot plate and the press, gasoline, alcohol, gas and liquid gas stoves will not be used at the rooms.
- In principle, automatic fuses will be employed with the internal electrical installation of the buildings.
- When performing indoor heat treatment, due care shall be paid.
- All sorts of warning signs and instructions will be obeyed.
- Making a fire in and around the working site shall not strictly happen.
- To prevent fire to break out, attention shall be paid to the cleanness of the workplace.
- Combustible liquids will be stored in special containers.
- Due attention shall be paid for the closed containers containing oxygen not to get lubricated. If the oxygen found in a closed container gets in contact with the oil, an explosion shall take place.
- The fire-fighting exercise shall be conducted once a year and training shall be offered to the employees on which extinguisher would be used with what type of fire.
- Fire hoses will not be used for the works outside the fire.

Flood: In occurrence of a probable flood;

- The drainage and sewerage systems at the working site will be periodically controlled.
- The chemicals whose contact with water is dangerous will be stored in closed containers and at the elevated places.
- The high-flood sensitive spots will be identified and the working area and the facilities will be built at higher level than the overflow level.

- When deemed necessary for the flood disaster, a separate Emergency Meeting zone shall be selected. This zone shall be chosen from the highest point of the working space and the facility.
- During periods of heavy rainfall, flood warnings will be followed and "Sudden Flood Surveillance" shall be carried out from a predetermined high spot.

Lightning fall: Regarding the development of a lightning, in addition to the meteorological conditions, state of the ground surface is very crucial as well. The ionizing materials such as the high buildings, trees, and metallic objects prepare the appropriate conditions for the formation of lightning. Direct damage exposed by the control and command center of the power station as a result of lightning strikes would lead to the basic electrical unit at the plant. In this instance, the operator of the operation shall get in touch with the electrician and with the required units for commencement of repair works as soon as possible. To be able to reduce the loss of life and property down to minimum, following points are to be taken into account:

- Lightning arrestor shall be employed on high buildings and structures (like minaret),
- The crouching down shall be preferred in the open land, laying down the ground shall not expressly be done,
- If you are in the water, immediate debarkation shall be tried,
- Objects with sharp metallic points like an umbrella will not be used,
- Care for not standing in groups in the open land shall be shown.

Landslide: Making embankments at the landslide – hazardous locations, the slopes will be afforested.

Natural gas leak: In the scope of the plant, in being confronted by such a case;

- Entries into the zones where the natural gas pipes and pressure control stations exist shall be prohibited excluding the authorized personnel. If deemed necessary, these zones will be isolated with the materials like wire fence.
- Within the facility, cigarette shall not expressly smoked and make fire.
- For detection of gas leakage, detectors will be placed at the locations deemed necessary and their periodic maintenances will be performed.
- The valves to be intervened in an emergency situation and by whom they would be closed will be predetermined.

Chemical spillage / oozing into the soil: The procedures to be applied whenever the chemicals such as oil, fuel oil and paint have spilled on the construction areas and transportation paths are listed below.

- Location of the source of oozing,
- In order to prevent spread of oozing, surrounding of the source of oozing shall be encircled with the sand bags,
- With the large oozing, considering the ground gradient as well, it shall be arranged that the substance spread out in consequence of oozing is prevented to mix with underground water by digging a small canal toward downstream of the oozing and filling it with high – absorbent materials to collect it,
- Pollutant agent, used absorbent agent and soil will be put into appropriate bags in suitable size and durability and labeled accordingly,

- Large leak and / or spill situation shall be immediately reported to the construction site supervisor.

In case where fuel, oil and other chemicals have infiltrated into surface water sources, to avoid spread of the chemicals into the water surface, the pontoons suitable for the size of oozing and flow rate of the running water will be used. Inner sections of these pontoons will be filled with the fibrous material bearing absorbent feature.

In case where the chemicals have spilled into soil or surface water sources, following equipments will be used;

- Pollutants spilled on roads and soil can be effectively absorbed by dry sand.
- Using sawdust, the spread of substances spilled earth and roads can be avoided.
- Pontoons used in cleaning oozed agents,
- Absorbent cushions,
- Plastic gloves, special clothing and personal protective equipment,
- Vacuum pump,
- Chemicals – resistive drums,
- Hard plastic bags,

Storm and Hurricane: Storms are the natural event happening as a result of strong winds. Severe winds blowing together with precipitation is called flood and the ones blowing dry precipitation – free are called typhoon. During presence of these strong winds, the spiral whirling's so called hurricane and high waves and overflows take place in the lakes and seas. To be protect ted from the storm and hurricane; there shall be an emergency warning system at the workplace. Making roofs composed of parts solidly assembled in blocks and using thick glasses, not to use much outer surface accessories and afforesting the environment are among the measures to be taken against the storm and hurricane.

VIII.2 In case where a positive EIA certificate was issued, program related to realization of requirements contained under title of "Liabilities of Institutions / Organizations Which Have Acquired Qualification Certificate" in the Circular of Qualification.

Following expressions are comprised in Clause – 18 of EIA Regulation;

"(1) Being related to the projects for which "Positive Environmental Impact Assessment" decision or "Environmental Impact Assessment is not required" decision was taken, the Ministry monitors and controls the Environmental Impact Assessment Report or whether or not the points foreseen in the project introduction file prepared according to Annex – IV of this Regulation and committed by the owner of the project are fulfilled.

(2) When performing this mission, the Ministry, when deemed necessary, cooperates with relevant institutions and organizations.

(3) Upon having taken "Positive Environmental Impact Assessment" decision or "Environmental Impact Assessment is not required" decision, Owner of Project or its authorized agent is obliged to convey the monitoring reports related to the startup, construction, operation and post-operation periods of the investment to the Ministry or the Governorship."

Furthermore, following statement is contained in Clause – 9 of "Circular of Qualification Certificate" taken effect upon having been published in the Official Gazette dated 12.18.2009 and numbered 27436;

"*Project owner related to the projects for which Positive EIA Decision was given is obliged to have any one of the institutions / organizations empowered within scope of this Circular controlled whether or not the stated commitments for the startup and construction periods of the investment were fulfilled and in situ – monitoring control conducted until transition of the investment into operation. Pertinent EIA Department Presidencies communicate the institution / organization authorized by the Project owner to Department Presidency using Annex – 4 form of this Circular. By filling out Construction Period Monitoring – Control Form of the Investment Pertaining to the Commitments given in EIA Reports contained in Annex – 4 of this Circular, the institution / organization authorized by the Project owner is obliged to convey it to the Ministry within twenty labor days starting from the end of monitoring – control periods specified in the Final EIA Report".*

In this respect, in issuance of a "Positive EIA Certificate" for the project in question, the institution / organization authorized by the Project owner shall fill out the "Monitoring – Control Form" contained in Annex – 4 of the Circular upon having visited construction site to check whether or not commitments given for the startup and construction periods of the investment specified in EIA Report were fulfilled and making in situ control.

The institution / organization empowered by the Project owner shall convey the Annex – 4 Monitoring Form to said institution and Kırıkkale Province, Environment and Urban Development Directorate by filling it out at the periods specified by T.R: Ministry of Environment and Urban Development in the Final EIA Report.

SECTION 9. PUBLIC PARTICIPATION

(How and with which methods locals who shall probably be affected by the project are informed, community's opinion about the project, comments on subject, reflection of problems and explanations of EIA Report)

As per article 9 of EIA regulation, Public Participation Meeting was held in Kırıkkale-Yahşihan-Kılıçlar town "City Tavern" on 23.05.2013 at 14.00 to enable public participation, inform public about the investment and to hear their opinion and views (**See Figure 84, Figure 85, Figure 86** and **Figure 87**).

Figure 84. Images from Public Participation Meeting-1

Figure 85. Images from Public Participation Meeting-2

Figure 86. Images from Public Participation Meeting-3

Figure 87. Images from Public Participation Meeting-4

Information of Public Participation Meeting was announces in local (Pusula Newspaper) and national (Taraf Newspaper) newspapers on the date of 11.05.2011 before the meeting.

Public participation meeting realized within the scope of the Project was held before Kırıkkale Provincial Direction of Environment and Urban Planning.

The issues brought by local people in the meeting are presented below

- Emphasizing that principle means of livelihood of local people were animal husbandry and agriculture, how the means of livelihood will be affected by the facility
- They wanted to have detailed information on employment opportunities offered by the Project
- They wanted to learn how the personnel to be employed in the Project will be selected,
- They wanted to learn whether caisson wells where cooling water will be supplied will be sufficient,

ESIA firm answered the questions, trying to eliminate public concern, these issued were kept in meeting minutes by the Provincial Directorate of Environment and Urban Planning.

The settlement that is closest to the project site is Kılıçlar Town. People living in these settlements will probably be affected from the project during construction and operation. Date, time and place of Public Participation Meeting are announced by methods such as newspaper, municipality announcement system and manual delivery of notice publications.

SECTION 10. NON-TECHNICAL SUMMARY OF INFORMATION GIVEN UNDER HEADINGS ABOVE

(Explanation, as simple as possible, in a way not to include technical terms and with simplicity that people will understand, of all works planned to be performed at construction and operating phases of the project and all measures set forth to be taken for environmental impacts, inclusion of questions asked, opinions declared, suggestions made to the ministry, from all stakeholders in Public Participation Meeting and EIA process, emphasizing how these opinions are met)

ACWA Power Electricity Operation and Management Industry and Trade Co. plans to establish a natural gas combined cycle plant in Kılıçlar town of Yahşihan district of Kırıkkale province. This investment is envisaged to produce 7,557 GWh electric on annual basis. Installed capacity of the planned Project is 927.4 MW_e- 960 MW_m-1,663 MW_t.

The project will consume 1,250,000,000 m³ natural gas annually. Natural gas to be used in the facility is planned to be supplied from BOTAŞ Natural Gas Transmission Line.

Wet type cooling system was preferred in the Project. Therefore, raw cooling water that is necessary in the plant will be supplied from caisson wells to be opened near Kızılırmak River.

Construction period of the Project is planned as 30 months; operation lifetime is planned as 49 years.

A total of 1000 people are planned to be employed in operation phase, and 60 people are planned to be employed in operation phase.

Total area of the central site on which Project units will be constructed is 185,480 m^2. Detailed information of land use status of central site is presented in Chapter 2.

522,285 m^3 of excavation waste is estimated to be produced in construction phase of the plant. Excavated soil will be used as filling material in the plant and to construct roads in the plant.

Planned Natural Gas Combined Cycle Plant will consist of the following units:

- 2 Dry Low NO_x Boiler Gas Turbine,
- 2 horizontal flow type three pressure level Heat Recovery Steam Generator
- 1 Condensing, three pressure level Steam Turbine (ST) with horizontal exit,
- 3 water or air cooled generator units
- 1, wet type cooling tower
- 3 Auxiliary Transformers, 15/380 kV main step-up transformer,
- Isolated Phase Connector, 380 kV Switchyard,
- Water Treatment Plant, Wastewater Treatment Plant, Boiler feeding water pumps,
- Electric systems, Mechanical systems, Gas supply and heating system

Drinking and utilization water the personnel will need during Project activities will be supplied from caisson wells.

Wastewaters produced by the system within the scope of the Project will be sent to industrial wastewater plant that will be established for treatment. Water treated here will be discharged to Kızılırmak River after being treated according to discharge limits as per Water Pollution Control Regulations. Sludge produced in treatment plant will be stored in

container and will be sent to licensed plants that can discharge these types of wastes by trucks.

Metal sheet, metal parts, package and boxes, timber, container, steel, iron, cement bag, waste wood and scrap metal generated during construction phase of the Project will be collected in a storage area within the site that allows for temporary storage of these types of wastes. Renewable construction wastes will be recycled, others will be sent to a licensed dumping area by trucks.

Domestic solid wastes that will be produced in construction phase will be submitted to municipality for discharging as per “Directive on Solid Waste Control” published in Official Gazette dated 26.03.2010 numbered 27533.

Waste battery and accumulators generated from devices and equipment used in the site will be collected in a separate area; after recycling recyclable wastes, the rest will be discharged as per the relevant regulation.

An infirmary will be established in the Project site during construction activities. Medical waste generated in infirmary will be collected and discharged as per the provisions of “Directive on Control of Medical Waste” published in Official Gazette dated 22.07.2005 and numbered 25883. The plant will be included in the system established in the general of the city on discharge of medical wastes.

Necessary precautions will be taken against fuel and lubricant discharge from heavy equipment during construction activities. Maintenance of heavy construction equipment will be performed in nearest stations.

The tires of heavy equipment and trucks that will be used in construction phase of the Project will be discharged as per the provisions of “Directive on Control of Worn out” published in Official Gazette dated 30.12.2009 and numbered 27448.

To minimize dust formation during land preparation and construction, the vehicle that carries excavation materials will be covered; the roads in the site will be periodically washed when necessary.

All issues specified to prevent environmental effects within the scope of the Project will be conducted in line with “Law on Amendment of Environmental Law” no 5491 published in Official Gazette dated 13.05.2006 and numbered 26167 and relevant regulations.

In addition to abovementioned, the subjects analyzed in this ESIA Report are summarized below:

ESIA Report prepared for the Project firstly presents information on technical properties and design parameters of the Project, the aim and lifetime of the investment. Timetable envisaged by the investing firm and work items for the Project was explained.

In next sections of the report, properties of the site where the plant is planned to be constructed, transport routes to be used to reach the site, satellite images and maps of the site were presented. As a result of conducted studies, the plant site does not include the following:

- Surface and/or groundwater source,
- Protected areas (Natural Parks, Nature Parks, Wetlands, Natural Monuments, Nature Conservation Areas, Natural Protected Areas, Wildlife Protection Areas, Biogenetic Reserve Areas, Biosphere Reserves, Natural Protected Areas and Monuments, Archeological, Historical, Cultural Protected Areas, Special Environmental Areas, Special Conservation Areas, Tourism Area and Centers).
- Rare, endangered plant species that should be protected according to IUCN categories, CITES and BERN Convention lists among the taxa that are likely to be found,
- State-owned Closed Military Areas, areas allocated to public institutions for certain purposes, the areas limited with the decision of the cabinet published in Official Gazette dated 25.09.1978 and numbered 16415.

Current status of the Project site proposed for the planned plant and its near surrounding was determined by analyzing climatic, meteorological, geologic, hydrogeological and hydrologic properties, agricultural and forest areas and protected areas. Similarly, information was provided on agriculture and animal husbandry activities in the Project site and it's near surrounding, local crops and their role in Turkish economy was analyzed. Official statistics were presented on means of livelihood of local people, status of social infrastructure, economic characteristics.

Measurement and analysis Works conducted in the plant site and its near surrounding to identify pollution load of the region in current situation, the results obtained were presented and they were evaluated in terms of relevant legislation.

ESIA Report mentioned about environmental effects that will occur during construction and operation activities and the measures to be taken to minimize these effects. The environmental effects were analyzed under three main titles:

- Impacts on air quality
- Impacts on water quality
- Impacts on soil
- Social impacts

Modeling studies recognized in national and international platforms were used to analyze these effects. The results obtained from modeling studies were analyzed considering relevant regulations. Modeling and analyses performed for the Project showed that noise, air emissions, gas emissions and dust emissions of the proposed plant during construction and operation stage are below regulation limit values.

ESIA Report prepared for the proposed plant included activities to be performed for land arrangement and "*restoration*" in Project site and it's near surrounding during and after the operation of the plant.

Final section of the report provided information on the monitoring program prepared to control possible environments effects of the plant during and after construction and operation of the plant.

SECTION 11. CONCLUSION

(Summary of all explanations made, a general assessment in which important environmental impacts of project is listed and which states to what extend success might be ensured in preventing negative environmental impacts in case project is realized, selection between alternatives within the scope of project and reasons for these choices)

- Planned plant is located in Kırıkkale province, Yahşihan district, Kılıçlar town.
- Activity are is located in 1/25,000i Kırşehir I30-b2 map section on an area of 185,840 m^2.
- Planned plant is planned to generate 7,557 GWh electric energy on annual basis.
- Annual natural gas amount to be used in the plant is 1,250,000,000 m^3.
- Natural gas to be used in the Project is planned to be supplied from BOTAŞ Natural Gas Transmission Line.
- Cooling system in the plant will operate in close cycle. Thus, waster will be supplied from caisson wells to be opened near Kızılırmak River only for once, to meet water need when the plant starts operation. Since the cooling system is closed cycle, no cooling water will be discharged to Kızılırmak River.
- There is no cultural or natural asset within the scope of Law no 2863 on the Protection of Cultural and Natural Assets
- Potable (drinkable) water required to meet the needs of staff shall be provided from drinking water supply network and/or purchased commercially.
- Use water required to meet the needs of staff shall be provided from caisson wells
- Water required in readily mixed concrete plant and cooling water required in operation phase of the project shall be provided from caisson wells that will be opened near Kızılırmak River.
- There is no tourism center or cultural and tourism protection and development area within the scope of law no 4957/2634 on Tourism Promotion.
- Drinking and utilization water needed for the personnel will be supplied from caisson wells.
- 1000 people are planned to be employed in construction and 60 people are planned to be employed in operation phase of the Project.
- Wastewaters generated by the personnel during construction and operation phase will be taken to package wastewater treatment plant and will be discharged to Kızılırmak River after meeting necessary discharge criteria. Similarly, a wastewater treatment plant will be installed for wastewaters that will be generated during operation phase; wastewaters will be discharged to Kızılırmak River after meeting necessary discharge criteria.
- As sludge to be generated in package wastewater treatment plant is safe waste, it will be disposed together with other domestic waste.
- Sludge generated in industrial wastewater treatment plant will be properly disposed after conducting analyses.
- Among solid wastes generated by the personnel during construction and operation phase, the ones that can be recycled (glass, paper, plastic etc.) and cannot be recycled will be collected in separate containers. Recyclable solid wastes will be sent to licensed recycle firms, while others will be submitted to the municipality.
- Provisions of “Directive on Control of Excavated Soil, Construction and Debris Wastes” which entered into force by being published in the Official Gazette dated 18.03.2004 no. 25406 will be complied with during construction activities,
- Waste batteries and accumulators from device and equipment used in the site will be collected in a separate area; the wastes will be recycled and will be disposed as per the provisions of Directive on Control of Waste Batteries and Accumulators which

entered into force by being published in the Official Gazette dated 31.08.2004 no. 25569.

- Packaging waste generated in the Project will be collected separately from solid wastes and will be disposed as per "Directive on the Control of Packaging Wastes" published in Official Gazette dated 04.08.2011 and numbered 28034.
- The tires which completed their lives of the vehicles to be used during the construction works will be disposed as per the provisions of Directive on Control of Worn out Tires which entered into force by being published in the Official Gazette dated 25.11.2006 no. 26357.
- Wastes that can be termed as hazardous waste such as paint containers, thinner cups are expected to be produced during construction Works. These wastes will be collected in an area covered with water-proof concrete and will be sent to a licensed facility for final disposal. Directive on Control of Hazardous Wastes which entered into force by being published in the Official Gazette dated 14.03.2005 no. 25755 will be complied with in storage and transport of these substances.
- Domestic waste amount to be generated during construction phase is 1.140 kg; solid waste amount during operation phase is 46 kg/day. Solid waste to be generated in the Project will be collected and disposed by the municipality. Provisions of "Directive on Control of Solid Wastes" which entered into force by being published in the Official Gazette dated 14.03.1991 no. 20814 will be complied with.
- Wastewater amount generated by the personnel during construction of the plant will be 150 lt/day, wastewater amount during operation will be 9 m^3/day. Wastewaters produced by the personnel will be taken to wastewater treatment plant and will be discharged to Kızılırmak River after meeting certain discharge criteria.
- A low amount of medical waste will be produced due to medical interventions in the infirmary which will be constructed in construction and operation phase of the plant. These wastes will be disposed according to "Directive on the Control of Medical Wastes" published in Official Gazette dated 22.07.2005 and numbered 25883.
- Air emissions to occur were determined by modeling studies. Emission values determined are below the limit specified in directive.
- Acoustic report was prepared to determine noise levels generated by machines and equipment during construction and operation phases. Noise levels were calculated and found to be below limit values stated in Regulations on Assessment and Management of the Environmental Noise.
- Cooling water that will be used in operation stage of the plant will not be discharged to any receiving environment. Therefore, there will be no negative impact on water resources in the site and its near surrounding including Kızılırmak River due to cooling water supply.
- Potential environmental effects in construction phase of the planned Project are short-term and temporary. After completion of construction activities, these effects will be eliminated.
- The most important environmental impact of the planned Project in operation phase is stack gas emissions. To reduce these emissions, low-NOx boilers will be used in the plant, stack gas values will be constantly monitored and these values will be periodically presented to Kırıkkale Provincial Directorate of Environment and URBAN Planning.

Laws and regulations to be complied with during construction and operation of the Project are listed below:

- Environment Law no 2872 (amended by law no 5491) and relevant provisions
- Law no 2863 on Protection of Cultural and Natural Assets (amended by law no 5226) and relevant provisions
- Coastal Law no 3621
- Labor Law no. 4857 and relevant provisions
- Pasture Law No 4342 (amended by law no 5751) relevant provisions

- Soil Conservation and Land Use Law No 5403 (amended by law no 5751) and relevant provisions
- Forestry Law No 6831 (amended by law no 5192) and relevant provisions
- Law no 5346 on the Use of Renewable Energy Sources for Electric Generation Purposes
- Law on Groundwater no 167 (which entered into force by being published in the Official Gazette dated 23.12.1960 and no 10688)
- Mining Law no 3213 (which entered into force by being published in the Official Gazette dated 03.02.2005 and no 25716)
- Law no 2863 on the Protection of Cultural and Natural Assets (which entered into force by being published in the Official Gazette dated 23.07.1983 and no 18113)
- Aquaculture Law No 1380 (which entered into force by being published in the Official Gazette dated 04.04.1971 and no 13799
- Directive on Noise Emission in the Environment Caused by Equipment Operating in Open Areas (which entered into force by being published in the Official Gazette dated 30.12.2006 and no)
- Directive on Environmental Impact Assessment (which entered into force by being published in the Official Gazette dated 17.07.2008 and no 26939 amended by Official Gazette dated 30.06.2011 and no 27980)
- Directive on General Principles of Waste Management (which entered into force by being published in the Official Gazette dated 05.07.2008 and no 26927)
- Directive on the Control of Solid Wastes (which entered into force by being published in the Official Gazette dated 14.03.1991 and no 20814)
- Aquaculture Directive (which entered into force by being published in the Official Gazette dated 10.03.1995 and no 22223)
- Directive on Buildings to be Constructed in Disaster Areas (which entered into force by being published in the Official Gazette dated 14.07.2007 and no 26582)
- Directive on Environmental Inspection (which entered into force by being published in the Official Gazette dated 21.11.2008 and no 27061, amended by Official Gazettes dated 22.10.2009 and no 27384; dated 12.11.2010 and no 27575; dated 16.08.2011 and no 28027)
- Directive on the Control of Waste Oils (which entered into force by being published in the Official Gazette dated 30.07.2008 and no 26952; amended by Official Gazette dated 30.03.2010 and no 27537)
- Directive on the Control of Excavation Earth, Construction and Demolition Wastes (which entered into force by being published in the Official Gazette dated 18.03.2004 and no 25406; amended by Official Gazette dated 26.03.2010 and no 27533)
- Directive on the Control of Waste Batteries and Accumulators (which entered into force by being published in the Official Gazette dated 31.08.2004 and no 25569 ; amended by Official Gazette dated 30.03.2010 and no 27537; dated 25.03.2012 and no 28244; dated 07.04.2012 and no 28257)
- Directive on the Control of Water Pollution (which entered into force by being published in the Official Gazette dated 31.12.2004 and no 25687; amended by Official Gazette dated 13.02.2008 and no 26786;dated 30.03.2010 and no 27537)
- Directive on the Control of Hazardous Wastes (which entered into force by being published in the Official Gazette dated 14.03.2005 and no 25755;amended by Official Gazette dated 30.10.2010 and no 27744)
- Directive on the Control of Waste Vegetable Oils (which entered into force by being published in the Official Gazette dated 19.04.2005 and no 25791; amended by Official Gazette dated 30.03.2010 and no 27537)
- Directive on the Control of Medical Wastes (which entered into force by being published in the Official Gazette dated 22.07.2005 and no 25883;amended by Official Gazette dated 03.12.2011 and no 28131)
- Directive on the Control of Industrial Air Pollution (which entered into force by being published in the Official Gazette dated 03.07.2009 and no 27277; amended by

Official Gazette dated 30.03.2010 and no 27537; dated 10.11.2012 and no 28463)

- Directive on the Evaluation and Management of Air Quality (which entered into force by being published in the Official Gazette dated 06.06.2008 and no 26898; amended by Official Gazette dated 05.05.2009 and no 27219)
- Directive on the Control of Package Wastes (which entered into force by being published in the Official Gazette dated 24.08.2011 and no 28035)
- Directive on the Control of Soil Pollution and Point Source Polluted Sites (which entered into force by being published in the Official Gazette dated 14.06.2012 and no 28323)
- Directive on the Evaluation and Management of Environmental Noise (which entered into force by being published in the Official Gazette dated 27.04.2011 and no 27917)
- Directive on the Protection of Wetlands (which entered into force by being published in the Official Gazette dated 17.05.2005 and no 25818;amended by Official Gazette dated 26.08.2010 and no 27684)
- Directive on Work Health and Safety (which entered into force by being published in the Official Gazette dated 09.12.2003 and no 25311)
- Directive on Health and Safety in Construction Works (which entered into force by being published in the Official Gazette dated 23.12.2003 and no 25325)
- Directive on Worker Health and Safety in Temporary Works or Works with Definite Time (which entered into force by being published in the Official Gazette dated 15.05.2004 and no 25463)
- Statutory decree no 644 on the Organization and Duties of the Ministry of Environment and Urban Planning published in Official Gazette dated 04.17.2011 and no 27984
- Directive on Facilities to be Constructed and Opened on Highways dated 15.05.1997 and no 22990 (amended by Official Gazette dated 06.01.1988 and no 23222)
- Directive on the Management of Surface Water Quality (which entered into force by being published in the Official Gazette dated 30.11.2012 and no 28483)

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