BORASCO®

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SAMSUN PROVINCE, TERME DISTRICT

SAMSUN NATURAL GAS COMBINED CYCLE PLANT PROJECT

ENVIRONMENTAL IMPACT ASSESMENT (EIA) REPORT

☐ **EIA Report** ■ **Final EIA Report**

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ANKARA – 2009

TITLE PAGE

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Project Name:	Samsun Doğal Gaz Kombine Çevrim Santralı (Samsun Natural Gas Combined Cycle Plant)
Project Price:	Approximately 499 million €
Full Address of the Project Location (City, District, Location):	Samsun Province Terme District
Coordinates of the Project Location, Zone:	X: 344197; Y: 4557122 (Datum: ED50) UTM Zon 37
Position of the Project in the EIA Regulation Scope (Sector, Sub Sector):	Annex-I, 2.a
Name of the Institution / Working Group Preparing the Report:	ENVY Enerji ve Çevre Yatırımları A.Ş.
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Number, Date of the Compliance Certificate of the Institution preparing the Report:	09, 11.04.2007
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ABBREVIATIONS

$	: Dollar
%	: Percentage
$\mu g/m^3$	: microgram/cubicmeter
°C	: Centigrade degree
A.Ş.	: Incorporated Company, Inc.Co.
AB	: Low Pressure
AIK	: Waste heat boiler
AKM	: Suspended solid substance
AMP	: Emergency Response Plan
BOİ	: Bio-chemical oxygen requirement
BORASCO	: BORASCO Elektrik Üretim Sanayi ve Ticaret A.Ş.
Petroleum Pıpelıne Cooperatıon	: Boru Hatları ile Petrol Taşıma A.Ş.
BT	: Vapor Turbine
Ca	: Calsium
$CaCO_3$	: Calsium carbonate
Cd	: Preservation measurement required
CEMS	: Continous emmission monitoring system
Cl	: Chlor
cm	: centimeter
cm^3	: cubiccentimeter
CO	: Carbonmonoxide
CO_2	: Carbondioxide
Cr	: Under Great Danger
Cu	: Copper
EIA	: Environmental Impact Assessment
D	: East
da	: Decare
dB(A)	: Decibel (A)
DD	: Deficient Data
EC	: Electrical Conductivity
En	: Endangered
End	: Endemism
ENVY	: Enerji ve Çevre Yatırımları A.Ş.
ERL	: European Red List
EVRDB	: European Vertebrate Red Data Book
Ex	: Extinct
Fe	: Iron
GB	: Southwest
GD	: Southeast
GE	: General Electric
GT	: Gas Turbine
GWsaat	: Gigawatt-hour
ha	: hectare
HC	: Hydrocarbon
HNO_3	: Nitric Acid
Hz	: Hertz

IEC	:International Electrothechnical Commission
ISCST	: Industial Source Complex-Short Term
IUCN	: International Association of Nature Conservation
K	: North
KB	: Northwest
kcal	: kilo calori
KD	: Northeast
KDK	: Cation Exchange Capacity
kg	: kilogram
km	: kilometer
kV	: kilo volt
kWsaat	: Kilowatt-hour
L	: Liter
L/s/m	: Liter/second/meter
Lc	: Least Concerned
LPG	: Liquid Petroleum Gas
Lr	: Under Less Duress
m	: meter
m^2	: squaremeter
m^3	: cubicmeter
MAED	: Model for Analysis of Energy Demand
MAK	: Central Hunting Commission
Mg	: Magnesium
mg	: miligram
mhos/cm	: milimhos/cm
MoEF	: Ministry of Environment and Forestry
mm	: milimetre
mS	: microsiemens
MTA	: Mine Exploration Prospecting
Mtep	: Milion ton petroleum equivalent
MW	: Megawatt
MWe	: Megawatt electric
N	: Nitrogen
Na	: Sodium
NB	: Proportional Abundance
Ne	: Inevaluable
NH_3	: Ammoniac
NH_4-N	: Ammonium nitrogen
Nm^3	: Normal cubicmeter
NO	: Nitrogenmonoxide
No	: Number
NO_2-N	: Nitrogen dioxide
NO_3-N	: Nitrate nitrogen
NOx	: Nitrogen oxide
Nt	: Possible to imperiled
°	: Degree
O	: Medium Sensitivity
OB	: Medium Pressure

ÖKA	: İmportant Bird Area
PM	: Particulate Substanca
PO_4	: Phosphate
s	: second
SCR	: Selective Catalic Reduction
WPCR	: Water Pollution Control Regulations
SO_2	: Sulphurdioxide
SO_4	: Sulphate
T.C	: Republic of Turkiye
TEIAŞ	: General Directorate of Electricity Transmission Inc.
TOC	: Total Organic Carbon
TSE	: Turkish Standards Institution
TÜBİTAK	: Turkiye Scientific and Tehcnoloical Research Institute
TSE	: Turkiye Statistical Institute
USEPA	: USA Environment Protection Institute
GLC	: Ground level concentration

I. DESCRIPTION AND PURPOSE OF THE PROJECT

(Description, life-time, service tools, bazaar or service areas and importance and necessitation of them within this area economically and socially on the scale of region and/or province)

I.1 Description, Life-time and Service Purposes of Proje Matter Activity

Construction of a power plant with a total installed capacity of approximately 886,92 MWm / 868,6 MWe within the borders of Samsun Province Terme County has been planned by BORASCO Electricity Generation Industry and Trade Inc.. It is stipulated that the plant in which natural gas will be used as fuel will produce approximately 6.948.800.000 kWh electricity per year.

The purpose of the Project is constructing a low-cost power plant with high efficiency and serving to energy demand by transmitting electric energy produced in the plant to the interconnected system. Natural gas that will be used within Project has been planned to be provided from Blue Stream Natural Gas Pipeline that is operated by Petroleum Pipeline Corporation (Petroleum Pipelıne Cooperatıon). The appropriate location for gas receiving will be designated by making an application regarding the matter to Petroleum Pipelıne Cooperatıon.

The stipulated facility has been planned to be commissioned on December 2010, electric energy energy produEIA in the facility will be transmitted to the national network with 380 kV transmission lines. Connection points of the plant to the system and their voltage levels will be Kayabaşı 2 TM, 380 kV and Çarşamba TM, 380 kV (see Appendix-1). Concerning the matter, a System Connection Contract has been claimed from General Directorate of Turkish Electricity Transmission Company (TEİAŞ). Life-time of the Project is stipulated as 30 years.

Project area is located within borders of Samsun Province Terme County. Besides area takes place in Samsun F38.d2 map section scaled 1/25.000, area is sized approximately 50 ha. Project field takes place approximately 76 km eastwards of Samsun city center and approximately 18 km eastwards of Terme county town. Closest allocation unit to the field is Akçay and Hocaoğlu districts on the west. Besides, Ünye County which is dependant to Ordu Province is on the east of the field and the distance from the county to the field is approximately 12 km.

“In case of need within our outside of planning sub-regions determined with this plan; usages regarding social equipage areas such as security, health, education, large urban green fields, every kinds of waste disposal facilities and recycling facilities integrated with them intended for the whole of town or region/basin, treatment facilities, social and technical infrastructure, highway, railway, airport, barrage, energy production and transmission, by looking after public interest, their subscaled plans, in line with opinions of relevant institutions and associations, without any necessity for an amendment in the environment plan, is prepared in line with protection, development and planning principles of this plan by its relevant administration. Prepared plans are not approved without opinion of appropriateness of the Ministry.

As mentioned by T.R. Samsun Governorship Provincial Department of Environment and

Forestry, it has been confirmed that said area is on the Environment Plan F38 map section scaled 1/100.000 of Samsun-Çorum-Tokat Planning Region which was approved by T.R. Ministry of Environment and Forestry on 26.02.2008 after allowable amendments on it in consequence of evaluation of the objections in suspending period after approval of T.R. Ministry of Environment and Forestry on the date of 20.07.2007. Consequently, provisions of Samsun-Çorum-Tokat Planning Region 1/100.000 Scaled Environment Plan, Plan Map Sections, Plan Description Report and Plan Notes should be complied with (see Appendix-1). Below statements take place in Article 1.4.17 of Plan provisions:

In this sense, location of project area on 1/100.000 scaled Environment Plan, notes and legend of the plan has been approved by T.R. Samsun Special Provincial Administration and related documents have been enclosed here with Appendix-3.

Foregoing considerations; for the purpose of receiving final opinion related to zoning appropriateness of the activity at the stage of preparation of zoning plans of the activity, zoning plan proposal prepared with all related institution and association opinions will be submitted to T.R. Ministry of Environment and Forestry.

I.2 Bazaar or Service Areas and Their Importance and Necessitations Economically and Socially

I.2.1 Energy Policy of Turkiye

According to 2007 statistics published by TEİAŞ, by the end of year 2007, electric energy installed capacity of Turkiye has become 40.835,7 MW with a %0,7 increase in comparison with 2006. On primary energy resources basis, out of this increase, 1486,5 MW by thermal plant, 156,7 MW by hydrolic plant and 38,9 MW by wind plant has been provided. Out of the electricity produEIA on 2007; %81,0 by thermal (mineral coal, lignite, fuel oil, natural gas, geothermal, LPG, naphta and others), %18,7 by hydrolic and %0,3 by geothermal and wind plants has been provided (see Table I.1). %27,9 as Share of coal and %49,6 as share of natural gas in between these production values has been recorded (see Table I.2 ve Figure I.1).

Long-Term Production Planning Study including 2005-2020 period by TEİAŞ has been executed with two different scenarios. Analyzed Demand Forecasting Series have been obtained from MAED Model ("*Model for Analysis of Energy Demand*") results. For peak time power and energy demand values regarding 2005, MAED model result has been used and for the production schedule prepared for this year, stipulated values has been taken. Therefore both in two scenarios, 2005 values are same. Annual average increase in electric energy demand for 2005-2020 period is %7,9 according to Scenario 1 and %6,4 according to Scenario 2 (see Figure I.2 and Figure I.3 and Table I.3).

Table I.1: 2006-2007 Period Distribution of Electric Energy Production of Turkiye

Energy Sources	2006			2007		
	MW	Ratio (%)	Increase (%)	MW	Ratio (%)	Increase (%)
Thermic	27.420,2	74,7	-	27.271,6	81,0	-
Hydrolic	13.062,7	25,1	-	13.394,9	18,7	-
Geothermal and wind	81,9	0,2	-	169,2	0,3	-
TOTAL	**40.564,8**	**100,0**	**4,4**	**40.835,7**	**100,0**	**0,7**

Source: www.teias.gov.tr

Table I.2: 2006-2007 Development of Electric Energy Production of Turkiye Acc. to Primary Energy Sources

Energy Sources	2006		2007	
	GWhour	Ratio (%)	Gwhour	Ratio (%)
Coal	46.649,5	26,4	53.430,9	27,9
Liquid Fuels	4.340,4	2,5	6.526,8	3,4
Natural Gas	80.691,2	45,8	95.024,8	49,6
Renewable and waste	154,0	0,1	213,7	0,1
Hydrolic	44.244,2	25,1	35.850,8	18,7
Geothermal and wind	220,5	0,1	511,1	0,3
TOTAL	**176.299,8**	**100,0**	**191.558,1**	**100,0**

Source: www.teias.gov.tr

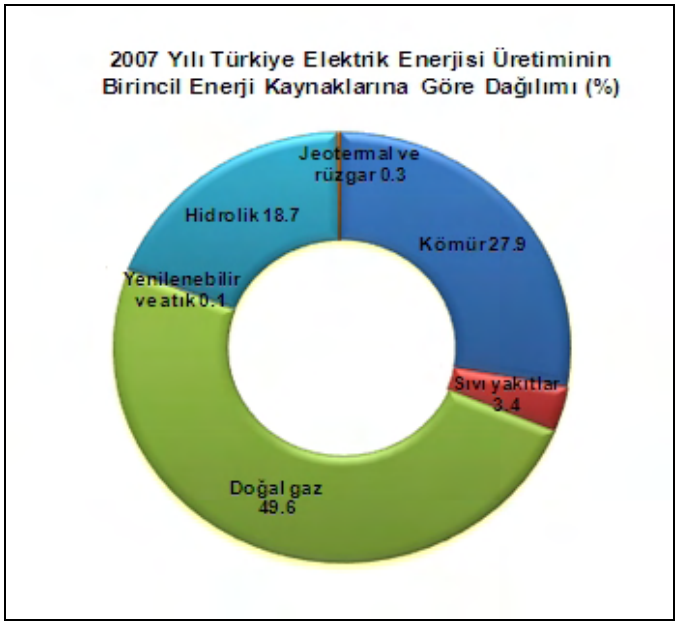
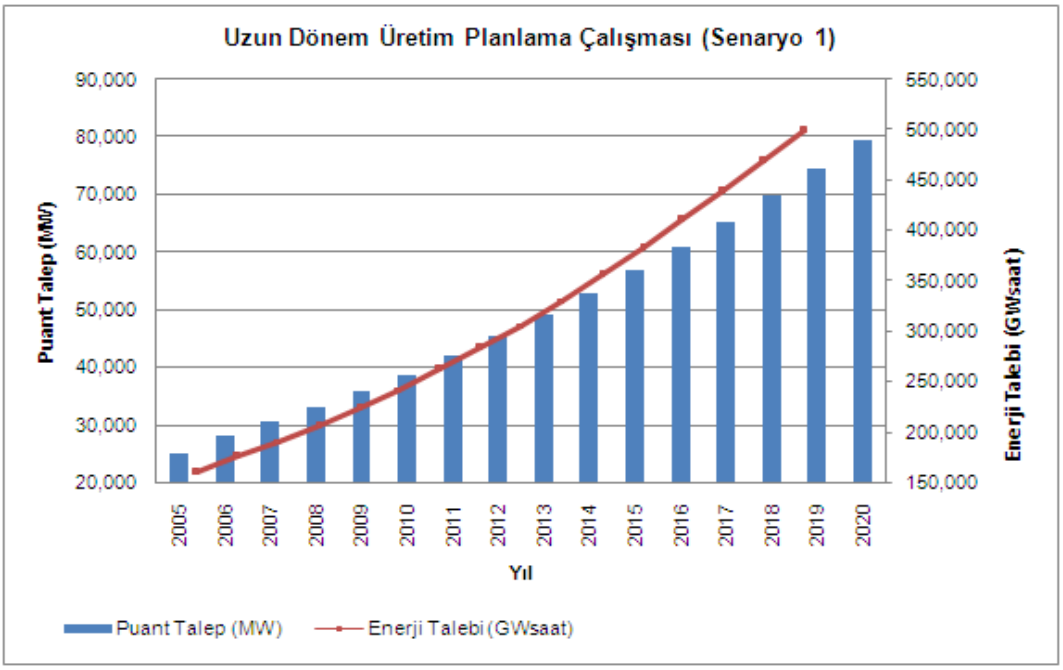
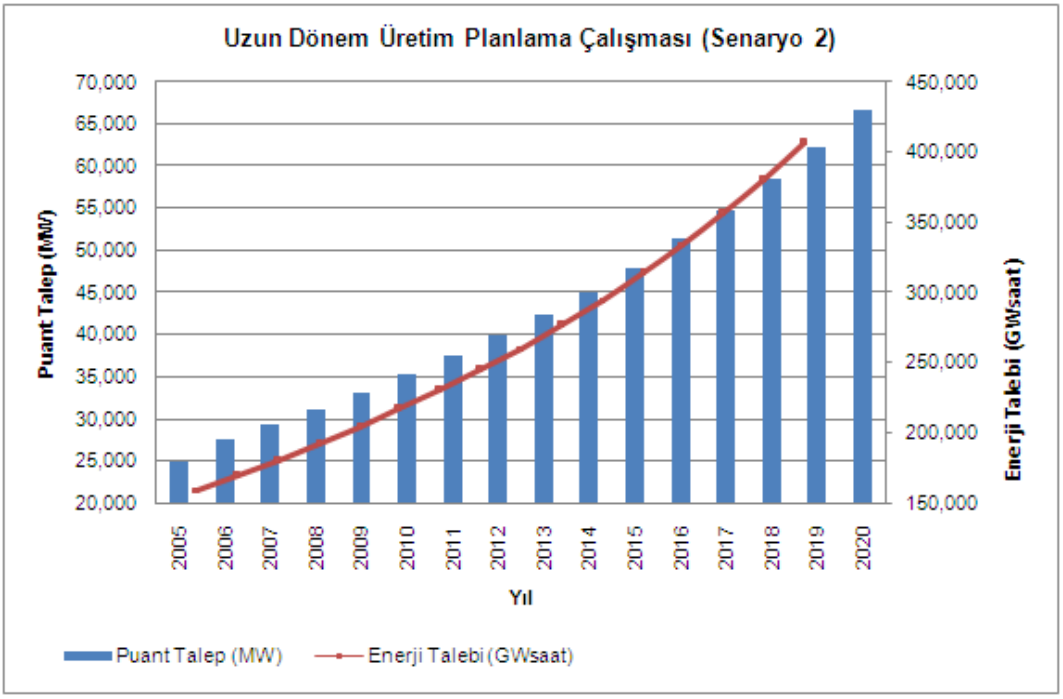


Figure I.1: 2007 Distribution of Electric Energy Production of Turkiye Acc. to Primary Energy Sources



Source: TEİAŞ

Figure I.2: Long-term Production Planning Study (Scenario 1)



Source: TEİAŞ

Figure I.3: Long-term Production Planning Study (Scenario 2)

Table I.3: Long-term Production Planning Study Involving 2005-2020 Period

Year	Scenario 1				Scenario 2			
	Peak Time Demand		Energy Demand		Peak Time Demand		Energy Demand	
	MW	Increase (%)	GWhour	Increase (%)	MW	Increase (%)	GWhour	Increase (%)
2005	25.000	-	159.650	-	25.000	-	159.650	-
2006	28.270	13,1	176.400	10,5	27.555	10,2	169.517	6,2
2007	30.560	8,1	190.700	8,1	29.299	6,3	180.248	6,3
2008	33.075	8,2	206.400	8,2	31.157	6,3	191.677	6,3
2009	35.815	8,3	223.500	8,3	33.132	6,3	203.827	6,3
2010	38.785	8,3	242.020	8,3	35.232	6,3	216.747	6,3
2011	41.965	8,2	262.000	8,3	37.521	6,5	230.399	6,3
2012	45.410	8,2	283.500	8,2	39.891	6,3	244.951	6,3
2013	49.030	8,0	306.100	8,0	42.407	6,3	260.401	6,3
2014	52.905	7,9	330.300	7,9	45.077	6,3	276.799	6,3
2015	57.050	7,8	356.200	7,8	47.969	6,4	294.560	6,4
2016	60.845	6,6	383.000	7,5	51.384	7,1	313.599	6,5
2017	65.245	7,2	410.700	7,2	54.775	6,6	334.297	6,6
2018	69.835	7,0	439.600	7,0	58.413	6,6	356.500	6,6
2019	74.585	6,8	469.500	6,8	62.346	6,7	380.503	6,7
2020	79.350	6,4	499.490	6,4	66.611	6,8	406.533	6,8

Source: TEİAŞ

According to Development Plan (2007-2013) which became effective after being published on Official Gazette dated 01.07.2006 and No. 26215, in VIII. Plan period, in paralel with economic growth and population increase, essential increases have been recorded in consumption of primary energy and electric energy. In the VIII. Plan period, primary energy consumption has reached to 92,5 million ton petroleum equivalent (mtep) by end of 2005 with an annual average increase of %2,8, whilst electric energy consumption has reached to 160,8 billion kWhour with an annual average increase of %4,6. As for the period after 2003 in which economy has gained stability and effects of 2001 crisis has alleviated, these increases are distinctive. In this period, primary energy consumption has grown at the rate of %5,7 while electric consumption has grown at the rate of %6,7.

In the IX. Development Plan; in demand of primary energy, an annual average increase of %6,2 comparatively with economic and social development has been stipulated. Increasing of the share of natural gas within energy consumption from %28 level (2005) to %34, retreatment of the share of petroleum products from %37 to %31 is expected. On the other hand, of the electricity demand in the same plan period, in paralel with developments in predominantly industrial manufacturing and service sectors, is stipulated to show an annual average increase at the rate of %8,1 (see Table I.4).

Table I.4: IX. Development Plan Targets

Energy Targets	2006	2013	2007-2013*
Primary Energy Demand	96.560	147.400	6,2
Electrical Energy Demand	171.450	295.500	8,1

** Charts progresses within the periodr.*

Source: Development Plan (2007-2013), Officail Gazette dated 01.07.2006 and numbered 26215

I.2.2 Purpose of the Project

Establishment purpose of proposed Samsun Natural Gas Combined Cycle Plant is meeting a part of electric energy of the region by utilizing the gas received from Blue Stream Natural Gas Line. Briefly, the main purposes of the Project are as follows:

- To meet the electric energy increasing every year,
- To provide consistency in our country's electric energy policy,
- To bring new and advanEIA energy Technologies to our country,
- To add variety to energy sources,
- To provide source for transmitting healthy and continuous energy to the industrial facilities increasing rapidly in the country,
- To provide employment for the public in the region and to contribute to the economy of the territory.

I.2.3 Economic Importance of the Project

Gross production and net consumption figures of Turkey in 2007 had been respectively 191.558,1 million kWhour and 155.135,2 million kWhour. According to the IX. Development Plan, electric demand has been stipulated to show an annual average increase at the rate of %8,1. Under this circumstances, it is obvious that Turkey requires electric energy.

The Project which is stipulated to be established in Samsun Province Terme District has been planned to have a capacity of 890 MWe. The electric energy to be produced within Project will be used for meeting a part of the energy demand of Turkey by being transmitted directly ot the national network. In this sense, energy requirement of industrial and other facilities that are in the territory and intended to be established will be able to be met by this plant continuously.

Samsun Natural Gas Combined Cycle Plant which has been stipulated to produce annually approximately 6.948.800.000 kWhour electric, will meet approximately %4 of electric requirement of Turkey. Consequently, materializing of the proposed Project is of vital importance in terms of resolving the difficulties in energy supply that Turkey might well confront with in the near future.

I.2.4 Social Importance of the Project

Planned energy plant will be in Samsun Province Terme District. While the total population value of Samsun Province in 2007 is 1.228.959, the countryside and urban population ratios out of this total population are respectively %59 and %41. While total population of Terme District in 2007 is 74.833, out this population %62 is living in the countryside.

During the construction works of the energy plant, max 900 persons have been stipulated to work. It has been planned to meet a large proportion of this staff out of the public in Samsun, Terme and/or close settlements. Number of personnels to be worked on operating stage is approximately 80 persons. Similarly, it has been planned to provide personnel out of the territory public at the operating stage.

In this sense, it has been prescribed that direct or indirect employment opportunities together with direct or indirect expenditures to be arised at construction and operating stages of the proposed energy plant will benefit in support of the territory public and industrial development. Accordingly, importance of the Project includes its positive impacts on economy (indirect employment opportunities etc.) and enhancement of social life.

I.3 Environmental Impact Assessment

This report has been prepared by ENVY Enerji ve Çevre Yatırımları Anonim Şirketi (Energy and Environment Investments Inc., Co.) in such a manner to meet the requirements of Environmental Impact Assessment (EIA) report to be presented to T.R. Ministry of Environment and Forestry(MoEF) in concern with Samsun Natural gas Combined Cycle Plant planned to be established. EIA Application File concerning the Project has been prepared within EIA Regulations Appendix-III which went in effect by being published in Official Gazette dated 17.07.2008 and numbered 26939 and after approval of the file by T.R. Ministry of Environment and Forestry (MoEF) and General Directorate of Planning, the “Public Attendance Meeting” has been maden on 16.12.2008 within the project. Following the Public Attendance Meeting, “Scope and Special Format Identification Meeting” of the Project has been maden on 19.12.2008 by MoEF. Scope of the report has been determined according to the special format given by MoEF after said meeting (see Appendix-2).

Purpose of this EIA Report is identification and assessment of possible impacts of the proposed Project on bio-physical and socio-economical environment. Aforementioned study includes the following subjects:

- Identification of Project area and alternative Project fields,
- Identification of tehcnologic alternatives of the proposed energy plant
- Determination of present specifications of environment to be able to be impacted from the Project,
- Identification and determination of the possible impacts of the Project on the environment,
- Determination of the control methods to be executed for preventing or reducing possible environmental impacts,
- Developing proposals regarding the precautions to be taken against lasting impacts that will probably exceed related international standards.

Informations about current environmental condition of the project field have been

introduced by utilizing the data collected in consequence of field surveys and literature researches executed by the EIA group. As for impact assessment studies have been performed after determination of current specifications of the plant and its surrounding. Locating the areas to be able to be impacted by Project activities have been performed in the light of studies based upon pre-design parameters. Assessment stage of possible impacts of proposed Project includes the following dimensions:

Time Limits: Possible impact and durations of these impacts have been assessed by considering different stages of the Project such as construction, operating and post-operating.

Place Limits: Subject EIA (EIA) Report includes the assessment of Samsun Natural Gas Combined Cycle Plant Project area. Working area has been determined as 20 km × 20 km (width × length). In order to determine the socio-economic impacts, Samsun province and Terme district have been discussed.

Resources: Possible impacts of all Project activities on bio-physical resources (air, water, earth etc) have been considered. Besides, positive or negative social, cultural and economic impacts to be arisen upon neighboring settlements have also been assessed.

II. LOCATION OF THE SELECTED SITE FOR PROJECT

II.1 Project Site Selection (presentation on the Environment Plan scaled 1/25.000 in which the legend and plan notes of activity site verified by concerned Governorship or Municipality also take place (Plan notes and Provisions), Approved Structural Construction Plan and Execution Construction Plan, (Plan notes and legends), if not available on the present land use map)

II.1.1 Site Selection Criterias

Many criterias have been considered at the stage of site selection works for Samsun Natural Gas Combined Cycle Plant field. In site selection, below mentioned fundamental criterias have been considered:

- Environmental specifications of the Site (ambience air quality, etc),
- Connection opportunities of water and power supplies,
- Topographical, geological and seismicity specifications of the Site,
- Geological risks possible on the field,
- Accessibility to transportation (logistics),
- Land property status,
- Land use status,
- Economically viability.

In accordance with these general criterias, while below facts have been considered during site selection of stipulated Project field, area within the borders of Samsun Province Terme District and mentioned in Section II.1.2. has been accepted as the most appropriate location for Project:

- Accordance of ambient air conditions in terms of providing best energy efficiency and lowest flue gas emmission values,
- Procurable of natural gas stipulated to be used as fuel from Blue Stream Natural Gas Pipeline,
- Being higher of methane rate in Blue Stream gas in comparison with Iran gas and other alternatives and thus lower flue gas emmission values to be arised,
- When energy requirements in Samsun and its neighboring and energy sources offered to needers currently are assessed, requirement of the region for a reliable and continuous production,
- Proximity to an advances 380 kV transmission network (transmission convenience of energy to be produced in this plant to west regions in where requirement is high).

II.1.2 Activity Area

It takes place in the middle of Samsun Province Blacksea coastal between the deltas through which Yeşilırmak and Kızılırmak Rivers disembogue to Blacksea. As the geographical position, it is located between 40°50’ - 41°51’ North latitudes and 37°08’ - 34°25’ east longitudes. Neighbors of the province at the North of whose Blacksea takes place are Ordu in the east, Sinop in the west, Tokat and Amasya in the South, Çorum in the South west (see Figure II.1). Samsun province has 14 districts consisting of Alaçam, Asarcık, Ayvacık, Bafra, Çarşamba, Kavak, Ladik, Havza, 19 Mayıs, Salıpazarı, Tekkeköy, Terme, Vezirköprü and Yakakent, 51 municipalities and 945 villages. 1/25.000 scaled topographical map of the area is given on Figure II.2

Project area is located within the borders of Samsun Province Terme District. Besides

area while taking place on the map section of 1/25.000 scaled Samsun F38.d2, is approximately 50 ha sized. Project field is located approximately 76 km of east of Samsun city center and in the 18 km east of Terme district center. Closest settlement units to the field are Akçay and Hocaoğlu districts in the west of the field. Besides, while Ünye District affiliated to Ordu Province is located in the east of the field, distance of the district to the field is approximately 12 km (see Figure II.4).

Stipulated Project site is shown on Figure II.2, Figure II.3 and Figure II.6. In the east of Project site, Akçay is located (see Figure II.7– Figure II-9).

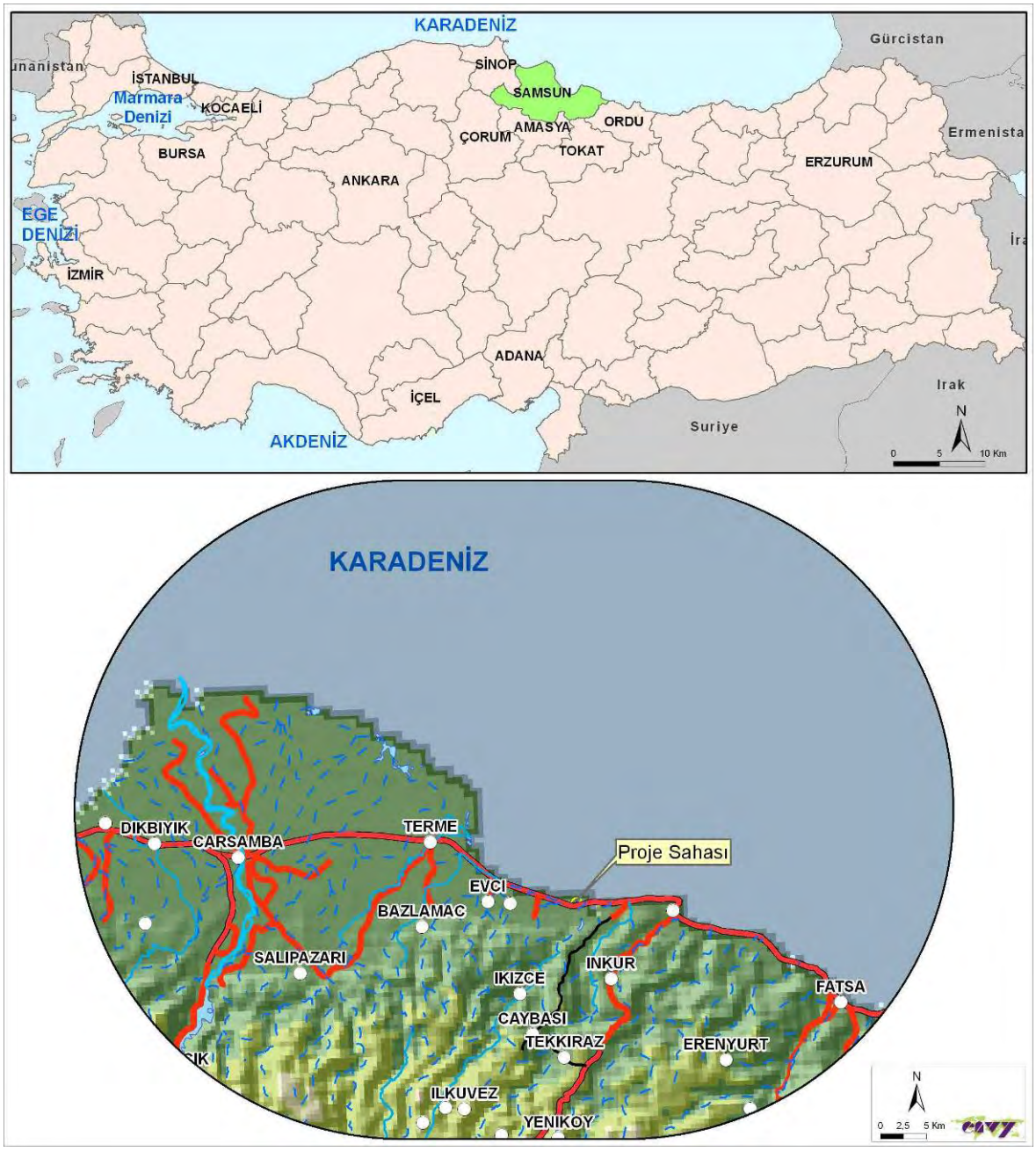


Figure II.1: Locator Map of Project Site

Coordinates Stipulated for Project Site:

Point 1: X: 344973 Y: 4557013
Point 2: X: 345253 Y: 4556983
Point 3: X: 345410 Y: 4556983
Point 4: X: 345866 Y: 4556927
Point 5: X: 345699 Y: 4556360
Point 6: X: 345175 Y: 4556337
Point 7: X: 345076 Y: 4556392
Point 8: X: 345047 Y: 4556569
Point 9: X: 345011 Y: 4556665
Point 10: X: 344968 Y: 4556891

As mentioned by T.R. Samsun Governorship Province Environment and Forestry Directorate, said area has been determined to be in F38 map section of Environment Plan scaled 1/100.000 of Samsun-Çorum-Tokat Planning Region approved by T.R. Ministry of Environment and Forestry on 26.02.2008 after allowable amendments have been made on in consequence of objections in suspending period after approval by T.R. Ministry of Environment and Forestry on 20.07.2007. For this reason, provisions of Samsun-Çorum-Tokat Planing Region 1/100.000 Scaled Environment Planı, Plan Map Sections, Plan Description Report and Plan Notes have to be complied with (see Appendix-1). In Plan provisions Article 1.4.17, following expressions take place:

"In case of need within our outside of planning sub-regions determined with this plan; usages regarding social equipage areas such as security, health, education, large urban green fields, every kinds of waste disposal facilities and recycling facilities integrated with them intended for the whole of town or region/basin, treatment facilities, social and technical infrastructure, highway, railway, airport, barrage, energy production and transmission, by looking after public interest, their subscaled plans, in line with opinions of relevant institutions and associations, without any necessity for an amendment in the environment plan, is prepared in line with protection, development and planning principles of this plan by its relevant administration. Prepared plans are not approved without opinion of appropriateness of the Ministry. ....."

In this sense, location of Project area on 1/100.000 scaled Environment Plan, notes and legend of the plan has been approved by T.R. Samsun Special Provincial Administration and related documents have been enclosed herewith Appendix-3.

In case of consideration of constructing based buildings such as work site, social and administrative buildings within activity area, for these areas, a geological-geotechnical and micro-zoning report base for the plan according the criterions specified in the circular of General Directorate of Disaster Affairs dated 19.08.2008 and numbered 10337 will be prepared and will be had approved by the relevant authority.

Propery of the area in magnitude of proximately 50 ha belongs to the project owner (see Appendix-1). For the purpose of determination of usage condition of the project area with agricultural purposes, a survey has been performed by authorities of T.R. Samsun Governorship Provincial Directorate of Agriculture in the project area on 24.12.2008. The report prepared as a result of the survey is presented in Appendix-1. Accordingly, 9,8929 ha of the survey area has been assessed as Dry Marginal Agricultural Lans, 8,9611 ha of it as Dry Special Product Land and 25,5521 ha of it as Planted Agricultural Land. In this sense, with respect to the subject, agricultural

surveys will be executed before starting for Project activities following the EIA process with pursuant to Land Protection and Land Usage Law numbered 5403 which became effective by being published in Official Gazette dated 19.07.2005 and numbered 25880 and Protection and Usage of Agricultural Lands Regulations regarding which became effective by being published in Official Gazette dated 13.06.2003 and numbered 25137, according to the survey result, in case of a requirement, an application will be made to Land Protection Board for the purpose of usage with non-agricultural purposes.

Figure II.2: Two Dimensional Display of Stipulated Project Area and Surrounding

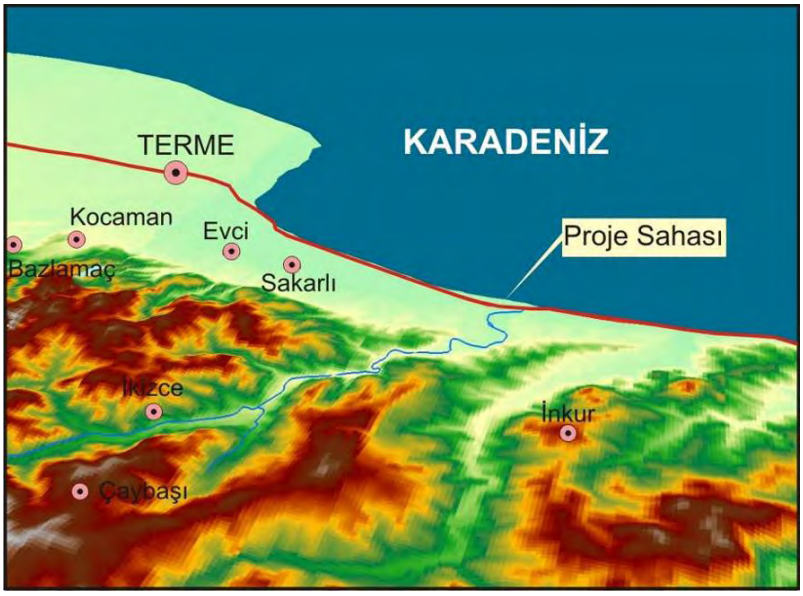


Figure II.3: 3D Display of Stipulated Project Area and Surrounding

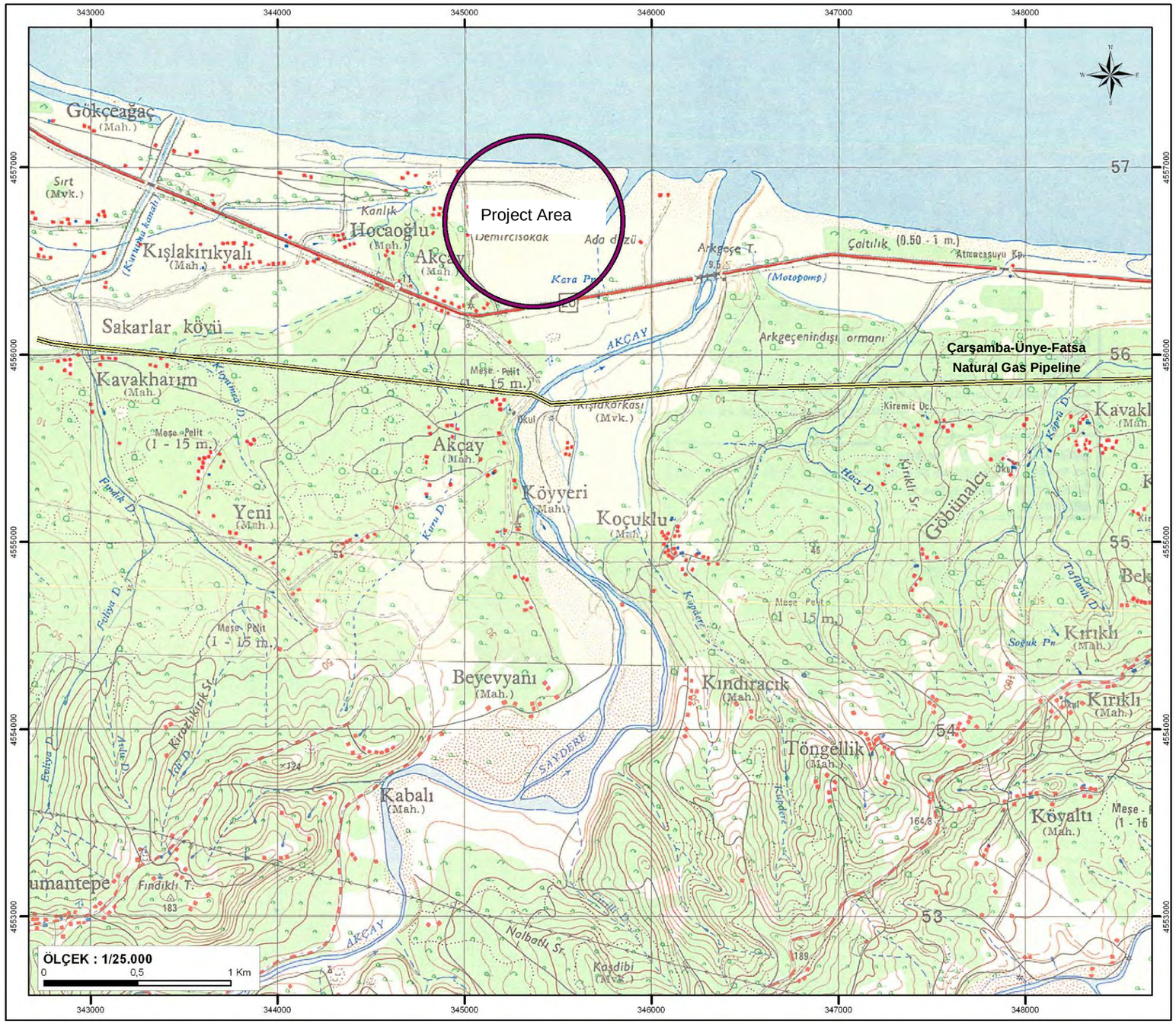


Figure II.4: Topographical Map of Stipulated Project Area and Surrounding

Figure II.5: Satellite Image of Stipulated Project Area and Surrounding

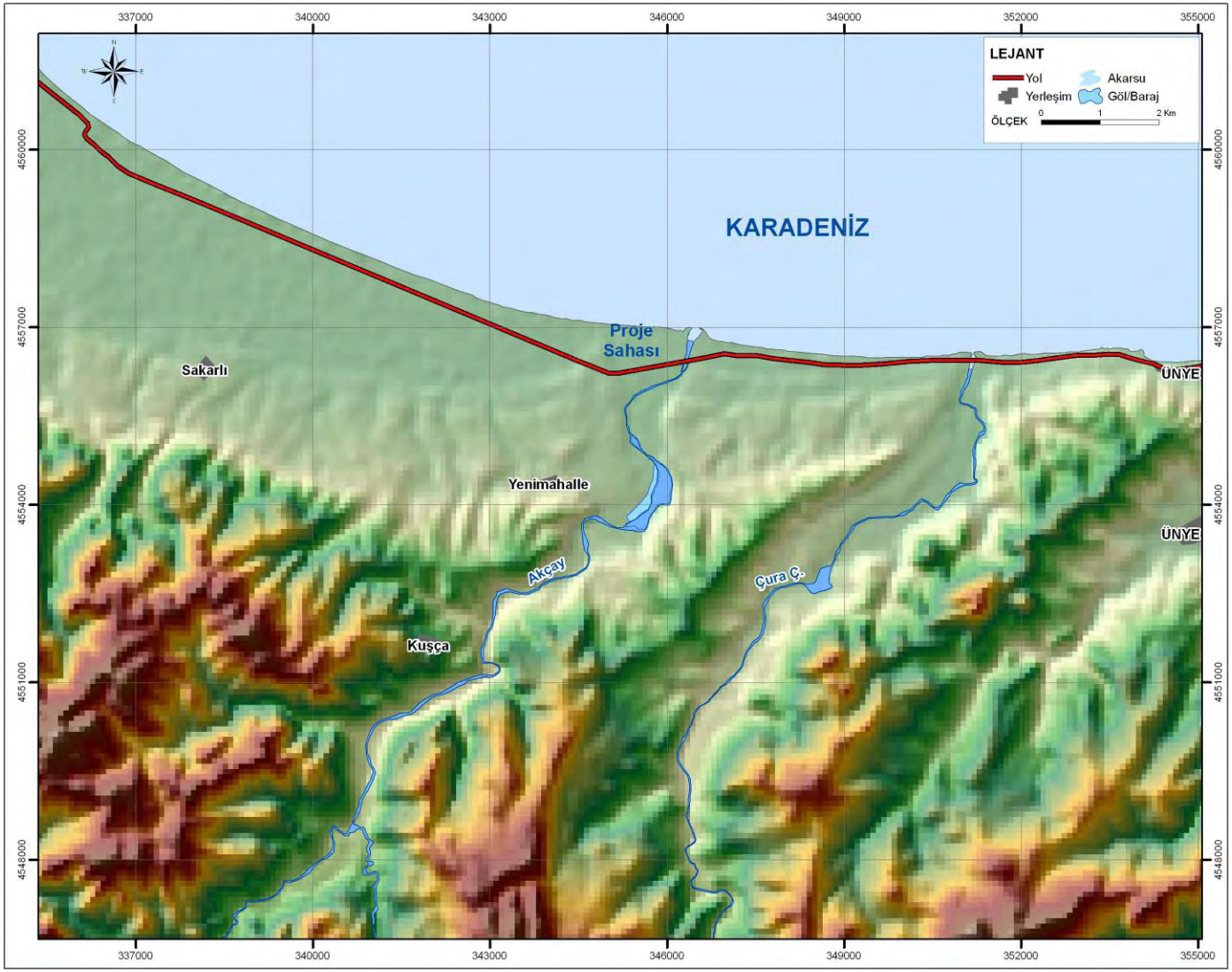


Figure II.6: Area Used in Air Quality Modelling Study

Figure II.7: South View of Project Area-1

Figure II.8: South View of Project Area-2

Figure II.9: West Coast View of Project Area

II.2 Location of the Acitivity Units within Project (Settlement plan of all administrative and social units, technical infrastructure units and other units if any, closed or open area magnitudes determined for them, floor quantities and heights of buildings, representational picture)

Stipulated Samsun Natural Gas Combined Cycle Plant has been designed as an energy plant with 890 MWe power and in which natural gas to be used as fuel. Economical life of the facility is stipulated as 30 years. Net thermal efficiency to be obtained from the system is proximately %58,01.

Plant will be composed of two units, in each of these units there will be two (2) Single Shaft 109B designed and produced by General Electric (GE) with proximately 45 MWe power. On every Single Shaft 109B unit, there will be as main equipment;

- One gas turbine,
- One steam turbine,
- A common generator on which shafts of one gas turbine and one steam turbine are coupled,
- One three-pressured, recirculation heated, fire-protected, horizontal gas flow waste heat boiler which provides neutral circulation,
- One condenser unit to condense turbine outlet steam,
- Control and command system,
- One step-up transformer to make generator voltage reach 380 kV,
- One internal requirement transformer,
- One natural gas fuel performance heater.

Besides, common support systems listed below will also take place in the facility:

- One auxiliary boiler,
- Demineralized water facility, raw water and demineralized water storage tanks,
- Fire water and fitler water storage tank,
- Make up water treatment system including single line demineralize system, acid feed system and caustic feed system,
- Lightening, conductor and grounding systems,
- Potable water system,
- Heat power station and systems,
- Waste water collecting, package treatment and discharge facilities,
- Pipeline to be provided connection to Petroleum Pıpelıne Cooperation natural gas pipeline branch duct,
- Water transportation lines from water stations for providing raw water and cooling water,
- Continuous emmission monitoring system,
- Electric power distribution system,
- Auxiliary transformers,
- Rain water collecting and discharge system,
- Emergency generator unit,
- Workshops and warehouses,
- Administrative building.

3D settlement plan of units to be available in the proposed facility is shown on Figure II.10. Alongwith this, layout plan and unit locations of the area are presented in Appendix-4. Informations regarding sizing activity units to be available in the facility are given on Table II.1.

Table II.1: Quantities and Dimensions of the Units

Ünit	Qty	Length (m)	Width (m)	Height (m)
Chimney	2	-	6,9 (Diameter)	60,0
Water Vapor Sample Panel	2	4,3	2,5	3,0
Chemical Dosing Section	2	9,0	4,3	3,7
Continuous Emmission Monitoring System	2	3,7	2,5	3,0
Electric Building	2	6,0	4,0	3,7
Auxiliary Boiler	1	-	1,0 (Diameter)	35,0
Auxiliary Boiler Electric Building	1	6,0	3,0	3,7
Electric Roomı/Electronic Room	2	40,0	15,0	8,0
Emergency Diesel Generator	1	5,5	2,3	2,3
Water Treatment Building	1	21,3	18,3	6,0
Fire Pumps Unit	1	7,6	4,3	3,7
Chemical Discharge and Storage Building	1	10,7	7,6	3,7
Control Building	1	72,0	15,0	5,0
Administration/Maintenance/Storage Building	1	46,0	18,3	6,0
Security Building	1	9,0	9,0	3,7

Figure II.10: Settlement Plan (3D)

III. ECONOMIC AND SOCIAL DIMENSIONS OF THE PROJECT

III.1 Investment Programme and Financial Resources Concerning Materialization of the Project

Proposed Samsun Natural Gas Combined Cycle Plant Project has been planned to be done by BORASCO. Invesment cost of the proposed Project is approximately €499 Million (566 €/MW; see Table III.1). As for Fixed opeating costs have been stipulated as to be €10 Million for every year. Gas supply of the plant which is planned to have an installed capacity of 890 MW will be provided through Blue Stream Natural Gas Pipeline of Petroleum Pipelıne Cooperation.

Table III.1: Project Estimated Cost

Work Item	Cost
Facility Turn-key Cost	€378,5 Million
Auxiliary Units	€43,5 Million
Land and Field Preparation Works	€5,7 Million
Gas Connection	€0,5 Million
Energy Transmission Line	€23 Million
Project Development and Pre-Activity Expenditures	€7 Million
Engineering Services	€3 Million
Spare Parts Expenditures	€8 Million
Water Supply Construction Works	€2 Million
Miscellaneous Expenditures	€1,5 Million
Reserve Item	€27 Million
Total Investment Amount	**€499,7 Milllion**

While all kinds of local and international technical, legal, commercial research and market researches together with engineering, purchasing, bidding works required for project costs given on Table III.1 have been completed by BORASCO, all expenditure items are reflecting agreements and offers executed for the project.

Financial resources to be used for meeting project costs given on Table III.1 are given on Table III.2. In this sense, Samsun Natural Gas Combined Cycle Plant Project will be financed by means of an equity capital in amount of €99.938.000 and a project financial loan in amount of €399.752.000.

Table III.2: Financial Resources of the Project

Equity Capital (%20)	99,938,000 €
Project Financial Loan (%80)	399,752,000 €
Total	**499,690,000 €**

III.2 Flow Process Chart or Scheduling Table Related to Materialization of the Project

While scheduling table concerning stipulated project is given on Table III.3, accordingly at the early stages of the Project land preparation will be done. Afterwards starting for construction, construction erection works will be performed for approximately 14 months. The plant has been stipulated to be operationalized on December 2010. Economic life-time of the facility will be 30 years.

Table III.3: Scheduling Table

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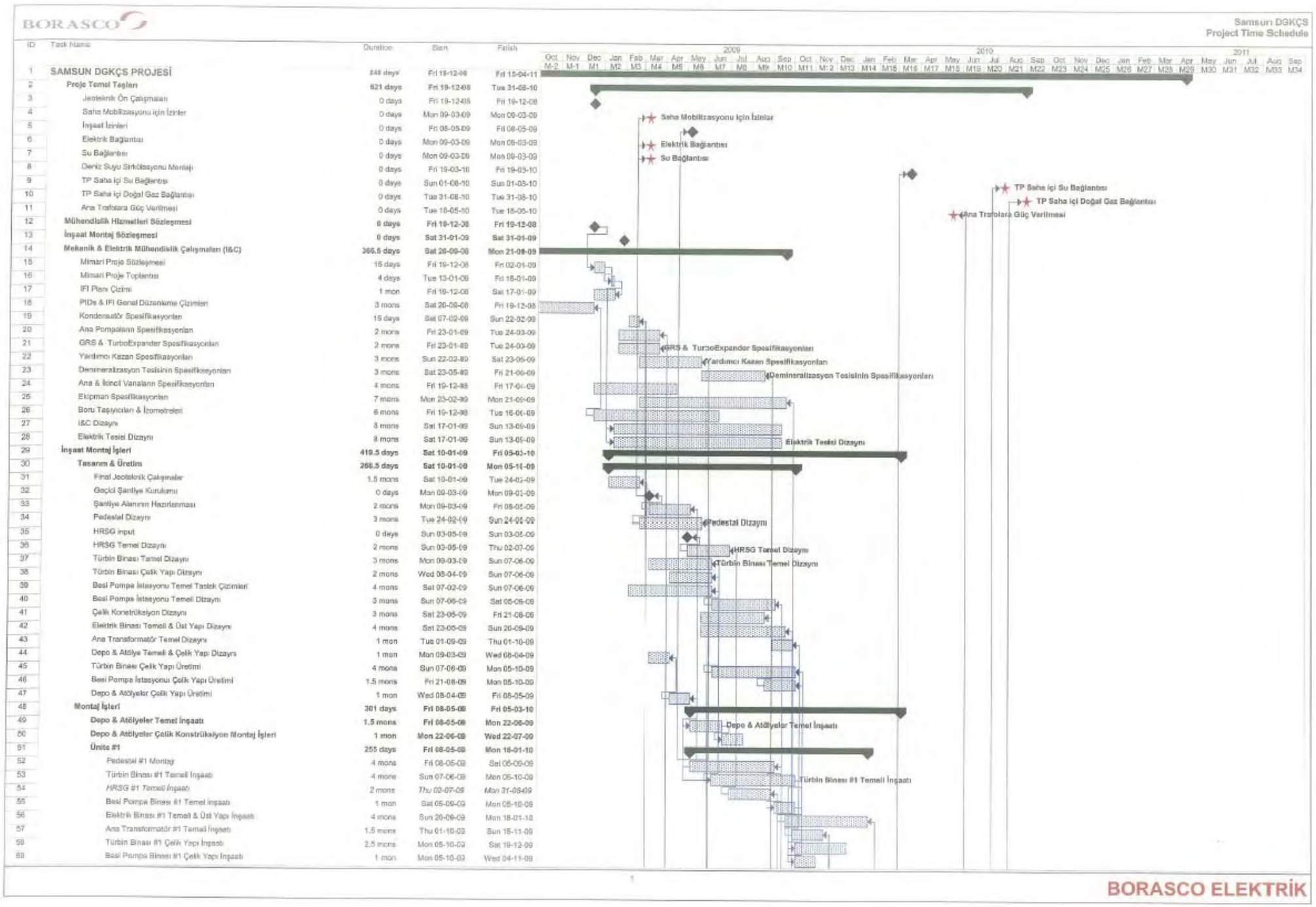
Samsun DGKÇS
Project Time Schedule

ID	Task Name	Duration	Start	Finish
1	SAMSUN DGKÇS PROJESİ	848 days	Fri 19-12-08	Fri 15-04-11
2	Proje Temel Taşları	621 days	Fri 19-12-08	Tue 31-08-10
3	Jeoteknik Ön Çalışmaları	0 days	Fri 19-12-08	Fri 19-12-08
4	Saha Mobilizasyonu için İzinler	0 days	Mon 09-03-09	Mon 09-03-09
5	İnşaat İzinleri	0 days	Fri 08-05-09	Fri 08-05-09
6	Elektrik Bağlantısı	0 days	Mon 09-03-09	Mon 09-03-09
7	Su Bağlantısı	0 days	Mon 09-03-09	Mon 09-03-09
8	Deniz Suyu Sirkülasyonu Montajı	0 days	Fri 19-03-10	Fri 19-03-10
9	TP Saha İçi Su Bağlantısı	0 days	Sun 01-08-10	Sun 01-08-10
10	TP Saha İçi Doğal Gaz Bağlantısı	0 days	Tue 31-08-10	Tue 31-08-10
11	Ana Trafolara Güç Verilmesi	0 days	Tue 18-05-10	Tue 18-05-10
12	Mühendislik Hizmetleri Sözleşmesi	0 days	Fri 19-12-08	Fri 19-12-08
13	İnşaat Montaj Sözleşmesi	0 days	Sat 31-01-09	Sat 31-01-09
14	Mekanik & Elektrik Mühendislik Çalışmaları (I&C)	366.5 days	Sat 26-09-08	Mon 21-09-09
15	Mimari Proje Sözleşmesi	15 days	Fri 19-12-08	Fri 02-01-09
16	Mimari Proje Toplantısı	4 days	Tue 13-01-09	Fri 16-01-09
17	IFI Planı Çizimi	1 mon	Fri 19-12-08	Sat 17-01-09
18	PIDs & IFI Genel Düzenleme Çizimleri	3 mons	Sat 26-09-08	Fri 19-12-08
19	Kondensatör Spesifikasyonları	15 days	Sat 07-02-09	Sun 22-02-09
20	Ana Pompaların Spesifikasyonları	2 mons	Fri 23-01-09	Tue 24-03-09
21	GRS & TurboExpander Spesifikasyonları	2 mons	Fri 23-01-09	Tue 24-03-09
22	Yardımcı Kazan Spesifikasyonları	3 mons	Sun 22-02-09	Sat 23-05-09
23	Demineralizasyon Tesisinin Spesifikasyonları	3 mons	Sat 23-05-09	Fri 21-08-09
24	Ana & İkincil Vanaların Spesifikasyonları	4 mons	Fri 19-12-08	Fri 17-04-09
25	Ekipman Spesifikasyonları	7 mons	Mon 23-02-09	Mon 21-09-09
26	Boru Taşıyıcıları & İzometreleri	6 mons	Fri 19-12-08	Tue 18-08-09
27	I&C Dizaynı	8 mons	Sat 17-01-09	Sun 13-09-09
28	Elektrik Tesisi Dizaynı	8 mons	Sat 17-01-09	Sun 13-09-09
29	İnşaat Montaj İşleri	419.5 days	Sat 10-01-09	Fri 05-03-10
30	Tasarım & Üretim	268.5 days	Sat 10-01-09	Mon 05-10-09
31	Final Jeoteknik Çalışmalar	1.5 mons	Sat 10-01-09	Tue 24-02-09
32	Geçici Şantiye Kurulumu	0 days	Mon 09-03-09	Mon 09-03-09
33	Şantiye Alanının Hazırlanması	2 mons	Mon 09-03-09	Fri 08-05-09
34	Pedestal Dizaynı	3 mons	Tue 24-02-09	Sun 24-05-09
35	HRSG input	0 days	Sun 03-05-09	Sun 03-05-09
36	HRSG Temel Dizaynı	2 mons	Sun 03-05-09	Thu 02-07-09
37	Türbin Binası Temel Dizaynı	3 mons	Mon 09-03-09	Sun 07-06-09
38	Türbin Binası Çelik Yapı Dizaynı	2 mons	Wed 08-04-09	Sun 07-06-09
39	Besi Pompa İstasyonu Temel Taslak Çizimleri	4 mons	Sat 07-02-09	Sun 07-06-09
40	Besi Pompa İstasyonu Temeli Dizaynı	3 mons	Sun 07-06-09	Sat 05-09-09
41	Çelik Konstrüksiyon Dizaynı	3 mons	Sat 23-05-09	Fri 21-08-09
42	Elektrik Binası Temeli & Üst Yapı Dizaynı	4 mons	Sat 23-05-09	Sun 20-09-09
43	Ana Transformatör Temel Dizaynı	1 mon	Tue 01-09-09	Thu 01-10-09
44	Depo & Atölye Temeli & Çelik Yapı Dizaynı	1 mon	Mon 09-03-09	Wed 08-04-09
45	Türbin Binası Çelik Yapı Üretimi	4 mons	Sun 07-06-09	Mon 05-10-09
46	Besi Pompa İstasyonu Çelik Yapı Üretimi	1.5 mons	Fri 21-08-09	Mon 05-10-09
47	Depo & Atölyeler Çelik Yapı Üretimi	1 mon	Wed 08-04-09	Fri 08-05-09
48	Montaj İşleri	301 days	Fri 08-05-09	Fri 05-03-10
49	Depo & Atölyeler Temel İnşaatı	1.5 mons	Fri 08-05-09	Mon 22-06-09
50	Depo & Atölyeler Çelik Konstrüksiyon Montaj İşleri	1 mon	Mon 22-06-09	Wed 22-07-09
51	Ünite #1	255 days	Fri 08-05-09	Mon 18-01-10
52	Pedestal #1 Montaj	4 mons	Fri 08-05-09	Sat 05-09-09
53	Türbin Binası #1 Temeli İnşaatı	4 mons	Sun 07-06-09	Mon 05-10-09
54	*HRSG #1 Temeli İnşaatı*	2 mons	*Thu 02-07-09*	*Mon 31-08-09*
55	Besi Pompa Binası #1 Temel İnşaatı	1 mon	Sat 05-09-09	Mon 05-10-09
56	Elektrik Binası #1 Temeli & Üst Yapı İnşaatı	4 mons	Sun 20-09-09	Mon 18-01-10
57	Ana Transformatör #1 Temeli İnşaatı	1.5 mons	Thu 01-10-09	Sun 15-11-09
58	Türbin Binası #1 Çelik Yapı İnşaatı	2.5 mons	Mon 05-10-09	Sat 19-12-09
59	Besi Pompa Binası #1 Çelik Yapı İnşaatı	1 mon	Mon 05-10-09	Wed 04-11-09



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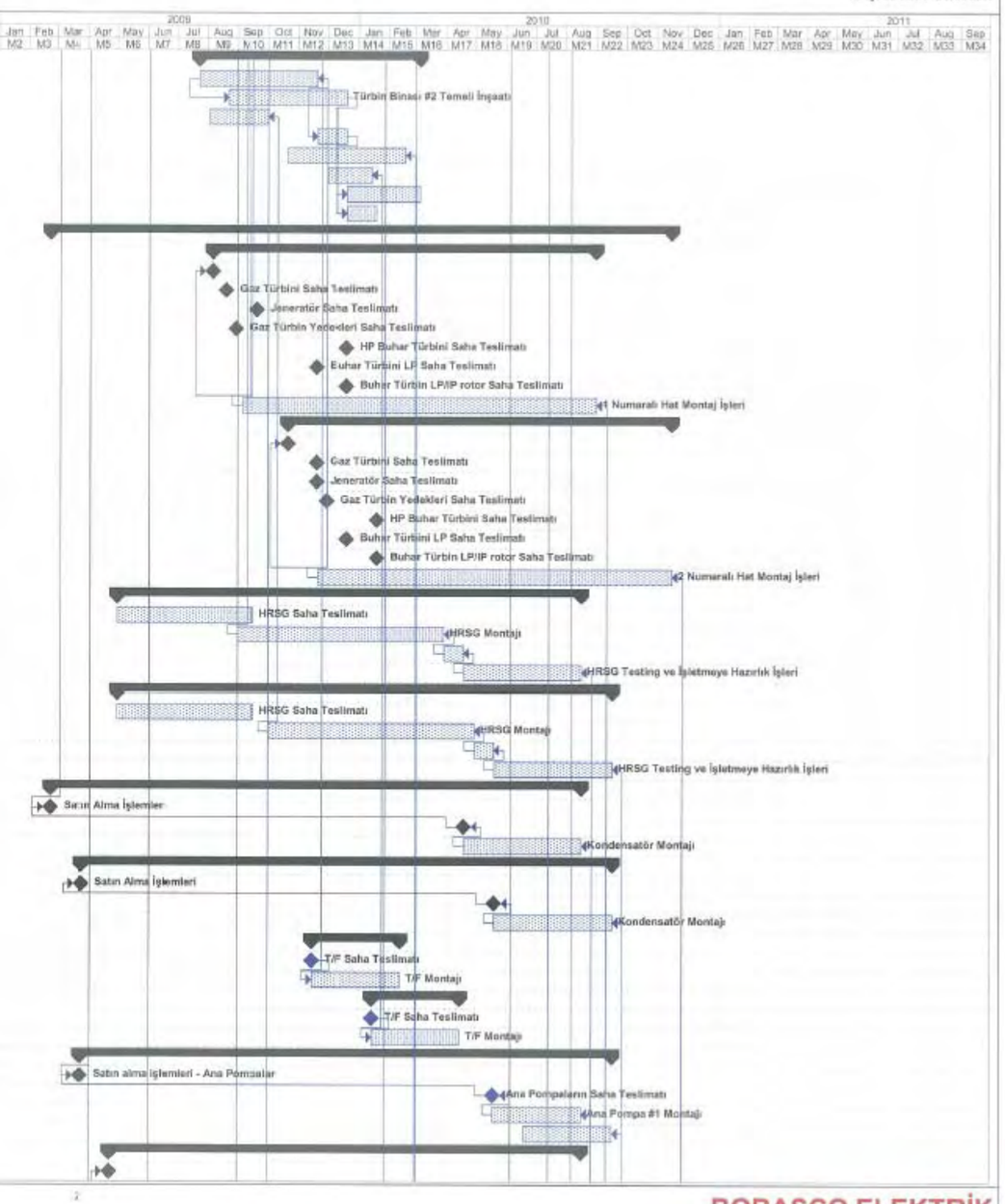
Samsun DGKÇS
Project Time Schedule

ID	Task Name	Duration	Start	Finish
60	Ünite #2	225 days	Thu 23-07-09	Fri 05-03-10
61	Pedestal #2 Montajı	4 mons	Thu 23-07-09	Fri 20-11-09
62	Türbin Binası #2 Temeli İnşaatı	4 mons	Sat 22-08-09	Sun 20-12-09
63	HRSG #2 Temeli İnşaatı	2 mons	Sun 02-08-09	Thu 01-10-09
64	Besi Pompa Binası #2 Temel İnşaatı	1 mon	Fri 20-11-09	Sun 20-12-09
65	Elektrik Binası #2 Temeli & Üst Yapı İnşaatı	4 mons	Wed 21-10-09	Thu 18-02-10
66	Ana Transformatör #2 Temeli İnşaatı	1.5 mons	Tue 01-12-09	Fri 15-01-10
67	Türbin Binası #2 Çelik Yapı İnşaatı	2.5 mons	Sun 20-12-09	Fri 05-03-10
68	Besi Pompa Binası #2 Çelik Yapı İnşaatı	1 mon	Sun 20-12-09	Tue 19-01-10
69	**Mekanik & Elektrik İşleri**	**631 days?**	**Sun 22-02-09**	**Mon 15-11-10**
70	**1 numaralı hat**	**390 days**	**Thu 06-08-09**	**Tue 31-08-10**
71	Güç Ünitesi Baz Plaka Montajları	0 days	Thu 06-08-09	Thu 06-08-09
72	Gaz Türbini Saha Teslimatı	0 days	Thu 20-08-09	Thu 20-08-09
73	Jeneratör Saha Teslimatı	0 days	Sun 20-09-09	Sun 20-09-09
74	Gaz Türbin Yedekleri Saha Teslimatı	0 days	Sun 30-08-09	Sun 30-08-09
75	HP Buhar Türbini Saha Teslimatı	0 days	Sun 20-12-09	Sun 20-12-09
76	Buhar Türbini LP Saha Teslimatı	0 days	Fri 20-11-09	Fri 20-11-09
77	Buhar Türbin LP/IP rotor Saha Teslimatı	0 days	Sun 20-12-09	Sun 20-12-09
78	1 Numaralı Hat Montaj İşleri	12 mons	Sat 05-09-09	Tue 31-08-10
79	**2 Numaralı Hat**	**390 days**	**Wed 21-10-09**	**Mon 15-11-10**
80	Güç Ünitesi Baz Plaka Montajları	0 days	Wed 21-10-09	Wed 21-10-09
81	Gaz Türbini Saha Teslimatı	0 days	Fri 20-11-09	Fri 20-11-09
82	Jeneratör Saha Teslimatı	0 days	Fri 20-11-09	Fri 20-11-09
83	Gaz Türbin Yedekleri Saha Teslimatı	0 days	Mon 30-11-09	Mon 30-11-09
84	HP Buhar Türbini Saha Teslimatı	0 days	Wed 20-01-10	Wed 20-01-10
85	Buhar Türbini LP Saha Teslimatı	0 days	Sun 20-12-09	Sun 20-12-09
86	Buhar Türbin LP/IP rotor Saha Teslimatı	0 days	Wed 20-01-10	Wed 20-01-10
87	2 Numaralı Hat Montaj İşleri	12 mons	Fri 20-11-09	Mon 15-11-10
88	**HRSG#1**	**472.5 days**	**Fri 01-05-09**	**Mon 16-08-10**
89	HRSG Saha Teslimatı	4.5 mons	Fri 01-05-09	Tue 15-09-09
90	HRSG Montajı	7 mons	Mon 31-08-09	Mon 29-03-10
91	HRSG Hidrolik Basınç Testi	20 days	Mon 29-03-10	Sun 18-04-10
92	HRSG Testing ve İşletmeye Hazırlık İşleri	4 mons	Sun 18-04-10	Mon 16-08-10
93	**HRSG#2**	**503.5 days**	**Fri 01-05-09**	**Thu 16-09-10**
94	HRSG Saha Teslimatı	4.5 mons	Fri 01-05-09	Tue 15-09-09
95	HRSG Montajı	7 mons	Thu 01-10-09	Thu 29-04-10
96	HRSG Hidrolik Basınç Testi	20 days	Thu 29-04-10	Wed 19-05-10
97	HRSG Testing ve İşletmeye Hazırlık İşleri	4 mons	Wed 19-05-10	Thu 16-09-10
98	**Kondensatör #1**	**540 days**	**Sun 22-02-09**	**Mon 16-08-10**
99	Satın Alma İşlemleri	0 days	Sun 22-02-09	Sun 22-02-09
100	Kondensatör Saha Teslimatı	0 mons	Sun 18-04-10	Sun 18-04-10
101	Kondensatör Montajı	4 mons	Sun 18-04-10	Mon 16-08-10
102	**Kondensatör #2**	**540 days**	**Wed 25-03-09**	**Thu 16-09-10**
103	Satın Alma İşlemleri	0 days	Wed 25-03-09	Wed 25-03-09
104	Kondensatör Saha Teslimatı	0 mons	Wed 19-05-10	Wed 19-05-10
105	Kondensatör Montajı	4 mons	Wed 19-05-10	Thu 16-09-10
106	**Ana Transformatör #1**	**90 days**	**Sun 15-11-09**	**Fri 12-02-10**
107	T/F Saha Teslimatı	0 days	Sun 15-11-09	Sun 15-11-09
108	T/F Montajı	3 mons	Sun 15-11-09	Fri 12-02-10
109	**Ana Transformatör #2**	**90 days**	**Fri 15-01-10**	**Wed 14-04-10**
110	T/F Saha Teslimatı	0 days	Fri 15-01-10	Fri 15-01-10
111	T/F Montajı	3 mons	Fri 15-01-10	Wed 14-04-10
112	**Ana Pompalar**	**541 days**	**Tue 24-03-09**	**Thu 16-09-10**
113	Satın alma işlemleri - Ana Pompalar	0 days	Tue 24-03-09	Tue 24-03-09
114	Ana Pompaların Saha Teslimatı	0 days	Tue 18-05-10	Tue 18-05-10
115	Ana Pompa #1 Montajı	3 mons	Tue 18-05-10	Mon 16-08-10
116	Ana Pompa #2 Montajı	3 mons	Fri 18-06-10	Thu 16-09-10
117	**Deniz Suyu Sirkülasyon Hatları**	**480 days**	**Thu 23-04-09**	**Mon 16-08-10**
118	DSS Ekipmanı Satın Alma İşlemleri	0 days	Thu 23-04-09	Thu 23-04-09



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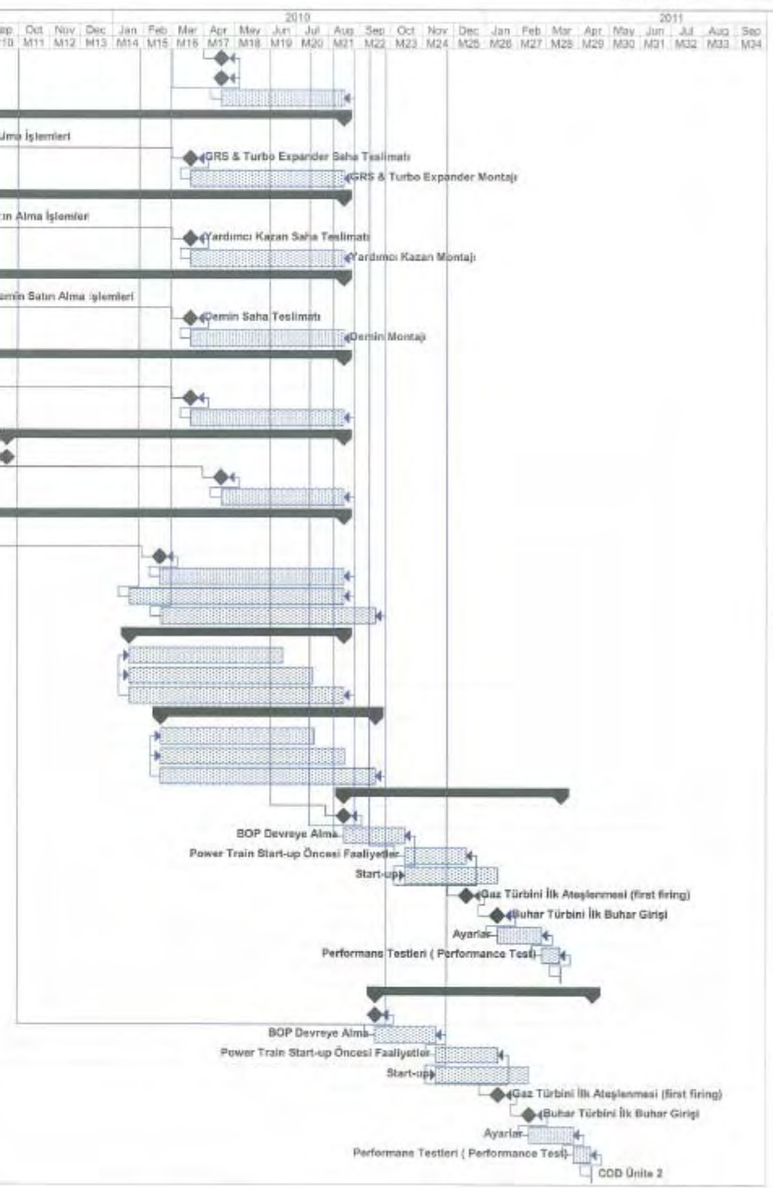
Samsun DGKÇS
Project Time Schedule

ID	Task Name	Duration	Start	Finish
119	Pompa Saha Teslimatı	0 days	Sun 18-04-10	Sun 18-04-10
120	Filtreleme Sistemi Saha Teslimatı	0 days	Sun 18-04-10	Sun 18-04-10
121	DSS Ekipmanı Montajı	4 mons	Sun 18-04-10	Mon 16-08-10
122	**GRS & Turbo Expander**	**510 days**	**Tue 24-03-09**	**Mon 16-08-10**
123	GRS & Turbo Expander Satın Alma İşlemleri	0 days	Tue 24-03-09	Tue 24-03-09
124	GRS & Turbo Expander Saha Teslimatı	0 days	Fri 19-03-10	Fri 19-03-10
125	GRS & Turbo Expander Montajı	5 mons	Fri 19-03-10	Mon 16-08-10
126	**Yardımcı Kazanlar**	**450 days**	**Sat 23-05-09**	**Mon 16-08-10**
127	Yardımcı Kazan Satın Alma İşlemleri	0 days	Sat 23-05-09	Sat 23-05-09
128	Yardımcı Kazan Saha Teslimatı	0 days	Fri 19-03-10	Fri 19-03-10
129	Yardımcı Kazan Montajı	5 mons	Fri 19-03-10	Mon 16-08-10
130	**Demineralizasyon Tesisi**	**360 days**	**Fri 21-08-09**	**Mon 16-08-10**
131	Demin Satın Alma İşlemleri	0 days	Fri 21-08-09	Fri 21-08-09
132	Demin Saha Teslimatı	0 days	Fri 19-03-10	Fri 19-03-10
133	Demin Montajı	5 mons	Fri 19-03-10	Mon 16-08-10
134	**Basınçlı Hava Tesisi**	**360 days?**	**Fri 21-08-09**	**Mon 16-08-10**
135	Basınçlı Hava Satın Alma İşlemleri	1 day?	Fri 21-08-09	Sat 22-08-09
136	Basınçlı Hava Saha Teslimatı	0 days	Fri 19-03-10	Fri 19-03-10
137	Basınçlı Hava Montajı	5 mons	Fri 19-03-10	Mon 16-08-10
138	**Örnek & Dozajlama Tesisi**	**330 days**	**Sun 20-09-09**	**Mon 16-08-10**
139	Örnek & Dozajlama Satın Alma İşlemleri	0 days	Sun 20-09-09	Sun 20-09-09
140	Örnek & Dozajlama Saha Teslimatı	0 days	Sun 18-04-10	Sun 18-04-10
141	Örnek & Dozajlama Montajı	4 mons	Sun 18-04-10	Mon 16-08-10
142	**Isıtma, Havalandırma ve Soğutma (HVAC) & Yangın Söndürme**	**390 days**	**Wed 22-07-09**	**Mon 16-08-10**
143	HVAC & Yangın Söndürme Satın Alma İşlemleri	0 days	Wed 22-07-09	Wed 22-07-09
144	HVAC & Yangın Söndürme Saha Teslimatı	0 days	Wed 17-02-10	Wed 17-02-10
145	HVAC & Yangın Söndürme Montajı	6 mons	Wed 17-02-10	Mon 16-08-10
146	**Elektrik Binası #1 iç elektrik montajı**	**7 mons**	**Mon 18-01-10**	**Mon 16-08-10**
147	**Elektrik Binası #2 iç elektrik montajı**	**7 mons**	**Thu 18-02-10**	**Thu 16-09-10**
148	**BOP Sistemleri 1 Numaralı Hat**	**210 days**	**Mon 18-01-10**	**Mon 16-08-10**
149	Ana Vanaların Saha Teslimatı	5 mons	Mon 18-01-10	Thu 17-06-10
150	Boru Malzemelerinin Saha Teslimatı	6 mons	Mon 18-01-10	Sat 17-07-10
151	Mekanik & Elektrik Montajı #1	7 mons	Mon 18-01-10	Mon 16-08-10
152	**BOP Sistemleri 2 Numaralı Hat**	**210 days**	**Thu 18-02-10**	**Thu 16-09-10**
153	Ana Vanaların Saha Teslimatı	5 mons	Thu 18-02-10	Sun 18-07-10
154	Boru Malzemelerinin Saha Teslimatı	6 mons	Thu 18-02-10	Tue 17-08-10
155	Mekanik & Elektrik Montajı #2	7 mons	Thu 18-02-10	Thu 16-09-10
156	**Ünite 1 Start-up İşlemleri**	**211.5 days**	**Mon 16-08-10**	**Tue 15-03-11**
157	MV Şalt Enerjileme	0 days	Mon 16-08-10	Mon 16-08-10
158	BOP Devreye Alma	2 mons	Mon 16-08-10	Fri 15-10-10
159	Power Train Start-up Öncesi Faaliyetler	2 mons	Fri 15-10-10	Tue 14-12-10
160	Start-up	3 mons	Fri 15-10-10	Thu 13-01-11
161	Gaz Türbini İlk Ateşlenmesi (first firing)	0 days	Tue 14-12-10	Tue 14-12-10
162	Buhar Türbini İlk Buhar Girişi	0 days	Thu 13-01-11	Thu 13-01-11
163	Ayarlar	1.45 mons	Thu 13-01-11	Sat 26-02-11
164	Performans Testleri (Performance Test)	17 days	Sat 26-02-11	Tue 15-03-11
165	**COD Ünite 1**	**1 day**	**Tue 15-03-11**	**Tue 15-03-11**
166	**Ünite 2 Start-up İşlemleri**	**211.5 days**	**Thu 16-09-10**	**Fri 15-04-11**
167	MV Şalt Enerjileme	0 days	Thu 16-09-10	Thu 16-09-10
168	BOP Devreye Alma	2 mons	Thu 16-09-10	Mon 15-11-10
169	Power Train Start-up Öncesi Faaliyetler	2 mons	Mon 15-11-10	Fri 14-01-11
170	Start-up	3 mons	Mon 15-11-10	Sun 13-02-11
171	Gaz Türbini İlk Ateşlenmesi (first firing)	0 days	Fri 14-01-11	Fri 14-01-11
172	Buhar Türbini İlk Buhar Girişi	0 days	Sun 13-02-11	Sun 13-02-11
173	Ayarlar	1.45 mons	Sun 13-02-11	Tue 29-03-11
174	Performans Testleri (Performance Test)	17 days	Tue 29-03-11	Fri 15-04-11
175	**COD Ünite 2**	**1 day**	**Fri 15-04-11**	**Fri 15-04-11**



3

BORASCO ELEKTRİK

III.3 Cost-Benefit Analysis of the Project

In the calculations maden for assessment of the project economically following parameters and acceptions have been based upon:

Energy Plant Facility Amount	: 421.990.000 €
Other Investments (Infrastructure, License etc)	: 77.700.000 €
Total Investment Amount	: 499.690.000 €
Electric Energy Unit Sale Price**	: 7,4 € cent/kW.hour
Annual Electric EnergySales Amount**	: 6395 GWhour
Annual Total Revenue Amount**	: 476.483.000 €
Annual Corporate Tax Payable**	: 6.912.000 €/year
Laboring Wages and Gen. Admin. Expenses**	: 13.285.000 €/year
Fuel Expenditure**	: 378.684.000 €/year
Local Service Procurements Total-Annual**	: 1.500.000 €/year
Annual Net Profit of the Project**	: 27.648.000 €
Net Present Value of the Project (NPV)	: 149.000.000 €
Investment Return on Ratio (IRR)	: %22,32
Investment Return on Period	: 5,5 yıl

*** Average of 20 years*

Throughout 30 years of Project operating period, average annual operatinbg costs have been stipulated as €53.570.000 and payrolls of the labourers have been stipulated as €4.000.000.

Similarly, “Financial Viability” described as the ratio of net profit to equity capital after tax on yearly basis is considerably high. Additionally, “Return on Investment” described as the ratio of net profit to total investment amount also gives high values.

When income-expenditure assessment is performed on cost-benefit analysis table, annuak total revenue amount is approximately €476.483.000 and Annual Corporate Tax Payable, Labouring Wages and General Administrative Expenses, Fuel Expenses, Local Service Procurements Total is being €400.381.000. As a consequence of all assessments done, it seems that proposed Samsun Natural Gas Combined Cycle Plant will contribute to the national economy.

III.4 Other Economic, Social and Infrastructural Activities Not to be in the Scope of the Project but Depending on Materialization of the Project Planned to be Executed by Investor Company or Other Companies

In addition to the main services such as food, service, quartering etc to be provided from local resources for life of the facility to be established along with the construction period, because of procurement of the labor force from the territory if possible, if not possible settlement of them in Samsun Province and/or Çarşamba/Terme districts from outside, a beef-up for the local economy is stipulated. Besides, in order to meet the qualified staff requirement of the facility, some education programmes will be opened. Technical, social and economic infrastructural activities planned fort the proposed project are explained in the below sub-titles.

III.4.1 Water Supply and Waste Water Treatment

Domestic water requirement of Proposed Samsun Natural Gas Combined Cycle Plant

Project to be arised at the construction stage will be supplied from groundwater pits which has already been opened and currently been using in the region. Potable water will be provided from market piyasadan (pet water, demijohn, tanker, etc.).

Domestic water required for the personnel to be worked continuously during operating stage will be supplied from groundwater pits which has already been opened and currently been using in the region. The domestic waste water to be constituted will be discharged to the sea following the treatment unit with waste water derived from the units. Discharge will be executed as deepwater discharge and detailed information regarding dishcrage structure is given in Section V.2.6. Discharge line is stipulated as proximately 400m. Last 100 m of the line will be composed of diffuser structure.

As for the cooling water to be used in plant's process will be supplied from the sea and will be again discharged to the sea.

III.4.2 Natural Gas Connection

Natural gas to be used within the plant will be supplied from Blue Stream Natural Gas Pipeline of Petroleum Pıpelıne Cooperatıon.

III.4.3 Electric Connections

Required electric during activities to be performed at construction stage will be supplied from generators and/or network in the region. As for at the operating stage, electric produced in the facility will be used.

III.4.4 Enlightening

In the open storage areas of the facility, on roads and at the main entrance doors of the plant, suitable enlightening will be ensured.

III.4.5 Park Lots and Service Roads

Roads and park lots will be stabilized coated in such a manner to keep dust emmision on roads and park lots at minimum.

III.4.6 Landscaping

For shielding purposes, afforestation will be made around the facility. Afforestation and green field arrangement works considered to be performed within and around facility field will be executed following the construction stage. Within the privacy of project and facility, for landscape works a private company will be assigned for a Project design and after this study species to be used for landscape purposes will be determined. Current flora of the region will be based upon in selection of the plant species to be proposed in the project.

III.4.7 Security System

All field stipulated as project area will be fenced in a circle fence, plant facilities will also be fenced in a security fence and entrance and exits to the facility will be controlled. Besides all required security and protection precautions will be provided.

III.4.8 Quartering

At the construction stage of the Project, prefab mass housings for singles, a dining hall, a dressing building and a health facility will be built for exregion personnel. Within the project area there will be mass housings for engineers and managers, foremen and laborers. All of the personnel to be worked at the operating stage of the plant (appr. 80 person) will house in settlement units in the territory.

III.4.9 Fire-Protection System

A protection system which will be consisted of various equipments to prevent possible fire events will be established within proposed energy plant project. Besides, there will be non-automatic fire protection systems in the facility.

III.4.10 Telephone

Required telecommunication infrastructure will be established in the project area.

III.5 Other Economic, Social and Infrastructural Activities Not to be in the Scope of the Project but Depending on Materialization of the Project Planned to be Executed by Investor Company or Other Companies

No other infrastructural facility is required except the activities mentioned in Section III.4 for materializing the proposed project.

III.6 Other Considerations

There are no other considerations to be preffered to specify in the report.

IV. DETERMINATION OF THE AREA TO BE IMPACTED BY THE PROJECT AND DESCRIPTION OF ENVIRONMENTAL CHARACTERISTICS WITHIN THIS AREA

In this section, a general assessment of current environmental condition within the working area has been made. For this purpose, the bio-physical and socio-economical data has been obtained as a result of field explorationsi measurement studies and literature researches.

IV.1 Determination of Area to be Impacted by the Project, Projection of the Area to be Impacted on the Map

Selection of the borders of working area has been determined in accordance with interaction potential of the Project with economic, social, biological and physical environment. In this sense working area of the energy plant stipulated to be built by BORASCO has been accepted as 20 km × 20 km (width × length) (see Figure II.2 and Figure II.3).

IV.2 Characteristics of Physical and Biological Environment and Usage of Natural Resources

IV.2.1 Meteorological and Climatic Characteristics (Genera and local climatic conditions of the region, topographical structure of the position in which Project takes place, monthly, seasonal and annual temperature, rainfall, relative humidity, pressure and evaporation regimes and their graphics, number of days with inversion, stationery state, wind direction and speed, annual and seasonal windmill, number of gales etc.)

Both local and regional scaled climate characteristics play an essential role in diffusion of pollutants thrown from a source in the atmosphere. Apprehension of impacts of the pollutants to the environment is possible by examining local and regional climatic conditions on which short and long term meteorological factors have an impact.

An emmission arised from incineration of natural gas within proposed project is in question. In this sense, for determination of climatic condition of the working area, closest meteorology station had been utilized. Closest station to the region is Ünye Meteorology Station with proximately 10 km distance to the Project area. Within this context, in determination of meteorological and climatic characteristics, long years (1975-2007) wind (speed and direction), temperature (average and extreme) and rainfall data recorded in Ünye Meteorology Station affiliated to General Directorate of State Meteorology Affairs (DMİ) had been used (see Appendix-5). Aforesaid meteorology station is located on 37º17' North latitude and 41º08' east longitude and has got a rise of 20 m.

General Climate Conditions in the Region

Climate of the region differs in coastal and inlands. In coastal departments influence of Karadeniz, in inlands influence of Akdağ and Canik Mountains has been observed. Region does not look like neither East nor West Karadeniz climates in terms of temperature and rainfalls. Rainfall amount is less than according to East Karadeniz region, average temperature is higher. Inlands of the region is colder because of it is far from sea effect. In the coastal departments, winters are warm, apring is foggy and chilly, summer season is arid.

Annual average temperature is 14,1ºC. Warmest month is August (average temperature 23,2ºC), coldest month is February (average temperature is 6,5ºC). Sun is very effective in July and August. Annual average total rainfall amount (1172 mm) is over country average. Region takes

the most rainfall in October. Most of the rainfall fall as rain. Rainfall amount in the east sections of the region is much than west sections.

Ünye district generally is under South-southwest winds. Speed of the winds blowing westwards has been reached to 28,6 m/sec. Average wind speed is 1,9 m/sec. In Ünye district number of annual average cloudy days is 175,9 and sunny days is 74,1. Number of average snowy days is 11,7 whilst number of snowcovered days is 11,4.

Relative humidity rate in the district (%75) is considerably over the country average. Spring season has the highest humidity rate (%81). Lowest humidity rate has been recorded (%70) in winter. Relative humidity rate of spring and summer months are respectively %75 and %77 (Ünye Meteorology Station Data, 1975-2007).

Temperature Regime

Monthly minimum, average and maximum temperature values obtained from Ünye Meteorology Station are presented on Table IV.1 and Figure IV.1. Aforesaid values include a period of 33 years 1975-2007.

Table IV.1: Ünye Meteorology Station Temperature Normalities (1975-2007)

Months	Maximum (°C)	Average (°C)	Minimum (°C)
January	23,6	7,0	-5,0
February	26,2	6,5	-5,4
March	30,3	7,7	-4,5
April	34,2	10,9	-1,0
May	28,0	15,0	3,0
June	32,7	19,8	10,0
July	32,0	22,9	13,3
August	33,0	23,2	14,3
September	35,0	19,9	9,7
October	36,1	16,0	4,3
November	27,7	11,9	-1,0
December	25,3	8,9	-2,6
Annual	**36,1**	**14,1**	**-5,4**

Source: State General Directorate of Meteorology Affairs

As it can be seen on Table IV.1, average temperature differs between 6,5ºC (February) and 23,2ºC (August). Annual average temperature is 14,1ºC. Temperature increases regularly from January to August, decreases regularly from September to December. Average temperature within the coldest months January and February does not decrease under 6,5ºC. While August is the warmest month, average temperature in this month is 23,2ºC. Maximum temperature value measured in Ünye Meteorology Station between 1975-2007 had been observed as 36,1ºC in October and lowest temperature had been observed as –5,4ºC in February.

Seasonal temperature variations according to temperature data recorded in Ünye Meteorology Station are shown in Figure IV.2.

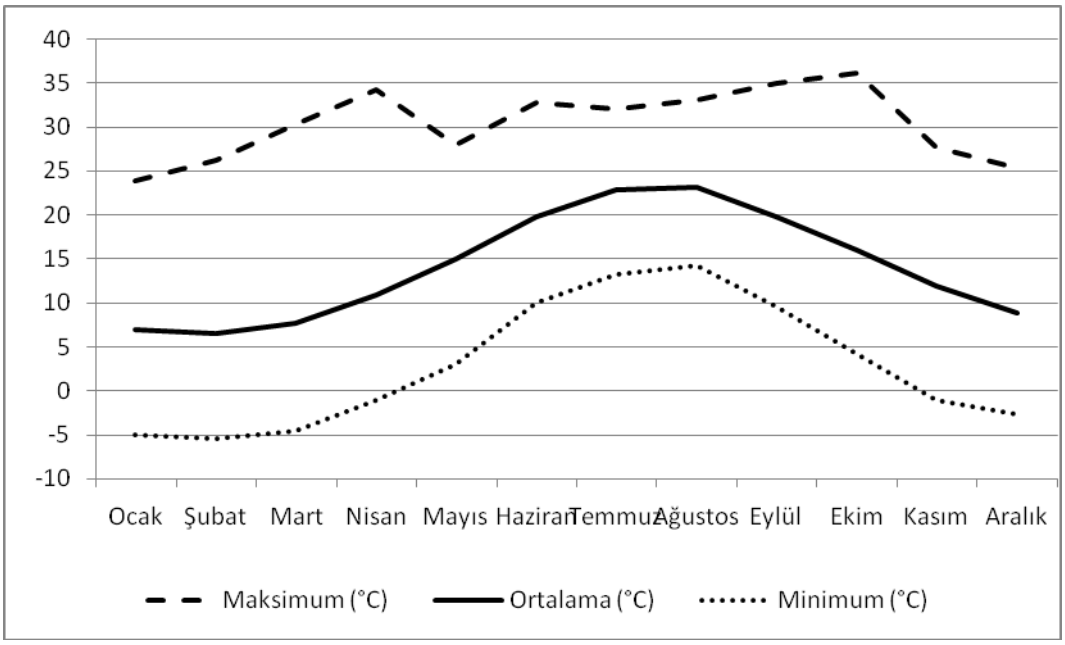


Figure IV.1: Ünye Meteorology Statıın Temperature Regimei (1975-2007)

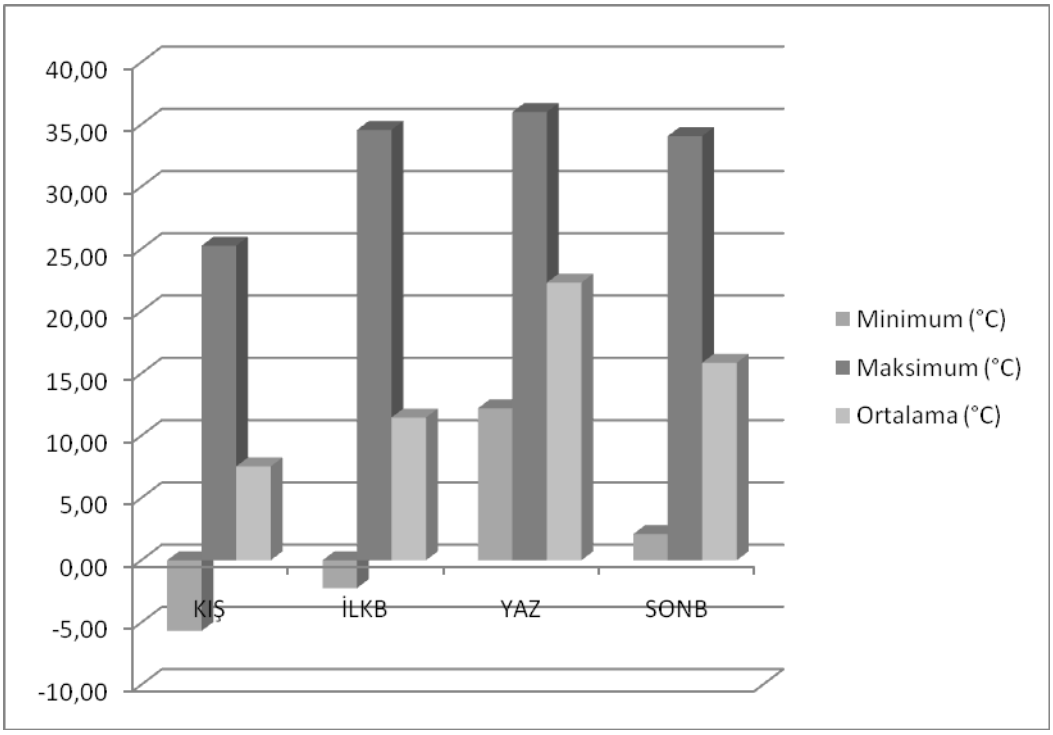


Figure IV.2: Ünye Meteorology Station Seasonal Temperature Variations (1975-2007)

Precipitation

Distribution, amount and type of recorded precipitations is essential because of it influences wet deposition of the pollutants. In assessment of precipitation in the territory, precipitation data recorded in Ünye Meteorology Station between 1975-2007 have been used. Precipitation normalities obtained according to the recorded data are shown on Table IV-2, precipitation variations are shown in Figure IV.3, average and daily most precipitation variations according to seasons are shown in Figure IV.4.

Table IV.2: Ünye Meteorology Station Precipitation Normalities (1975-2007)

Months	Average Total Precipitation (mm)	Daily Max Precipitation (mm)	Number of Days Receiving ≥ 0,1 mm Precipitation
January	105,2	58,7	14,3
February	97,0	50,6	13,7
March	88,2	38,4	14,9
April	80,7	59,6	14,3
May	60,1	47,5	12,6
June	76,8	22,4	10,2
July	66,7	126,4	8,9
August	97,9	174,6	9,5
September	92,1	97,7	10,6
October	146,1	128,2	13,6
November	139,3	81,4	13,2
December	121,3	73,7	14,5
Annual	**1172,0**	**222,4**	**150,3**

Source: State General Directorate of Meteorology Affairs

As it can be seen on Table IV-2, annual average total precipitation amount in the region is 1172,0. Season with the most precipitation is spring during which %32 of annual average precipitation is received. In winters %28 of total precipitation and in spring %21 of total precipitation are seen.

According to the data including years 1975-2007, most daily precipitation amount is 222,4 mm. Max monthly precipitation average has recorded in October (146,7 mm) and min precipitation average has recorded in May (60,1 mm). Number of annual average rainy days is 150,3.

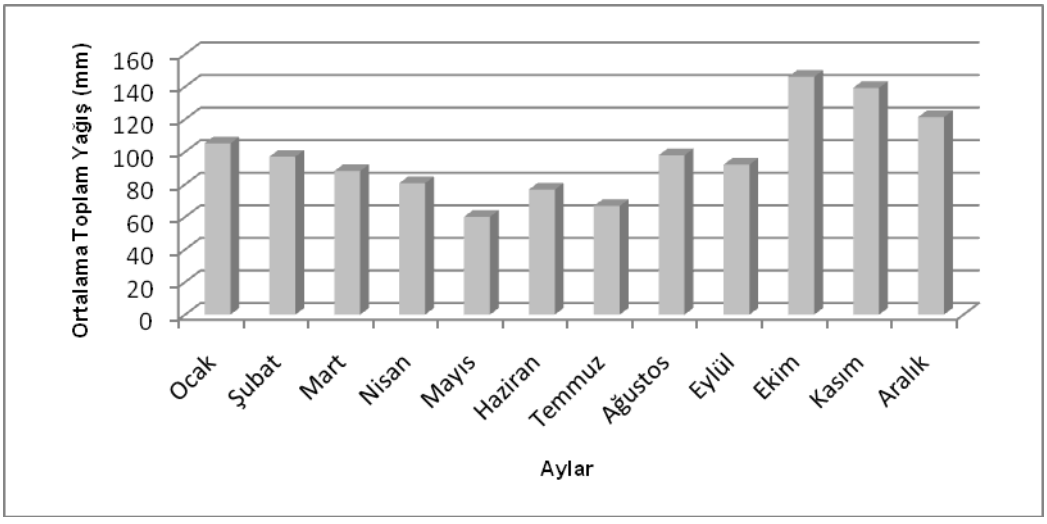


Figure IV.3: Precipitation Variations Recorded in Ünye Meteorology Station (1975-2007)

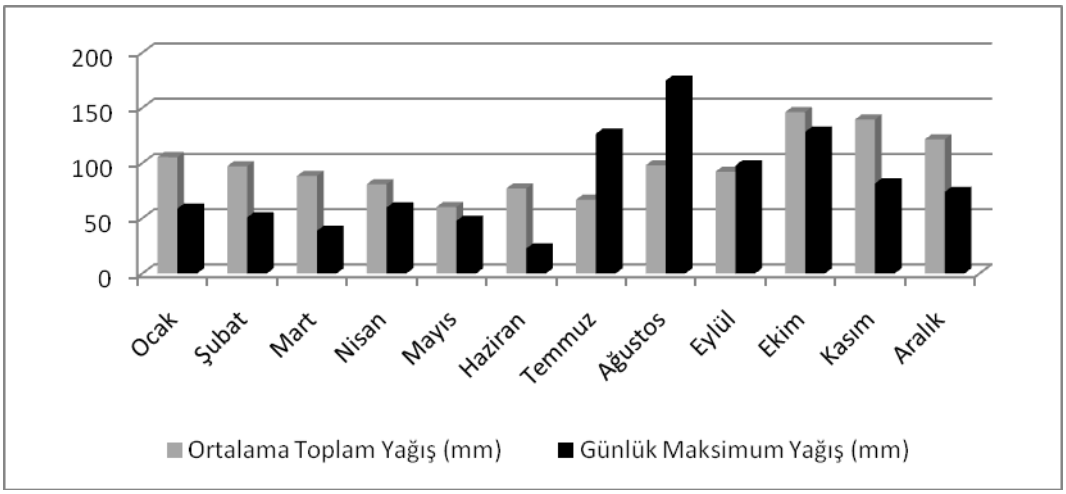


Figure IV.4: Ünye Meteorology Station Monthly Average Precipitations (1975-2007)

Wind Direction and Speed

According to the measurements made in Ünye Meteorology Station between 1975-2007, distribution of wind blow speeds (m/sec) as per directions is shown on Table IV.3, number of blow as per directions is shown on Table IV.4. Accordingly, prevailing winds within the year are in South-southwest (SSW) direction (%15,3) and west-southwest (WSW) direction (%15,1), while average wnd speeds of these directions are respectively 1,7 m/sec and 2,1 m/sec.

Long-year wind chart obtained by using blow speeds as per directions is shown on Figure IV-5, wind chart obtained acc. to blow numbers is shown on Figure IV.6.

Table IV.3: Ünye Meteorology Station Average Blow Speeds of Winds As Per Directions (m/sec)

Directions	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
N	2,2	2,2	2,1	1,7	1,4	1,9	2,1	2,2	2,3	2,1	2,0	2,1	2,0
NNE	1,5	1,9	1,9	1,3	1,5	1,5	1,8	1,9	1,7	1,9	1,7	1,9	1,7
NE	1,6	1,9	1,6	1,5	1,7	1,5	1,4	1,8	1,7	1,7	1,6	1,3	1,6
ENE	2,7	3,2	3,0	2,8	2,4	2,5	2,8	2,6	3,2	2,8	2,5	2,5	2,7
E	2,0	2,3	2,6	2,5	2,2	2,1	2,3	3,1	2,8	2,6	2,5	1,8	2,4
ESE	2,0	1,7	2,1	1,9	1,7	1,6	1,7	1,7	1,6	1,7	1,7	1,8	1,8
SE	1,5	1,6	1,9	1,6	1,4	1,4	1,5	1,5	1,8	1,5	1,6	1,5	1,6
SSE	1,6	1,6	1,7	1,5	1,2	1,2	1,1	1,2	1,2	1,4	1,5	1,4	1,4
S	2,0	1,9	1,7	1,6	1,4	1,3	1,4	1,4	1,4	1,4	1,4	1,7	1,5
SSW	1,9	1,9	1,7	1,7	1,5	1,6	1,6	1,7	1,7	1,7	1,7	1,8	1,7
SW	1,9	1,9	1,8	1,4	1,3	1,4	1,4	1,4	1,6	1,6	1,6	1,8	1,6
WSW	2,2	2,3	2,1	2,0	1,8	2,0	2,1	2,1	2,0	2,1	2,1	2,2	2,1
W	2,4	2,6	2,4	2,3	2,0	2,0	2,3	2,4	2,4	2,3	2,1	2,3	2,3
WNW	1,9	2,1	2,1	1,9	1,7	1,8	1,9	2,0	1,9	1,7	1,7	1,7	1,9
NW	1,7	2,0	2,0	1,6	1,6	2,2	2,4	2,4	2,5	2,1	2,2	1,7	2,0
NNW	1,9	2,0	2,2	1,5	1,6	1,9	2,2	2,4	2,5	2,3	2,2	2,0	2,1

Table IV.4: Ünye Meteorology Station Total of Wind Blow Numbers As Per Directions (m/sec)

Directions	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
N	75	80	78	72	100	100	180	157	143	93	61	63	1202
NNE	78	86	91	99	99	116	110	142	117	109	72	65	1184
NE	44	46	58	51	69	68	71	67	72	48	31	52	677
ENE	100	125	222	261	289	293	192	190	249	240	127	106	2394

E	74	96	105	133	184	182	90	77	100	118	115	79	1353
ESE	94	96	193	261	325	186	89	72	46	93	129	112	1696
SE	78	101	127	153	182	115	102	53	45	74	84	90	1204
SSE	148	146	241	221	175	187	140	115	102	97	155	157	1884
S	183	180	144	125	95	144	123	169	196	179	218	193	1949
SSW	555	418	300	208	215	276	360	522	643	648	580	585	5310
SW	319	209	178	138	132	169	249	304	312	347	311	370	3038
WSW	529	457	409	328	332	319	543	466	400	430	440	585	5238
W	273	299	314	318	282	235	228	200	179	214	234	234	3010
WNW	167	140	235	209	213	181	122	91	74	102	123	142	1799
NW	91	84	92	108	137	130	116	95	72	73	89	88	1175
NNW	119	95	117	110	136	190	213	202	134	119	110	82	1627

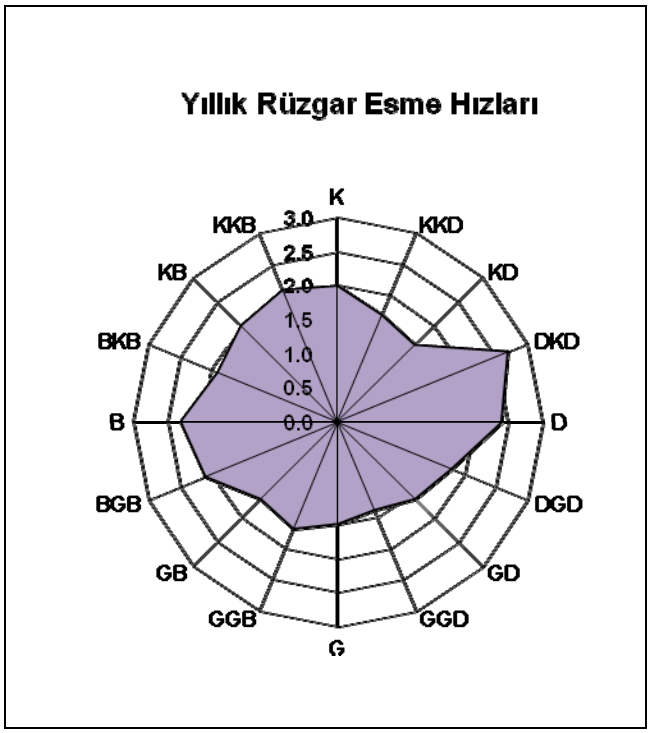


Figure IV.5: Ünye Meteorology Station Long Years Wind Chart (As per blow speeds)

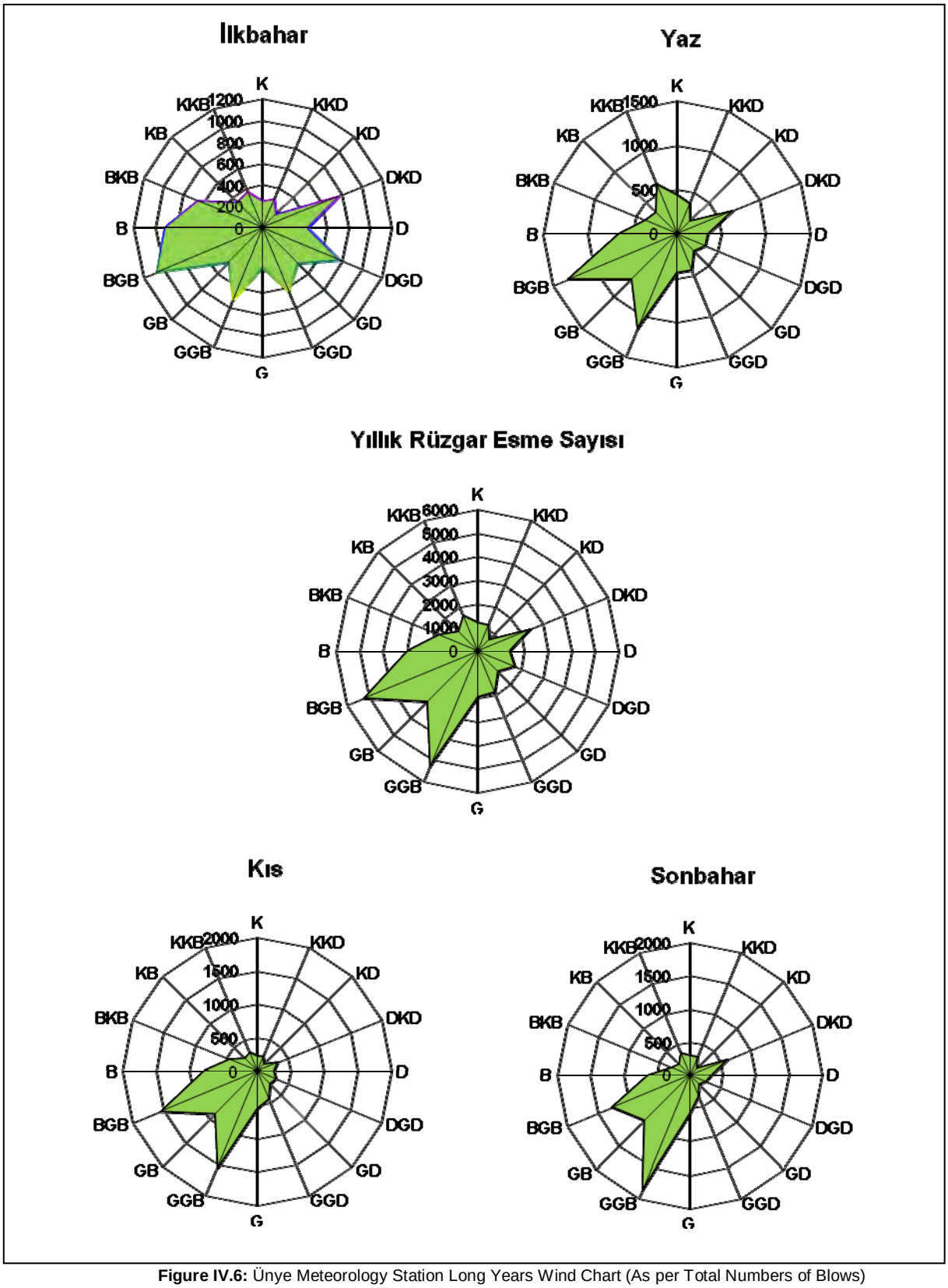


Figure IV.6: Ünye Meteorology Station Long Years Wind Chart (As per Total Numbers of Blows)

Strongest gale is west-directed (W) with a speed of 28,6 m/sec, while had been observed in April (see Table IV.5).

Table IV.5: Ünye Meteorology Station Average Blow Speeds of Winds As per Directions (m/sec)

Meteorological Elements	Observing Period (year)	Months												
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Direction of the Fastest Wind	33	S	S	W	W	WNW	W	W	NNE	ENE	W	W	SW	W
Speed of the Fastest Wind (m/sec)	33	27,1	26,1	21,5	28,6	22,8	21,5	16,0	23,1	22,2	21,8	23,8	27,6	28,6

Number of gales (wind speed ≥ 17,2 m/sec) is 4,1 and number of days with strong winds (wind speed 10,8 – 17,1 m/sec) is 49,8 during the period in which datas were recorded. February is the month in which most storms are seen with average of 6,3 days (see Table IV.6).

Table IV.6: Ünye Meteorology Station Average Blow Speeds of Winds As Per Directions (m/sec)

Meteorological Elements	Observing Period (year)	Months												
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Ave. Number of Gales (wind speed>=17,2 m/sec)	31	0,8	0,6	0,3	0,4	0,2	0,3	-	0,2	0,2	0,1	0,4	0,6	4,1
Ave. Nbr of Days with Strong Winds (wind speed 10,8-17,1 m/sec)	31	5,8	6,3	5,8	4,3	3,2	2,9	2,9	2,7	3,3	3,7	4,6	4,3	49,8

Relative Humidity

Average and lowest relative humidity values recorded in Ünye Meteorology Station between 1975-2007 are shown on Table IV.7 and relative humidity variations are shown on Figure IV-7. Annual average relative humidity amount is %75, lowest relative humidity amount is %10.

Table IV.7: Ünye Meteorology Station Relative Humidity Values

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Average Relative Humidity (%)	70	72	76	80	81	78	77	76	76	77	72	70	75
Lowest Relative Humidity (%)	16	18	12	10	29	24	24	43	27	25	15	11	10

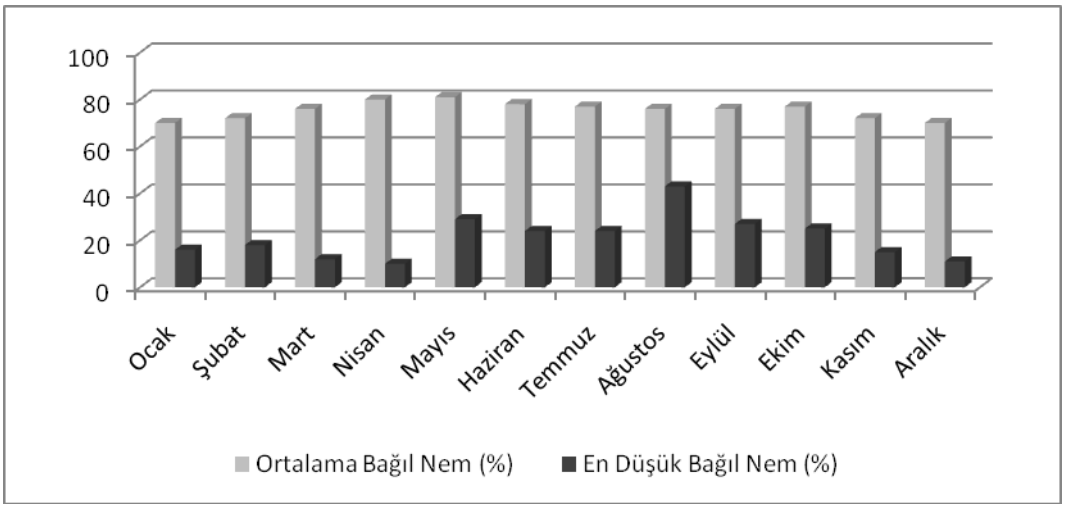


Figure IV.7: Ünye Meteorology Station Relative Humidity Variations As per Months

Local Pressure

Annual average pressure recorded in Ünye Meteorology Station between 1975-2007 is 1013,5 hPa. Highest pressure is in March with 1041,5 hPa and lowest pressure is in January with 989,2 hPa. Average, highest and lowest pressure values are shown on Table IV.8 and Figure IV.8.

Table IV.8: Local Pressure Values Measured in Ünye Meteorology Station (hPa) (1975-2007)

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Average Local Pressure (hPa)	1016,9	1016,0	1014,5	1011,9	1012,0	1010,4	1008,9	1009,5	1012,8	1015,8	1016,6	1016,7	**1013,5**
Highest Local Pressure (hPa)	1035,0	1034,5	1041,5	1028,4	1024,7	1022,0	1018,3	1019,8	1028,2	1033,1	1031,5	1034,6	**1041,0**
Lowest Local Pressure (hPa)	989,2	994,0	992,3	996,5	997,0	996,8	996,5	998,0	997,5	1002,3	996,1	992,2	**989,2**

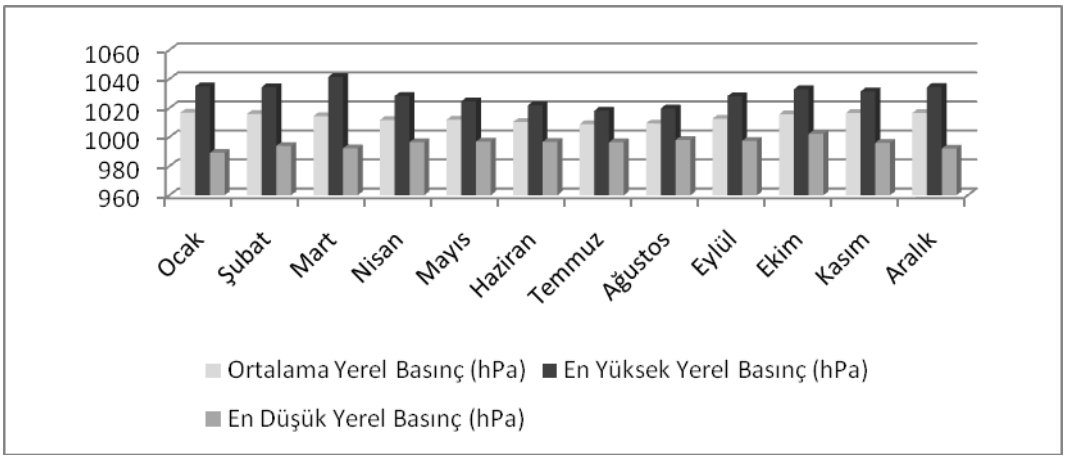


Figure IV.8: Ünye Meteorology Station Local Pressure Variations as per Months

Counted Days Distribution of the Region

Counted days distribution values of the region includes the average values of 33 years between 1975-2007.

Number of annual average snowy days is 11,7 while highest snow depth is 42,0 cm and has ben observed in January and February.

Fog is seen mostly in April with average of 4,1 days, hail is seen mostly in January with average of 0,5 days, frosty daysa re seen in January with average of 4,0 days, thunderstorm is mostly seen in June and August with average of 3,0 days.

Counted days distribution of the region as per months is shown on Table IV.9 and Figure IV.12.

Table IV.9: Counted Days and Their Annual Average Values (1975-2007)

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Number of Snowy Days	3,3	4,3	2,2	0,2	-	-	-	-	-	-	0,4	1,6	**11,7**
Number of snow covered Days	3,5	4,8	1,4	0,1	-	-	-	-	-	-	0,1	1,5	**11,4**
Highest Snow Depth (cm)	42,0	42,0	25,0	6,0	-	-	-	-	-	-	3,0	28,0	**42,0**
Number of Foggy Days	0,4	0,7	2,1	4,1	1,8	0,4	-	-	0,0	0,1	0,2	0,3	**9,8**
Number of Days with hail	0,5	0,3	0,2	0,2	0,1	0,1	0,0	-	0,0	0,0	0,4	0,3	**2,2**
Number of Frosty Days	4,0	3,2	2,6	0,1	-	-	-	-	-	0,1	0,4	3,6	**13,5**
Number of Days with thunderstorm	0,1	0,1	0,3	1,8	2,9	3,0	1,9	3,0	2,9	0,9	0,5	0,3	**17,7**

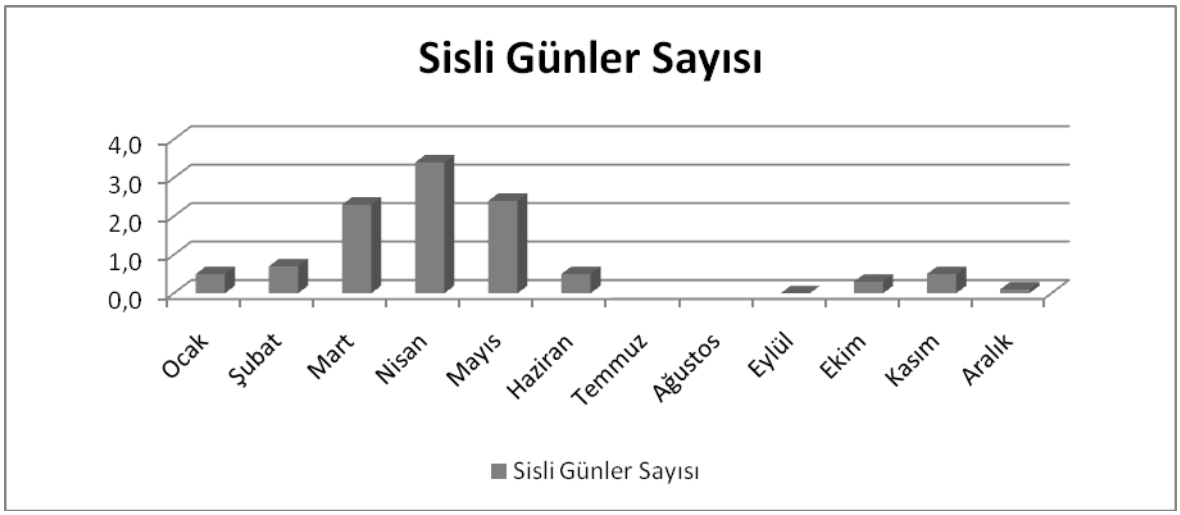


Figure IV.9: Ünye Meteorology Station Monthly Foggy Days Distribution (1975-2007)

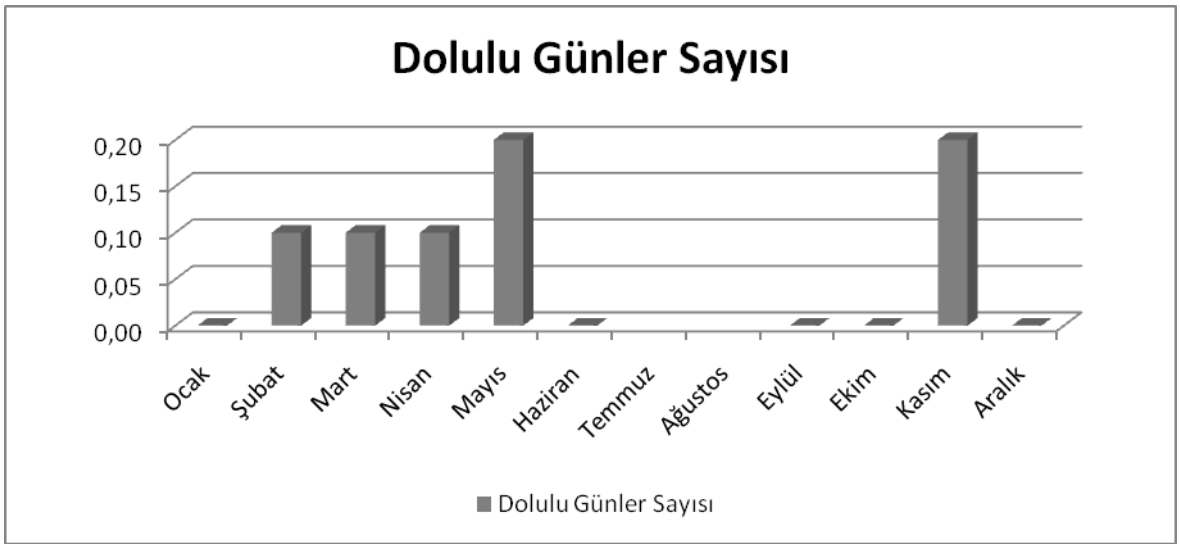


Figure IV.10: Ünye Meteorology Station Monthly Days with Hail Distribution (1975-2007)

Figure IV.11: Ünye Meteorology Station Monthly Frosty Days Distribution (1975-2007)

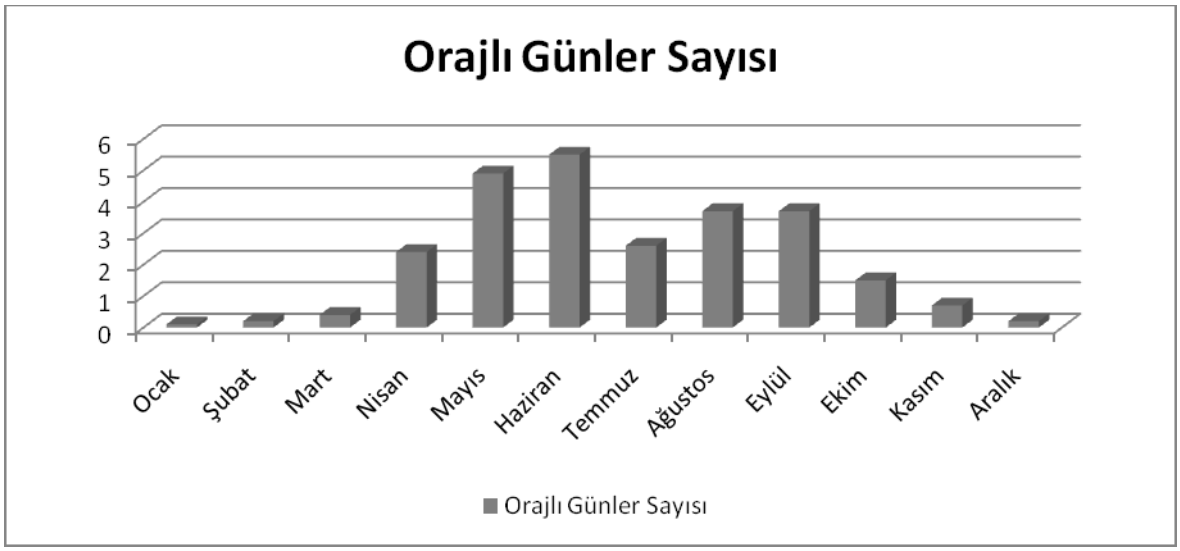


Figure IV.12: Ünye Meteorology Station Monthly Days with Thunderstorm Distribution (1975-2007)

IV.2.2 Geological Characteristics (Physio-chemical characteristics, tectonic movements, topographical characteristics, mineral resources, landslide, unique formations, Specifying the geological units – acc to their lithologic characteristics- on 1/2.000 or 1/5.000 Scaled Engineering maps, geological and geotectonic study reports of the Project area)

In case of consideration of constructing based buildings such as work site, social and administrative buildings within activity area, for these areas, a geological-geotechnical and micro-zoning report base for the plan according the criterions specified in the circular of General Directorate of Disaster Affairs dated 19.08.2008 and numbered 10337 will be prepared and will be had approved by the relevant authority.

General Geology

Informations relating to the general geology of the region have been compiled from results obtained in consequence of studies executed by General Directorate of Mine Exploration Prospecting (MTA) between May-October 1987. General geology map and stratigraphy of the region is respectively shown on Figure IV.13 and Figure IV.15. Detailed information relating to formations available in the region is given under the following sun-titles.

Quaternary (Al)

Sea front coastal lines of the project area and Akçay Creek bed limiting the area easterly are composed of Quaternary aged alluvials. Dominant materials in the alluviums are well-sized sand and pebbles. Even though it is limited, aldo silt and clay locations and block materials can be met in the alluvial deposit.

In the sea-parallel section of alluvium depositions unattached sea-bottom sediments of which composed by generally sand and pebble material and shift occasionally. Because the area is close to delta Akçay, generally delta mouth sediments also deposit in the area. While the area has a completely plain topography, its elevation from sea level range between 1-10 m. Risks to be met in the area are problems relating to groundwater problems and bearing power of the ground. Ground reinforcement might be required according to the building type to be built.

Neogene (n)

Neogene aged units are composed of pebblestone, sandstone, claystone intercalated sea gazebos while they have been observed in the areas with 10-20 topographical heights in the upper part of the highway.

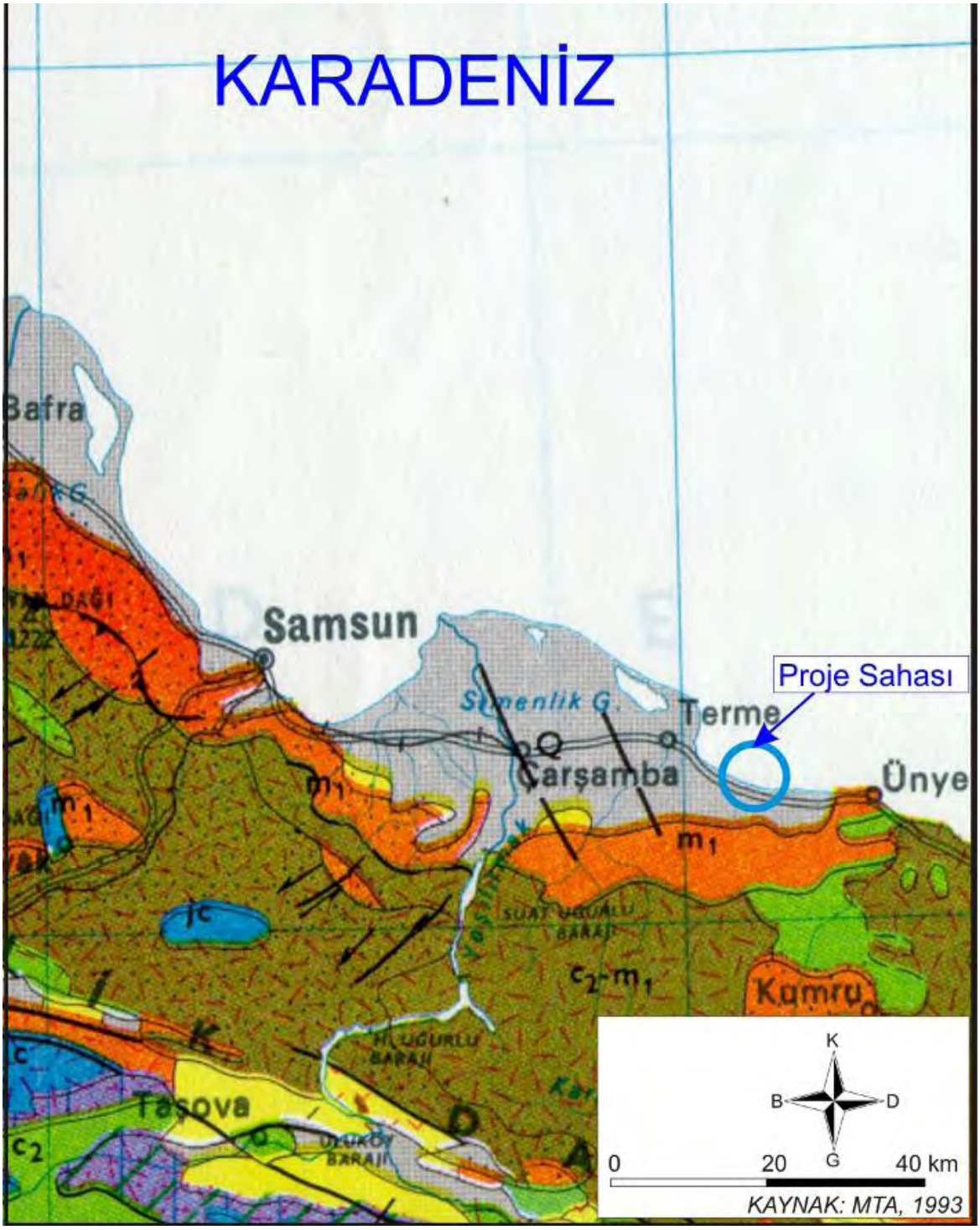
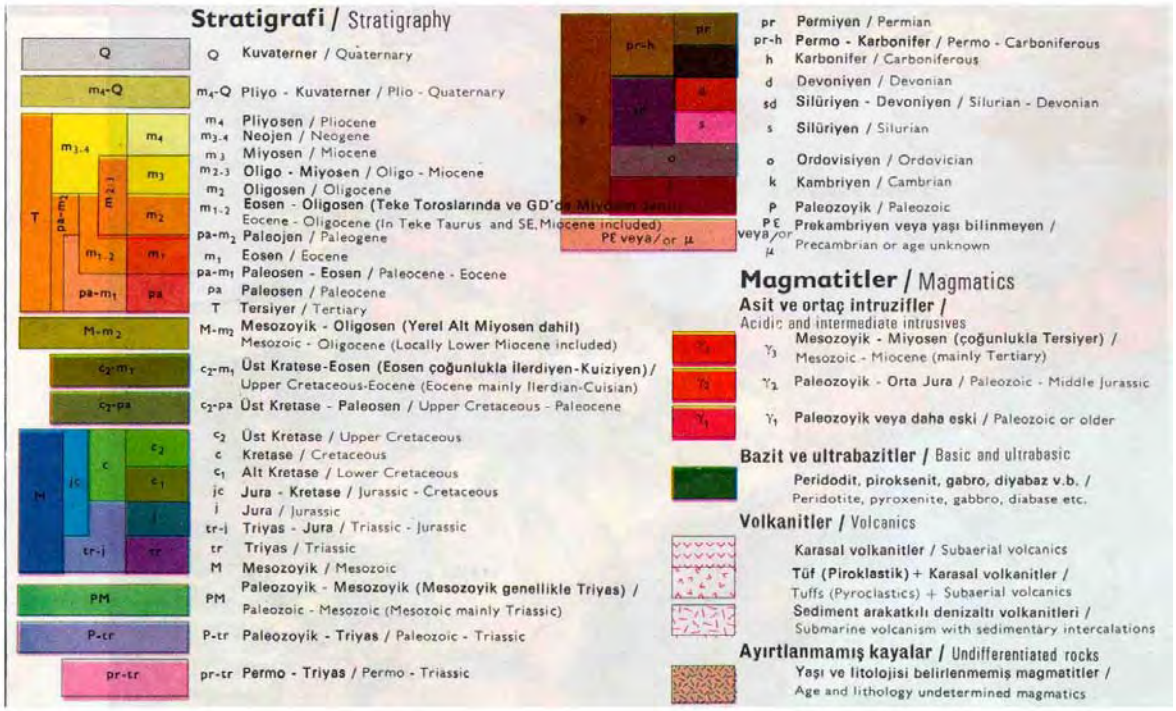


Figure IV.13: General Geology Map of the Region



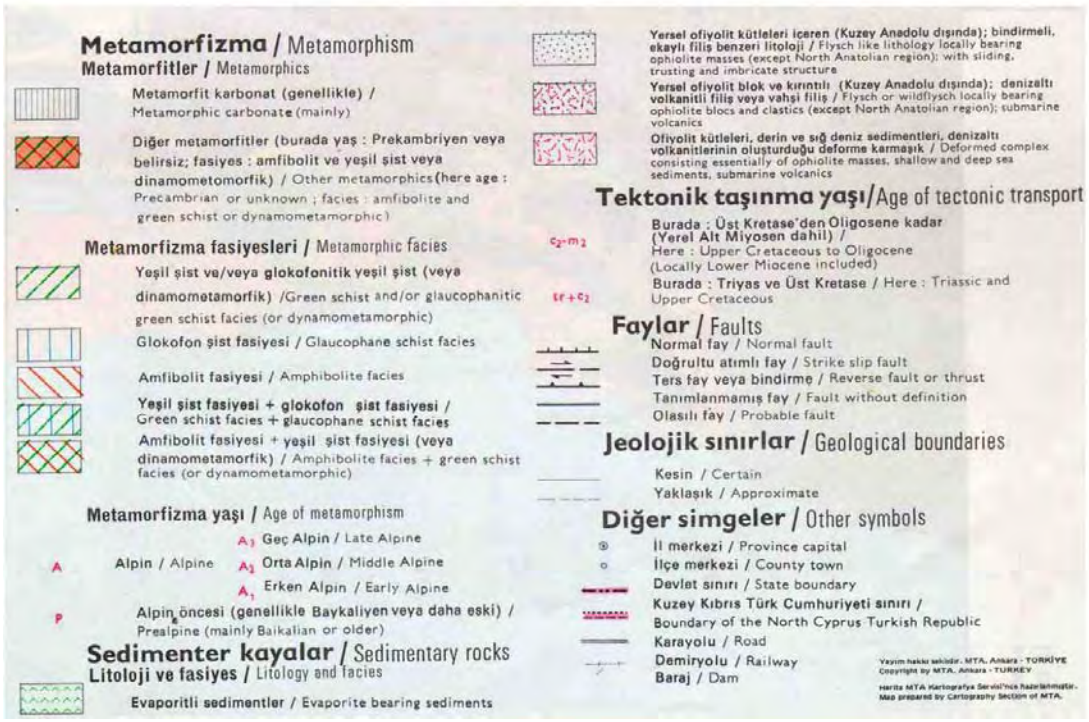


Figure IV.14: General Geology Map of the Region (Legend)

PERIOD	SUBPERIOD	SIGN	FORMATION PILE
QUARTERNARY		Al	River and sea deposits; sand, pebble based, having blocks in patches, in coast front parts which sea shells take place also.
TERTIARY	Neogene	N	Sediments; being on the alluvium ground, composed of attached pebble material and contain sea shells in patches and also named as sea gazebo.
	Eocene	E	Flysches; take place under Neogene units, composed at the sequence of claystone, mudstone, siltstone and sandstone in patches, continent edge formations.

Figure IV.15: Stratigraphical Cross-Section

Paleogene-Eocene (e)

Main rock units of Neogene old sea gazebos are composed of formations in Eocene old phylsch fasciaes. These rocks in phylisch fasciae generally are formed at the sequence of claystone, siltstone and sandstone levels in patches. Their general locations are in horizontal stratification manner.

Morphological Structure

Sea coastal lying along the coast generally recesses into the sea with a low sloped morphological structure. Approximately a part of 200 m into the sea from the coast forms the continental shelf and does not show a much sloped morphology. In this part, depending on the frequent shifting of the sea-bottom dunes, sea water depth also changes.

Topographical elevations in the sections close to the highway have been observed as 8-10 m. Area could be morphologically defined as a plain area.

Geological Structure of the Project Area

For determination of geological and geotechnical characteristics of the Project area, drillings has been performed in the Project area (see Figure IV.16). Accordingly, geological characteristics of the area are summarized in the followinf paragraphs.

Quaternary

Holocene

Youngest deposits in the study area are alluviums composed of Quaternary aged river and sea units. Alluviums in the field are the deposits composed by Akçay Creek and Karadeniz, while being composed of clay, silt, sand, pebble and large rocks.

Tertiary

Eocene

- Sarıyurt Formation (Ts)

Exposed in southwest parts of this unit area. Formation is composed of sandstone,

siltstone and marn. Gray colored.

- Tekkeköy Formation (Tt)

This formations covers very large areas in the South parts of the area. At the bottom of this formation; sandstone and marn are available as a very thin layer. As for in the upper layers, basalt, agglomere, tuff, dacite and pebble are available.

- Kusuri Formation (Tk)

Located in the South of the area. Composed of sandstone, marn and claystone. Within tuff matrix, agglomere is observed.

Figure IV.16: Drilling Locations

<u>Results from Drilling Works</u>

Depths of the drilling locations, for 1-7. Wells, showed on Figure IV.16 are respectively 33 m, 44 m, 36 m, 50 m, 40 m, 40 m and 37 m.

Development at the bottom is as follows:

- *Sandu Silty Clay-Clayed Sand*: Topping layer in the study area. Additionally, could be observed within the large material right beneath. Approximate thicknesses areı 2,0-15,0 m.

- *Sand, Pebble, Large Rock*: Over the Marn formation. Approximate thicknesses are 9,0-28,0 m. Composed with Akçay Creek. Inside, a little amount of clay interm additives is available. A great majority of thin material (Clay, silt, sand) has been washed out during drilling.
- *Marn*: Available beneath. Part on the 2-4 m of the upper side is soft. In the part beneath this, tough and very tough marn is available.

Groundwater Condition

In the drilling wells at 5,0 m in the South parts of the area, groundwater has been met (DW-1, DW-7). As for in the wells (DW-4, DW-5) in the North, water has been observed at 2,30-2,50 m.

Natural Disaster and Earthquake Condition

Natural Disaster Condition

There is no landslide, rock fall, avalanche risk in the Project area. But, Project area is located in the flood field of Akarçay Creek. Within this context, for all flood and drainage precautions to be taken, approval of competent Regional Directorate of State Water Affairs(DSİ) shall be taken. Additionally, within project, principles of Disaster Relief Law No. 7269 and "Buildings in Disaster Areas Regulations" which became effective by being published on Official Gazette No. 26582 and dated 14.07.2007 shall be complied with great care.

Earthquake Condition

North Anatolian Mountains have been separated partially by faults. Here, at the ridge of mountain there are no open passes from Eocene-phylsch layers to the plain ground. Neogene, gradually dives under plain alluvium, ebbs partially a little upwards at the mountian ridge. While North Anatolian Mountains is an igneous mountain, only in the core part it has a definition in type of Alps. Tectonic within the plain is weak and limited with slight fractures or flexures. These cause Neogene not to follow North Anatolian Mountains in a proper manner but to bounce forward towards inside of the plain with various distances. Research area and surrounding could be accepted as "less active" in comparison with significant earthquake line in the south. The Project field stipulated according to Turkiye Earthquake Regions Map published by Disaster Affairs General Directorate Earthquake Research Department which is affiliated to T.R. Ministry of Public Works in 1996 is engulfed in 4th Degree Earthquake Region (see Figure IV.17) (T.R. Ministry of Public Works, 1996).

Additionally, active fault map of the stipulated Project field is shown on Figure IV.18 (MTA, 1992). The most important active fault line in the region is the North Anatolian Fault Zone passing through 80 km of South of the Project area.

However there is any fresh faults in the Project area and its surrounding (see Figure IV.18), near-by Çarşamba faults have been observed. Regarding aforesaid faults, findings obtained from field studies by MTA between May-October 1987 in the region have been used.

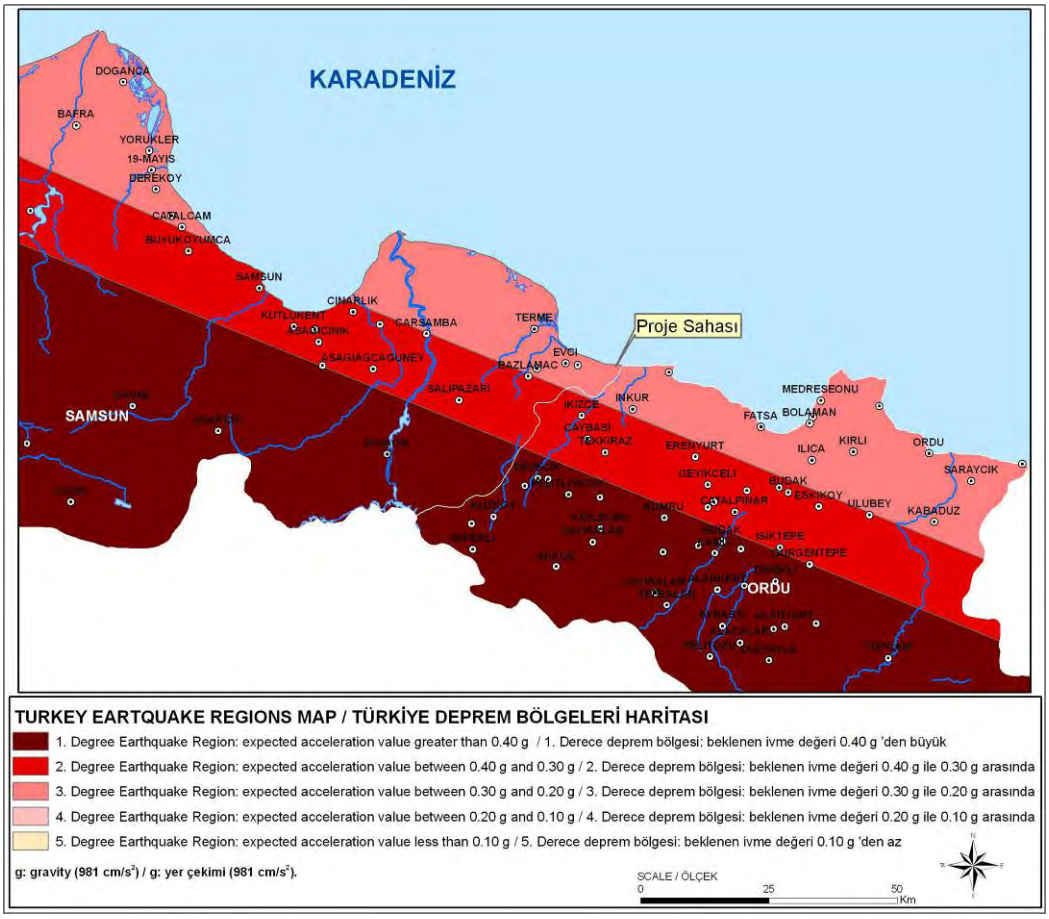


Figure IV.17: Samsun Province Earthquake Map

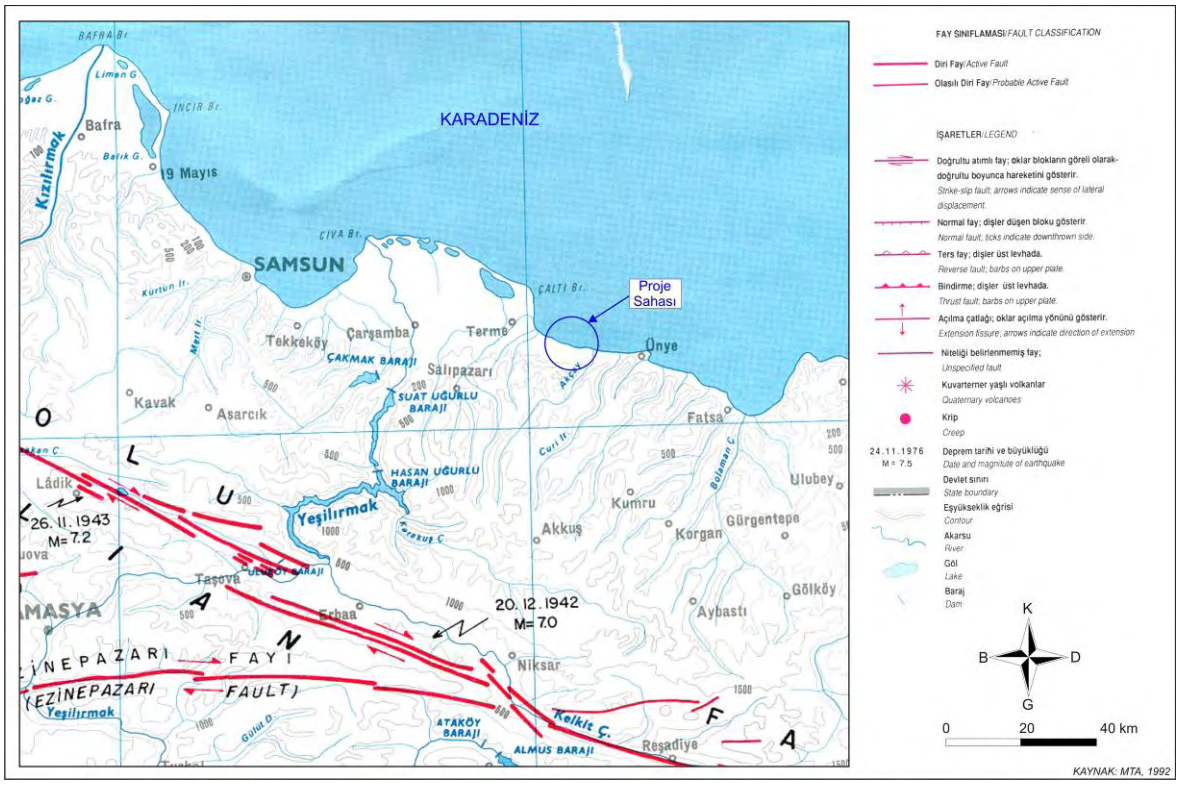


Figure IV.18: Active Fault Map of the Region

Being one of the two important faults in the area, Damatkır reverse fault composes the last observable section of Erikli Fault in southeast. This fault does not show a single and absolute linearity and be observed along a zon with excessive folding, inversion and fracture. General extension is in NW-SE direction. Fault plane is SW sloped with slopes ranging between 45-70º. Length in the area is approximately 13 km. This reverse fault seems as it is absorbing around the point at which Terice Creek meets Yeşilırmak, however it is considered that it continues to southeast within Karakuş Brook which is met to Yeşilırmak.

A second reverse fault is the Teric fault with 5 km length. Slope of this fault is higher than Damatkır reverse fault and its deformation area is larger.

Another important fault is Çarşamba reverse fault. This reverse fault which goes into sea near-by Samsun, heads for first southeast, then east and then northwest and roughly arches. Aforesaid fault then goes to the east starting from Umyan and Salıpazarı. Its length is approximately 27 km.

Direction of the latest movement in the region is NE-SW and NW-SE. But the predominant out of these is NE-SW. This orientation has settled Abdal Creek, Yeşilırmak and Terme Creek extensions. Distance of the aforesaid faults to the Project area is proximately 35 km (see Figure IV.18).

Earthquakes recorded in Samsun province and surrounding between the years 1881-1986 has been compiled by Association of Turkiye Chamber of Architects and Engineers (TMMOB) Chamber of Geophysics Engineers (TMMOB, 1990), while earthquakes between these years in the region are shown on Figure IV.19. Accordingly, there are any significant earthquakes recorded between years 1881-1986 close to the Project area. However in Tekkeköy and Terme settlement units one each earthquakes are recorded between the same years and their megnitudes are respectively 4,2 and 5,0.

In every kind of buildings to be built on aforesaid area, principles of “Buildings in Disaster Regions Regulations” which became effective by being published in Officia Gazette dated 14.07.2007 and with No. 26582 shall be complied with great care.

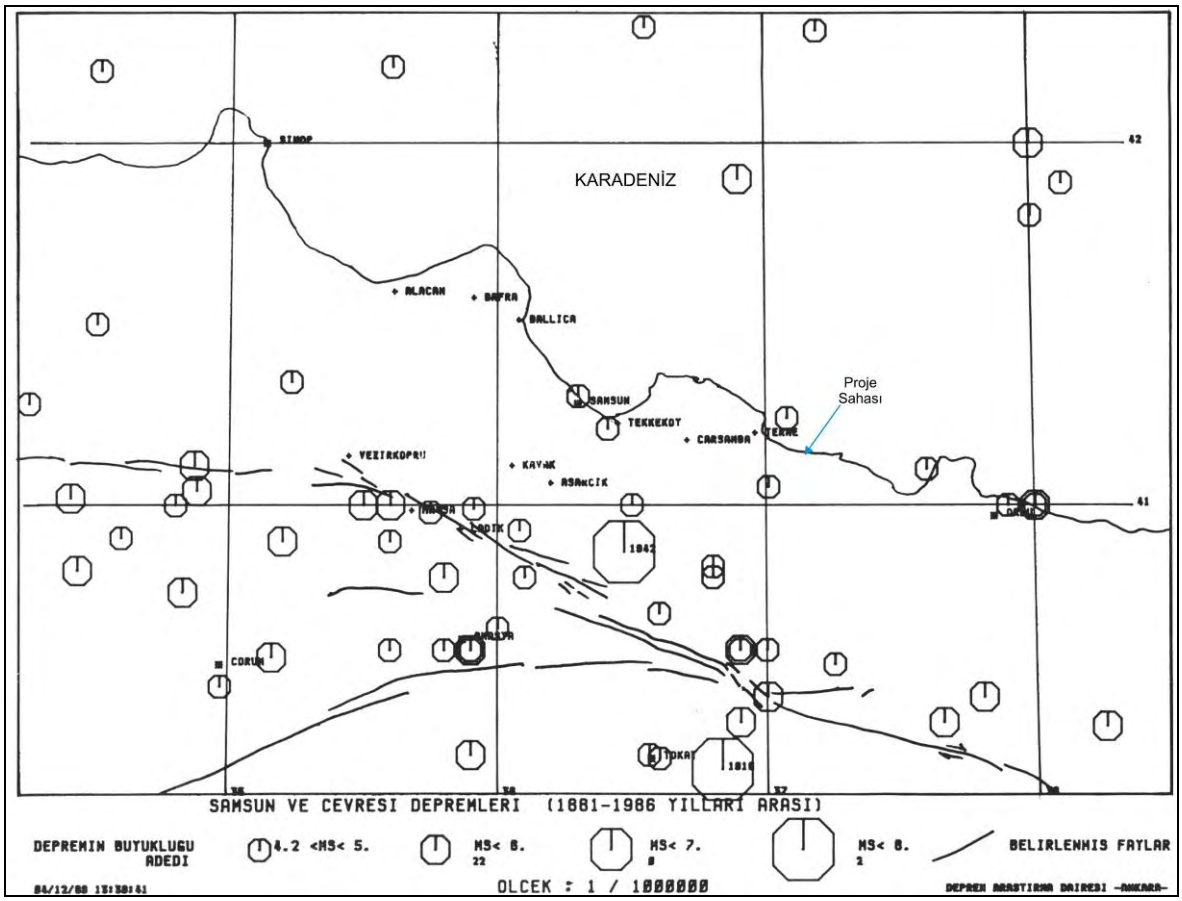


Figure IV.19: Earthquakes Around Samsun Province and Its Surrounding

IV.2.3 Hydrogeological Characteristics (Groundwater levels, every kinds of caisson, deep, artesian etc well stil available; safe gravity values, physica and chemical characteristics of water; current and planned usage of ground water)

The alluvial deposits with consedirably fine porosity in and around Project area, also depneding on the availability of feeding conditions, are in groundwater saturated aquifer position. Groundwater level is very close to the topographical surface (approximately between 2-5 m).

When the Neogene units that are more attached in comparison with alluvial materials and show cemented structure in patches, are compared with alluviums because of these characteristics, they are units with weak aquifer characteristics. Depending on the topographical location and feeding conditions, they carry piecemeal groundwater.

According to the informations obtained from Drilling works, groundwater has been met in the drilling wells in the South parts of the area at 5,0 m (DW-1, DW-7). As for in the wells in the north (DW-4, DW-5), water has been observed at 2,30-2,50 m.

IV.2.4 Land Characteristics and Usage Condition (Land structure, landuse capability classification, bearing capacity,slope stability, erosion, usage for lea, meadow, agricultural purposes conditions vb.)

While information about land groups had been obtained with desk works, as a reference, 1/100.000 scaled land maps of Ministry of Agriculture and Rural Affairs General Directorate of Rural Affairs (KHGM) have been utilized. Large soil groups which are the soil classifications of KHGM, landuse usage capability, erosion level and landuse classifications have been made and are presented below in sub-titles.

Large Soil Groups

Definitions of large soil groups seen on Project field and working area used by T.R. Ministry of Agriculture and Rural Affairs are given below:

1. Gray-Brown Podzolic Soils: These soils develop under chilly and rainy climates, mostly under deciduous partially under coniferous forest cover and upon diversified main substance. Their profiles are shaped in ABC. A slight podzolization prevails in their development. On a typical sample, a fine and unspoilt leave layer is located on top, beneath a granular houmous layer in grayish Brown with 5-10 cm thickness is located. Its reacton is slight acid or neutral. Houmus layer has converted into the grayish Brown coloured mineral A1 horizon after 5-10 cm. Its thickness is 5-6 cm. Generally medium bodied and granular. Also A2 horizon is medium bodied and in flaky structure just like A1. Color differs between grayish Brown and yellowish brown. Base saturation percentage and clay rate is low because of wash-out. Upper side of B Horizon ranges between yellowish Brown and light reddish brown. Body is generally clayed because of cumulation of washed-out clays from A horizon, structure is mostly block and reaction is medium acid. Efficiency in these soils changes dramatically according to type and characteristics of the main substance. Gray-brown podzolic soils show dissemination in the South of Terme district and southeast of Çarşamba, in territories in the South of province settlement location, in the North and west of Kavak district, between Kavak-Havza, around Kolay, Taflan and Mezraa, near-by the Çorum, Amasya, Sinop borders of the province.
2. Alluvial Soils: Azonal young soils which are located on young sediments carried and deposited by the rivers in the bottoms of surface waters and impact fields, have almost plane slope, with A (C) Profile. According to the intensity of the sedimentation coming in various periods, soil profile has mostly diversified layers. Upper soil penetrates the sub soil slightly. In the long-aged ones, a slight lime oxidation could be available. In the considerably large alluvial flood plains composed by the rivers, soils differ by body, drainage an deven topography as departed from river bed. Organic substance amounts show a large alteration according to climate, drainage and usage style. New layers in various thickness' would come by sediment onto these soils. As they are Azonal soils, there is no special climate type or vegetation.
3. Brown Forest Soils: Brown Forest Soils compose on the main substance which has high lime content. Their profiles are in A(B)C, while the horizons gradually penerate each other. Out of these, as A horizon is well-developed, is highly evident. In dark Brown color and dispersible. Has a porous or granular structure. Reaction is generally alkaline sometimes neutral. In B horizons, color differs between light Brown and red. Reaction is generally alkaline, sometimes neutral. Structure is granular or round-edged block. A little clay deposit is possible. In the below sides of the horizon $CaCO_3$ is available. These soils generally compose under broad-leaved forest cover. Their determinant soil composition processes are calsification and a little podzolization. Drainage is fine. Mostly used as forest or lea. While on the ones use d for agriculture, basic and regional products have been cultivated, their efficiencies are very well. In

Samsun, these soils are met in the territories in the northwest, South and southwest of city settlement area, around Alaçam, between mezraa and Başpınar subdistricts, in the northeast of Vezirköprü, between Bafra and Taşköy, in the South and southeast sections of Bafra, between Ladik-Kavak, in the North and southeast of Kavak, around Asarcık subdistrict, i the west and southwest of Gaman subdistrict, near-by Ladik Lake and in the northwest, west and southwest of Ayvacık. Their slopes are generally straight or very straight. Correspondingly their depths are mostly shallow or very shallow. In approximately 1/3 of it stony, in a small amount of it rocky could have been observed.

4. Red Yellow Podzolic Soild: Red-yellow podzolic soils are well-developed and well drained acid soils. Natural plant cover is either decidous or coniferous or mixture of both forest. Main substance is quite siliceous and poor in calsium. O horizon is thin while organic mineral A1 horizon is located beneath it. Light-colored A2 horizon is located upon red, yellowish red or yellow colored and more clayed B horizon. B horizon has clay pellicles on the ped surfaces and has a block structure. In red-yellow podzolic soils in which the main substance is thick, on sub-horizons red, yellow, brown and light gray lines and spots in thick net shape are available characteristically. As more effective moisture conditions are available comparatively in soils on which yellow color is predominant, iron oxides have been more hydrated with respect to the ones in red colored soils. Accordingly the colors are less bright. A2 horizonu also is a little more thick.
5. Coast Dunes: Coast dunes composed by sands deposited by waves and winds in the coasts have not been classified as a land type because they can not improve with respect to soil development. Their topographies are corrugated or slightly hilly. As they mostly are exposed to much wind, there is not any stable plant covers on them.
6. River Flood Plains: Except the usual beds of the rivers, they represent the areas in which they spread during high water. Generally they are covered with sandy, pebbly and ruble material. As they do not contain a soil material as result of being exposed to wash-out by flood waters frequently, they are classified as land type. As well as they are not avaliable for agricuşture, they do not have any vegetation covers on them also.

Distribution of large soil groups within the Project field and its impact area in size of 20 km × 20 km in percentage terms are shown in Table IV.10 and on Figure IV.20. As it is shown in Table IV.10, in the great majority of project field and working area gray-brown podzolic soils have been observed (aprr. %32).

Table IV.10: Distribution of Large Soil Groups in Project Field and Working Area (%)

Large Soil Groups	Area (km²)	Rate (%)
Gray Brown Podzolic Soils	128	32,0
Alluvial Soils	29	7,2
Brown Forest Soils	23	5,7
Red Yellow Podzolic Soils	10	2,6
Coastal Sand Dunes	7	1,7
River Flood Plains	1	0,2
Settlement	1	0,1
No Data	21	5,4
Land	**220**	**54,9**
Sea	**180**	**45,1**
TOTAL	**400**	**100,0**

Landuse Capability Class

Landuse Capability has been classified from I to VIII, while cultivation compatibility of the land has been based on. Definitons of the classes used by Ministry of Agriculture and Rural Affairs are presented on Table IV.11.

Table IV.11: Landuse Capability Classes and Compatibility for Cultivation

Capability Class	Tillage Availability	Agriculture-Limiting Factors
I	Available for tillage of many crop types.	Very little or none limiting.
II	Available for long-term tillage of various crops.	Requires special influence reducer measures against soil and water loss.
III	Available for cultivation of certain type products providing special protection measures. For general agricultural purposes, requires special care.	Unprotected for erosion and requires artificial drainage in case of tillage.
IV	Available for cultivation of a couple of agricultural products with proper plough. Requires special care in case usage with general agricultural purposes.	Has considerable limitings in soil depth, stone content, humidity and slope.
V	Not available for tillage and cultivation, plain or low slopped, rocky or lush soil. Generally used as lea or forest area .	Has a weak drainage and unsuitable structure for tillage.
VI	Not available for tillage and plough. Mostly used as meadow and forest area.	Has considerable limitings in terms of slope and shallow soil
VII	Not economic for agricultural activities but available as weak lea or forestation area.	Has considerable limitings in terms of shallow soil, Stone content, slope and erosion.
VIII	Not available for vegetation. Can be used as protection area for recreation or wild life.	Lacking in soil.

Source: General Directorate of Rural Affairs (KHGM)

Aforesaid classification in project field and working area in percentage terms according to 1/100.000 scaled land maps prepared by Ministry of Agriculture and Rural Affairs KHGM is given on Table IV.12 and is shown in Figure IV.21. As it can be seen on Table IV.12, lands in landuse capability class VI. are dominant in project field and working area (appr %14).

Table IV.12: Distribution of Landuse Capability Classeses in Project Field and Working Area (%)

Landuse Capability Classes	Area (km²)	Rate (%)
I	9	2,3
II	32	7,9
III	31	7,8
IV	51	12,7
V	0	0,0
VI	55	13,7
VII	12	3,0
VIII	8	1,9
Settlement	1	0,1
No data	21	5,4
Land	**220**	**54,9**
Sea	**180**	**45,1**
TOTAL	**400**	**100,0**

Erosion Level

In classification of the soils with respect of erosion, classification prepared by KHGM has been used. Accordingly erosion is classified in four levels:

- 1. Level: None or little erosion
- 2. Level: Medium erosion
- 3. Level: Severe erosion
- 4. Level: Very severe erosion

Distribution of erosion levels by percentage seen on the soils in project field and working area is given on Table IV.13 and is shown in Figure IV.17. As it is seen on Table IV.13, soils with 2. Level erosion have been observed predominantly in the aforesaid field (appr. %37).

Table IV.13: Distribution of Erosion Levels in Project Field and Working Area (%)

Erosion Level	Area (km²)	Rate (%)
1	8	1,9
2	146	36,6
3	11	2,9
4	0	0,0
Settlement	1	0,1
No data	54	13,4
Land	**220**	**54,9**
Sea	**180**	**45,1**
TOTAL	**400**	**100,0**

Current Land Usage

As specified in 1/100.000 scaled land maps prepared by KHGM and is seen from Figure IV-23, mostly hazelnut areas are available in working area (appr. %32) (see Table IV.14).

Table IV.14: Current Land Usage Distribution in Project Field and Working Area (%)

Current Land Usage	Area (km²)	Rate (%)
Hazelnut	128	32,3
Forest	30	7,4
Dry Agriculture (fallowless)	17	4,3
Irrigated Agriculture	9	2,2
Abandoned Land	8	1,9
Lea	3	0,7
Heather	2	0,6
Settlement	1	0,1
No data	22	5,4
Land	**220**	**54,9**
Sea	**180**	**45,1**
TOTAL	**400**	**100,0**

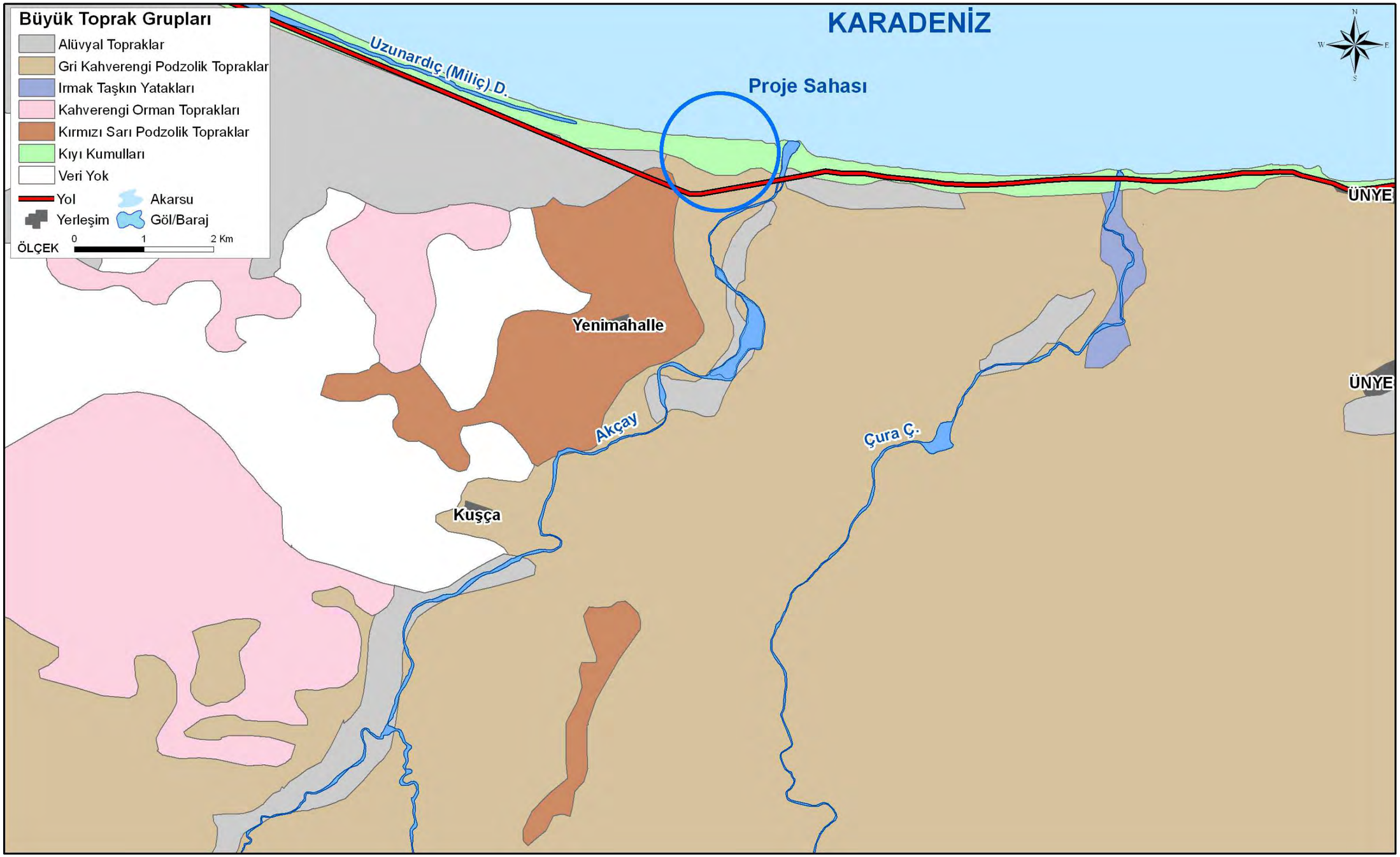


Figure IV.20: Distribution of Large Land Groups in Project Field and Working Area

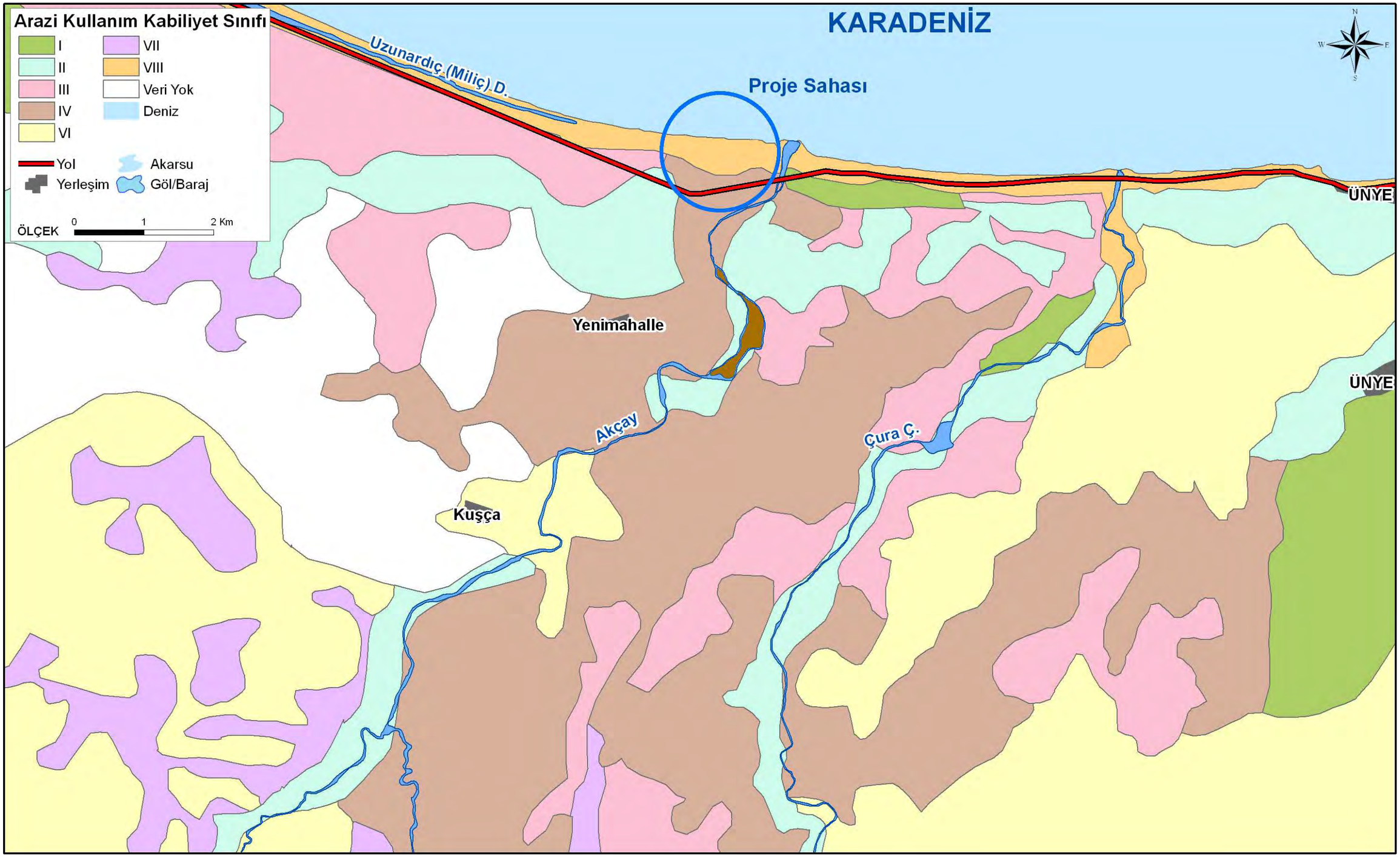


Figure IV.21: Distribution of Landuse Capability Classes in Proje Field and Working Area

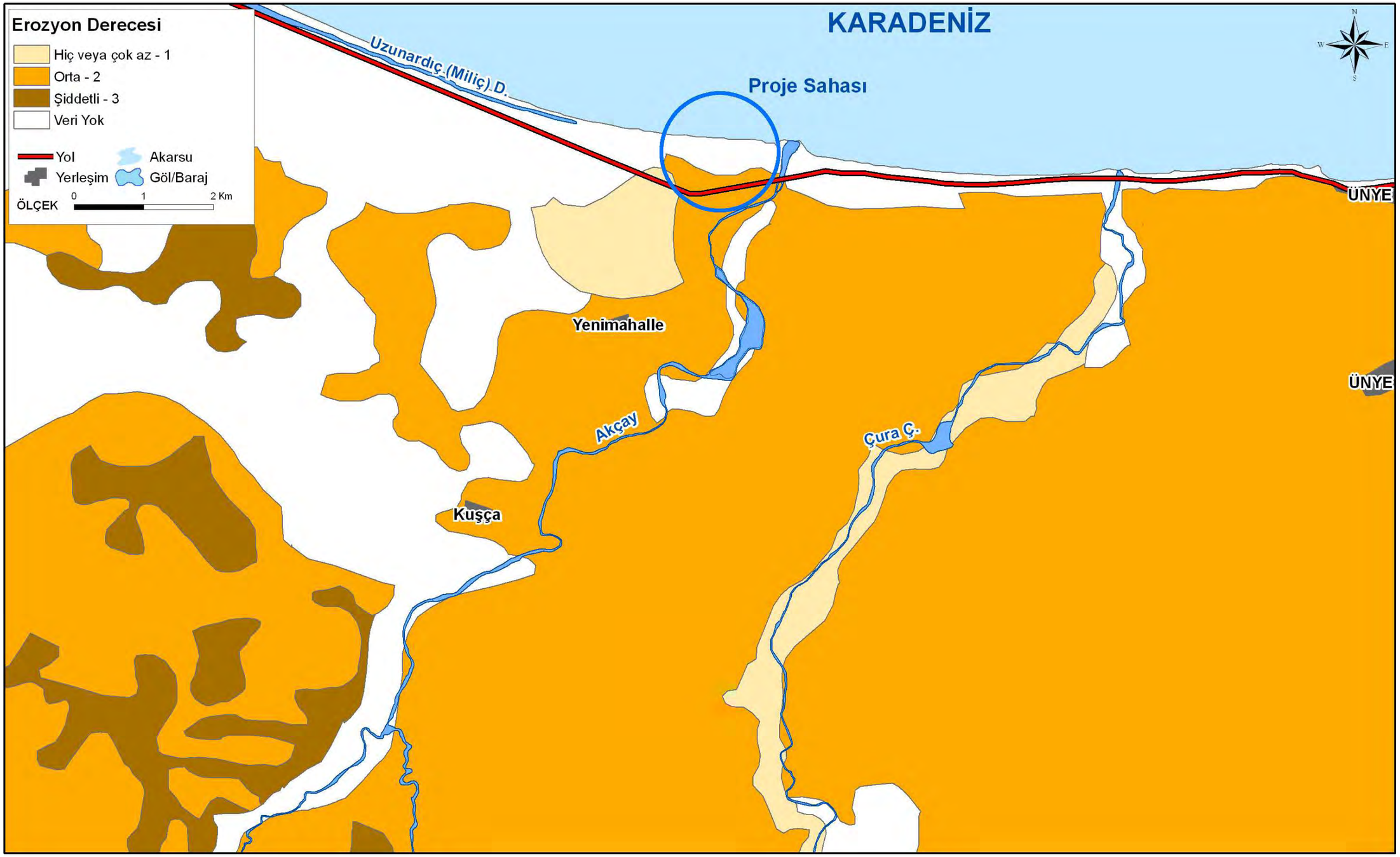


Figure IV.22: Distribution of Erosion Levels in Project Field and Working Area

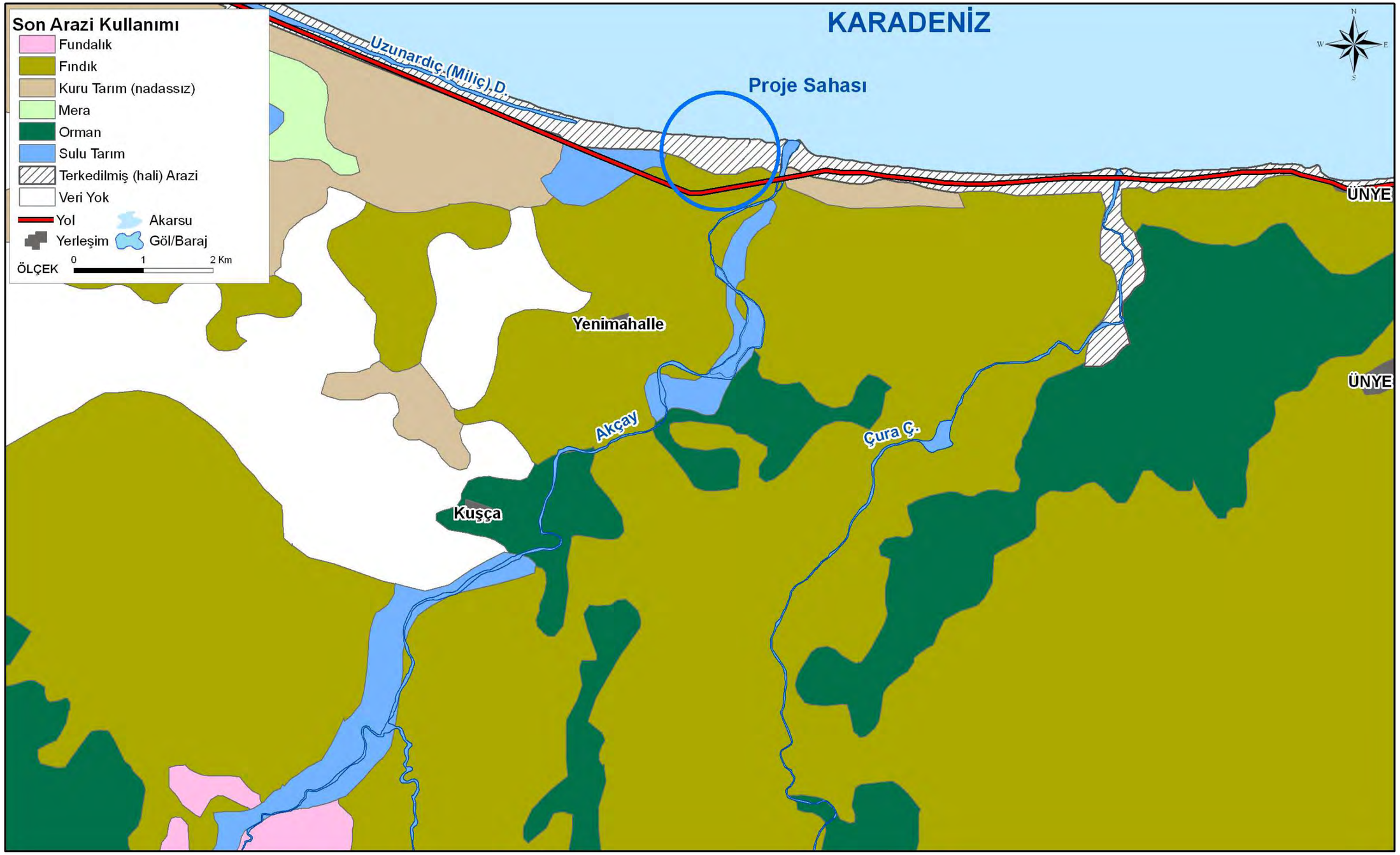


Figure IV.23: Distribution of Current Landuse in Proje Field and Working Area

IV.2.5 Agricultural Lands (Agricultural development Project areas, magnitude, product range and annual production amounts together with efficiency in respect of unit area of irrigated and dry agriculture lands, used pesticides)

According to 2006 data of Directorate of Provincial Agriculture, in Samsun with an acreage of 957.900 ha in total, land available for tillage is 455.324 ha. Land existence and distribution of Samsun Province is presented on Table IV.15. Accordingly, on proximately %25 of tillage compatible lands in Samsun province irrigation has been performing.

Table IV.15: Samsun Province Land Existence and Distribution

Land Existence and Distribution	Area (Ha)	Distribution (%)
Tillable Land	455.324	48
Irrigated	112.098	-
Dry	343.226	-
Cultivated	417.576	-
Fallow	12.656	-
Lea-meadow Land	33.721	4
Forest-Heather Land	358.107	37
Non-agricultural Land	110.748	11
TOTAL	**957.900**	**100,00**

Source: Samsun Governorship, 2006

Annual Agricultural Product Range

Distribution of agricultural lands in Samsun province as per cultivated land products is given on Table IV.16. Accordingly, cereals with a rate of %42,45 take place on the top. Even though it is seen as orcharding is taking the second place with the rate of %20,06; on the 85.532 ha of 91.334 ha orchard area, hazelnut tilth is being performed.

Table IV.16: Distribution of Agricultural Lands

Type of the Landarazi	Amount (ha)	Ratio to Agricultural Land (%)
Cereals	197.866	42,45
Industrial Plants	23.675	5,20
Edible Legumes	18.539	4,07
Vegetable	28.645	8,43
Orchard	91.334	20,06
Fallow	12.656	2,77
Lumpy Plants	2.370	0,52
Others	80.239	16,50
Total	**455.324**	**100,00**

Source: Samsun Governorship, 2006

Primary products cultivated economically in Samsun Province are wheat, corn, paddy and tobacco. Sunflower has been cultivating as an industrial plant. Closure orcharding has been performing. Significant part of it is hazelnut area. Mostly product vegetables are tomato, papria, cucumber, egg-plant, spinach, beans, cabbage, scallion, watermelon and casaba melon. Besides vegetable cultivation increased in last years have been executing in plastic greenhouses and high tunnels.

As it can be seen from Table IV.17, efficiency values of wheat, barley, rye, corn and

paddy out of the cereals; lentile (gren) and vicia sativa out of legumes; clover, sainfoin, corn and tritikale out of forage crops; tobacco, sugar beet and cannabis out of industrial crops cultivated in Samsun province are over the values of Turkiye (see Table IV.18). Vegetable production of Samsun Province in 2003 and share in Turkiye production are given on Table IV.19.

Table IV.17: Agriculture Products Efficiency Values

Product	Samsun Province			Turkiye		
	Culivated Area (hectar)	Production (ton)	Efficiency (kg/hectar)	Culivated Area (hectar)	Production (ton)	Efficiency (kg/hectar)
Cereals						
Wheat	139.825	459.177	3.284	8.490.000	20.010.000	2.357
Barley	13.328	36.902	2.769	3.649.800	9.551.000	2617
Rye	1.628	3.692	2.268	131.246	271.000	2.065
Oats (grain)	275	463	1.684	100.112	208.787	2.086
Kaplıca	380	444	1.168	4.289	6.341	1.478
Corn (grain)	36.521	205.037	5.614	536.000	3.811.000	7.110
Paddy	10.090	80.607	7.989	99.100	417.600	4.214
Legumes						
Broadbeans (dry)	11	4	364	10.539	21.316	2.023
Green peas (dry)	100	50	500	1.566	4373	2.792
Chickpea	1.338	1.309	978	524.367	551746	1.052
Beans (dry)	15.340	9.336	609	129.052	195970	1.519
Lentile (green)	2	2	1.000	45.463	42326	931
Vicia Sativa (grain)	1.778	2.895	1.628	134.526	175522	1.305
Forage Crops						
Clover	835	10.244	12.268	444.030	4.637.929	10.445
Trefoil	78	5.476	70.205	117.603	621.737	5.287
Corn	1698	408.205	240.403	259.891	10.502.836	40.412
Tritikale	45	3.726	82.800	24.112	77.642	3.220
Vicia Sativa (herb)	3.190	120.036	37.629	386.288	2.236.942	5.791
Üçgül (herb)	-	-	-	2.000	10.844	5.422
Industrial Crops						
Tobacco	1.240	11.930	9.621	146.167	98.137	671
Sugar beet	1.123	487.365	433.985	325.700	14.452.162	44.373
Cannabis (fibre)	5	52	10.400	65	60	923

Source:Samsun Governorship, 2006

Table IV.18: Samsun Province Fruit Efficiency Values

Product	Samsun İli			Turkiye		
	Number of Trees	Production (ton)	Efficiency (kg/tree)	Number of Trees	Production (ton)	Efficiency (kg/tree)
Pome Fruits						
Pear	202.418	8.045	39,74	9.956	317.750	31.915,43
Quince	52.275	787	15,05	3.121	106.214	34.032,04
Apple	324.630	13.063	40,24	36.444	2.002.033	54.934,50
Medlar	28.660	515	17,97	281	4.471	15.911,03
Stone Fruits						
Plum	135.550	3.245	23,94	7.572	214.416	28.316,96
Apricot	260	6	23,08	12.202	460.182	3.7713,65
Cherry	95.250	3.178	33,36	10.616	310.254	29.225,13
Cranberry	97.810	1.055	10,79	879	9.303	10.583,62
Peach	589.672	28.146	47,73	13.840	552.775	39.940,39
Sour cherry	31.452	937	29,79	5.214	121.499	23.302,45
Nuts						

Product	Samsun İli			Turkiye		
	Number of Trees	Production (ton)	Efficiency (kg/tree)	Number of Trees	Production (ton)	Efficiency (kg/tree)
Walnut	107.325	2.716	25,31	4.595	129.614	28.207,62
Almond	690	20	28,99	3.236	43.285	13.376,08
Hazelnut	42.105.155	107.298	2,55	337.380	661.000	1.959,22
Chestnut	27.000	602	22,30	1.863	53.814	28.885,67
Grapy Fruits						
Raspberry (da)*	38	36	947,37	3.387	1.997	589,61
Strawberry (da)*	1.454	1.005	691,20	104.101	211.127	2.028,10
Mulberry	47.510	1.413	29,74	2.029	51.558	25.410,55
Fig	59.840	2.148	35,90	9.958	290.151	29.137,48
Kiwi	13.050	429	32,87	322	10.962	34.043,48
Pomegranate	9.487	198	20,87	3.136	90.737	28.933,99
Trabzon Betel Nut	10.475	520	49,64	589	19.297	32.762,31
Grape (da)*	216.375	1.318	6,09	5.138.256	4.000.063	778,49

Source: Samsun Governorship, 2006
(*) da: decar

Table IV.19: Samsun Province Vegetable Production and Share in Turkiye Production

Vegetables	Samsun Production Amount (ton)	Turkiye Production Amount (ton)	Share of Samsun Province (%)
Leaf-edible vegetables	250.028	1.696.600	14,74
Legume vegetables	100.508	709.000	14,18
Fruit-edible vegetables	946.245	20.678.500	4,58
Bulbous –lumpy vegetables	6.118	826.580	0,74
Other vegetables	1.500	108.017	1,39
TOTAL	**1.304.399**	**24.018.697**	**-**

In order to determine the usage condition of the Project area with agricultural purposes, a survey study has been executed by T.R. Samsun Governorship Provincial Directorate of Agriculture on 24.12.2008. The report prepared as a result of survey study is presented on Appendix-1. Accordingly; 9,8929 ha of the project area has been assessed as Dry Marginal Agriculture Land, 8,9611 ha of the area has been assessed as Dry Special Product Land and 25,5521 ha of the area has been assessed as Cultivated Agriculture Land. In this sense, before starting of the Project activities, while agricultural survey study regarding the matter will be executed following the EIA process in accordance with Land Protection and Land Usage Law No. 5403 which became effective by being published in Official Gazette dated 19.07.2005 and no. 25880 together with Regulations Regarding Protection and Usage of Agriculture Lands which became effective by being published in Official Gazette dated 13.06.2003 and no. 25137, according to the result of the study, in case of necessity, an application will be made to Soil Protection Board for non-agricultural usage purposes.

IV.2.6 Current and Planned Usage of Surface Water Resources (Potable, domestic, irrigation water, electric production, dam, lake, pond, product range and production amounts in aquacultural products production, water way transportation facilities, water and/or coastal usages with tourism, sports and similar purposes, other usages)

Çarşamba Plain in which the Project area is located, generally is rich in groundwater sources. While the groundwater level is considerably high, static level is generally 1-2 m, max 5 m.

For this reason, water requirement of the public in region has been provided by the wells opened in the region. Water of a great majority of these wells which goes down deep generally into 10 m are convenient for drinking.

Because of slope deficiency in the ground lands composing the great majority of Çarşamba Plain and absence of natural discharging conditions, drainage problem has gained a great importance. Fort his reason there are several drainage channel built, being built and at planning stage by General Directorate Of State Water Affairs (DSİ) available in the region. In the Project area there are nı current or being planned irrigation Project of General Directorate Of State Water Affairs (DSİ) available (see Appendix-1).

Some of the barrages built, being built and have been considered to be built on Yeşilırmak and its branches are intended for irrigation, some for energy and some for floo control and some of them are multipurpose projects combining a couple of these purposes. Information relating to barrages built within Samsun province border is given on Table IV.20.

Table IV.20: Barrages Built in Samsun Province

Barrage Name	Inauguration Date	River it was built on	Aim	Irrigation Area (ha)	Power (MW)	Annual Production (GWhour)
Altınkaya	1988	Kızılırmak	Energy	-	700	1.632
Çakmak	1988	Abdal	Potable water	-	-	-
Derbent	1990	Kızılırmak	Torrent, flood, protection, energy	47.727	58	257
Dereköy	2000	Dereycan	Irrigation	-	-	-
Derinöz	2000	Derinöz	Irrigation	4.490	-	-
Divanbaşı	1988	Deve	Irrigation	320	-	-
Güldere	1993	Kirazın	Irrigation	115	-	-
Güven	1983	Dereçam	Irrigation, potable water	390	-	-
Hacıdede	2000	Allahu	Irrigation	-	-	-
Hasan Uğurlu	1981	Yeşilırmak	Energy	-	500	1.217
Karabük	1997	Dereköy	Irrigation	378	-	-
Kozansıkı	1989	Güngörmez	Irrigation	150	-	-
Ondokuzmayıs	2001	Engiz	Irrigation, potable water	1.665	-	-
Suat Uğurlu	1982	Yeşilırmak	Irrigation, energy	83.312	46	273
Üniversite I	1993	Kamaz	Potable water	-	-	-
Vezirköprü	2001	İstavloz	Irrigation	9.657	-	-

Source: www.dsi.gov.tr

There are no barrages within working area borders. Similarly, Project area is not located in any potable water basin and proje will not have any possible impacts on potable water basins and resources.

Lakes in the region are composed of fluctuant stream beds. Lakes have been collected in Bafra, Çarşamba and Ladik districts. Lakes in Samsun Province are given on Table IV.21, and ponds buit for irrigation purposes are given on Table IV.22.

Table IV.21: Lakes in Province Samsun

Lakes	Location	Area
Bafra Lake	Left Coastal of Kızılırmak	1390 ha
Cernek Lake	İn the norh of Balık Lake, in the east coastal of Kızılırmak	590 ha
Liman Lake	In the east coastal of Kızılırmak in the northwest of Cernek Lake	270 ha
Karaboğaz Lake	In the west coast of Kızılırmak	170 ha
Simenit Lake	In the North of Terme District, in the section close to the sea	-
Ladik Lake	10 km away from District Center	12.69 km²

Source: Samsun Governorship, 2006

Table IV.22: Ponds inProvince Samsun

Ponds	Location	It's River	Aim	Irrigation Area (ha)
Güven Pond Irrigation	Samsun – Kavak	Dereçam	Irrigation, potable water	150
Divanbaşı Pond Irrigation	Samsun – Kavak	Deve	Irrigation	320
Kozansıkı Pond Irrigation	Samsun – Kozansıkı	Güngörmez	Irrigation	150
Güldere Pond Irrigation	Samsun – Güldere	Kirazın	Irrigation	100
Karabük Pond Irrigation	Samsun - Vezirköprü	Dereköy	Irrigation	378

Source: www.dsi.gov.tr

In Samsun there is an essential potential available in aquaculture products. Samsun Province alongside with being a coastal city of Karadeniz, has a 4411 ha natural lake surface, a 17.289 ha of barrage lake water surface, a 28.144 ha of pond water surface and a 4615 ha of river surface. Aquaculture product investment in the province has been focused on trout and carp production. Investments have been centred in Bafra District in the I. Sub Region. According to 2004 statistics datas of Samsun Provincial Directorate of Agriculture, share of I. Sub Region is %95,4 within 219ton/year aquaculture production in total with 209 ton/year (see Table IV.23).

Table IV.23: Aquaculture production in Samsun Province

Aquaculture Species	Production Amounts of year 2006
Sea Fish Production	
Anchovy	8.496.589
Red Mullet	200.723
Horse-Mackarel	312.680
Bothus	66.341
Gray Mullet	205.497
Cod fish	776.288
Blue Fish – Small Blue Fish	4.924
Bonito	1.038.292
Others	1.487.509
TOTAL	12.588.843
Fresh-water Fish Production	
Dace	23.479
Gray Mullet	17.050
Carp	114.516
Bullhead	4.700
Pike	750
Crayfish	1.417

Aquaculture Species	Production Amounts of year 2006
Others	11.467
TOTAL	176.379
Culture Fish Production	
Trout	765.800
Carp	Veri yok
Trout (sea)	Veri yok
TOTAL	-
Other Marine Products Production	
S. Escargot	205.200
Carpet Shell	-
TOTAL	205.200

IV.2.7 Hydrological Characteristics (physical, chemical, bacteriological and ecological characteristics of river, lake and other wetland areas out of surace water resources, seasonal variations of the within this context, coastal ecosystems)

Rivers

Biggest rivers of th province are Yeşilırmak, Kızılırmak and Terme Brook. Yeşilırmak which reaches to Çarşamba through Erbaa district disembogues Karadeniz through Civa Cape by dividing the district into two. Other than these rivers there are large and small rivers such as Mert River, Kürtün Brook, Ters Akan Brook, Kara Boğaz Creek, Akçay, Uluçay, Esenli, İncesu, Hızırilyas, Ballıca Creek and Güdedi in the region.

Closest surface water source to the Project area is the Akçay Creek which is in the immediate east of the area (see Figure II.5, Figure IV.24). Akçay Creek rises from Kodaklı Hill, Mezarlık Hill, Molla Evi Site Kızılağaç Stop District Mahallesi and Camibaşı ridges. Precipitation area is 248 km², collector length is 24 km, and its capacity is Q_{max100}= 339 m³/sec, Q_{max500}= 422 m³/sec. Flood and its coastla cove has the potential to its disadvantageous.

Figure IV.24: Akça Creek on the East Border of the Project Area

Lakes and Ponds

Lakes in the region has been composed of fluctuant stream beds. Lakes have been

collected in Bafra, Çarşamba and Ladik districts. While the magnitude of Liman Lake in the 20 km North of Bafra Bafra is 3 km, it has shoved off the sea with some branches. Acreage of Ladik Lake which is 10 km distance from Ladik district is 10 km². Simenit Lake that was composed by shifting of the bed of Terme Creek is in 20 km distance to Terme and appears to be two lakes connected each other with a canal. Except these lakes there are many large and small lakes in the region. There is no lake available near abroad of Project field.

Barrages

Some of the barrages built, being built and being considered to be built on Yeşilırmak and its branches are intended for irrigation, some are intended for energy and some for flood control while some of them are multipurpose projects combining a couple of these aims. On the Yeşilırmak basin in which the stipulated Project field is located, there are 24 hydroelectric plant available. Of the plants with installed capacity of 1259 MW in total, annually produced averagely and reliable energy amounts respectively are 5297 GWhour and 4266 GWhour.

Wetland Areas

Delta Yeşilırmak is the biggest delta of Turkiye on Karadeniz coastal line (90.000 ha). A great majority of the delta has been converted into an agricultural area. Delta Yeşilırmak Important Bird Area is located in approximately 15 km east of stipulated project field. Detailed informations about the delta are presented in Section IV.2.10. As it was mentioned by T.R. Samsun Governorship Provincial Directorate of Environment and Forestry, Project area stays out of Delta Yeşilırmak Wetland Area Preservation Regions (see Appendix-1).

IV.2.8 Living Species in Waters in which Cooling Water to be Supplied and Other Characteristics (Natural characteristics of these species, species that were taken under preservation by national and international legislations; breeding, feeding, sheltering and living environments of them; preservation decisions determined for these environments, wave movements, temperature, depth, salinity etc.)

Cooling water within Project will be supplied from Karadeniz, so that informations about Karadeniz are presented in this section.

Karadeniz, while being one of the biggest semi-closed seas of the world with 432.000 km²' of surface area and 547.000 km³' of volume, has 6 countries around itself. In spite of being surrounded by abrupt mountains, has a poor structure in terms of bays and gulfs. Annual average rainfall amount, in comparison of west and east parts of it, ranges between 400 mm and 2500 mm, has a 750 km³ of fresh-water flow annually to the sea.

Out of this amount, approximately 350 km³ comes from the rivers that are main resources of rich nutrient content fresh water flow moved to Karadeniz (Çelikkale *ve diğerleri*, 1998a).

For determination of oceanographical characteristics of Karadeniz purpose, resources being presented below have been used:

- Research report prepared by NeSA (Studies have been performed by asessing calculated wave nd wind parameters, ship observations, satellite wave and wind parameters and meteorological observations) (NeSA, 1997),
- Results of oceanography studies executed by Fugro-Geos between January 1998 and January 1999 (Fugro-Geos, 1999).

- ODTÜ wind and wave parameters (SAIPEM, 1999).
- Wave and wind parameters received from satellite (OCENOR, 1999). Aforesaid parameters are presented below:
  - GEOSAT parameters: Parameters leaning against 5.000 observations relating to wave speed and wave length on the surface between the dates of 11 November 1986 and 22 September 1989.
  - TOPEX parameters: Parameters leaning against 25.000 observations relating to wave speed and wave length on the surface between the dates of 26 September 1992 and 30 December 1998.
- H_2S parameters assessment report (CAPCIS). Aforesaid report includes assessment of H_2S concentration together with base sediment and pH in water parameters in consequence of measurements done between January and April 1998 (CAPCIS, 1998).

Wind

While blast speeds belonging to the region and their periods have been determined, these values are shown on Table IV.24.

Table IV.24: Wind Speeds

Period (year)	Wind Speed (m/s)			
	NeSA Report	Fugro-Geos Report	ODTÜ Data	Satellite Data
1	14	18	21	15
50	20	25	26	21

Source*: SAIPEM Document No. 024640-4U-RP-5001.*

Wave

Wave lengths on the coastal lines close to the Project field and periods of these waves have been determined (see Table IV.25). Accordingly, the biggest wave length in the region is 7,3m.

Table IV.25: Wave Lengths and Periods

Period (year)	Dalga Boyu (m)		
	NeSA Report	ODTÜ Data	Satellite Data
1	3,3	3,4	4,0
10	-	5,4	5,7
50	5,6	6,8	6,9
100	6,4	7,3	7,4

Source: SAIPEM Document No. 024640-4U-RP-5001.

Flow

Flow measurements has been performed by AANDERAA RDCP600 device. Flow measurements at water coloumn has been executed once per hour and in 15 different layers of 5 m (in intersection of its %50 manner).

Dominant flow in the region is in N-NW direction. Flow speeds on surface range between 0,35-0,50 cm/sec (0,70-1,0 knots) while there is a standatill water layer on the sea bottom available. As for some periods in which flow measurement is executed, same direction and speed flows at all water coloumn have been observed.

In the Project area region, flow direction on the surface range between NW and NE. Even though flow speed rises to 50 cm/sec time to time, stands between average 20-30 cm/sec.

Undercurrents range between SE and SW. Even though flow speeds range between average 0-10 cm/sec, periods in which it rises until 45 cm/sec (0,9 knots) have been observed.

Time dependent variation of horizontal flow speed and vertical flow profile are respectively shown on Figure IV.25 and Figure IV.26. The report prepared by Derinsu regarding sea studies is given in Appendix-6.

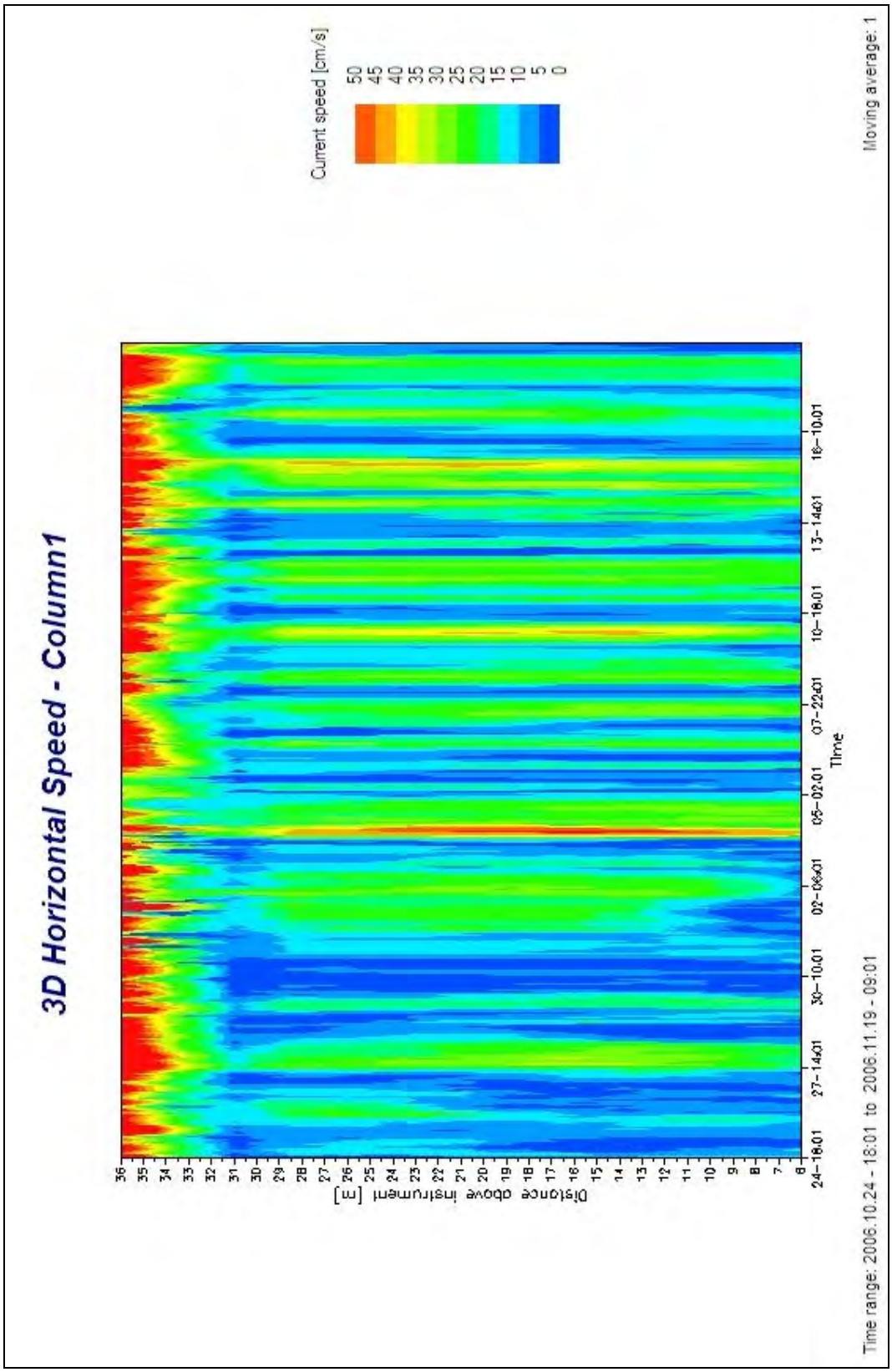


Figure IV.25: Time Dependent Variation of Horizontal Flow Speed

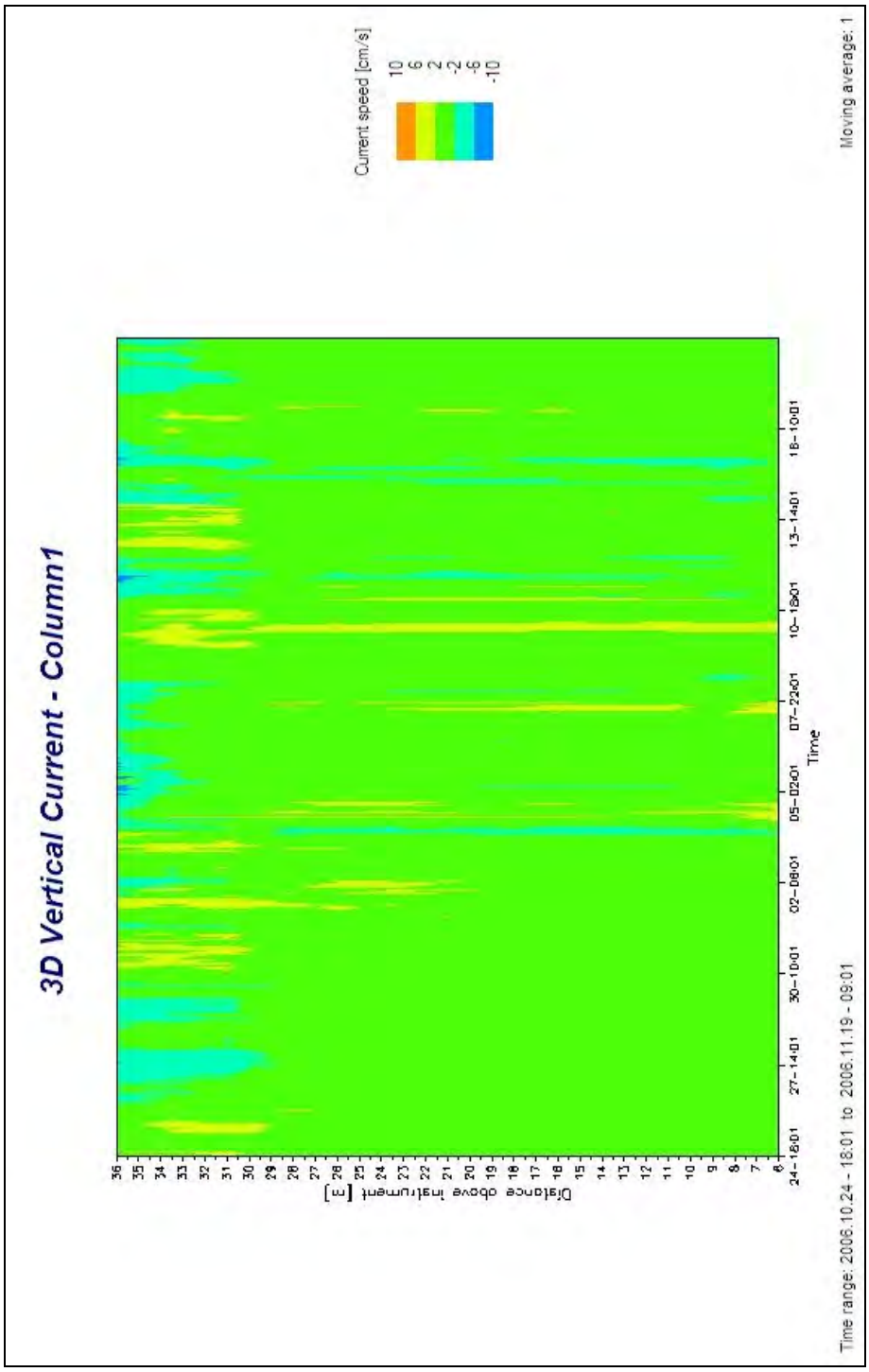


Figure IV.26: Vertical Flow Profile

Sea Water Temperature

In studies executed in project region; surface water temperature on stations A, B, C and D has been measured as proximately 19,20°C. This value had decreased to proximately 18°C proximately 12 m deep from surface, at the sea bottom had decreased until 11,50°C. On stations located close to the coast temperature values have been determined to be almost homogeneous all along water coloumn. Whilst on some stations surface water temperatures range between 19,00-19,20°C, temperature values in deep waters alter between 17,0-19,10°C (see Appendix-6) *Additionally*, *average values regarding sea water temperatures recorded in* Samsun Meteorology

Station between years 1975-2007 are presented in Appendix-5.

Salinity

Surface water salinity values measured in the region are very close to each other. These values alter between 17,65-17,73 PSU. Deep water salinity values have been measured between 17,69-18,24 PSU. Salinity values show similarity with general characteristics of Karadeniz and increase with deepness. (see Appendix-6)

Conductivity

Conductivity data from all stations range between 25,21-25,69 mmho/cm. Conductivity values in deep waters have ranged between a larger scale because of depth differences between stations and have been measured within the range of 19,99~25,39 mmho/cm. As a result of these measurements, it has been determined that conductivity in the region decreases with depth increase. (see Appendix-6)

Turbidity

Turbidity values for surface water range between 0,11-0,32 NTU whilst these values range between 0,11-0,63 NTU for deep waters (see Appendix-6).

Dissolved Oxygen

Values of measurement performed in project region range between 9,0-9,7 mg/L for surface water, 8,7 -9,6 mg/L for deep water (see Appendix-6).

Sea Water Characteristics

Generally, because of stratification in the upper sections of Karadeniz, oxygen amount in sea water have been decreasing rapidly with depth growth. From 150-200 m, oxygen-free ambient starts. From oxygen-free region to deeps, hydrogen sulphide (H_2S) amount increases against decrease in sulphate.

Results obtained from the studies performed for the purpose of determination of sea water characteristics have been summarized below:

- There is no oxygen in regions with over 200 m depth.
- H_2S concentration climbs up to 11 mg/L in regions close to sea bottom.
- However pH value of sea water is high on the surface, pH values are not scaled with depth and range betwwen 6,4-8,7.

Variations in Sea Level

Variations in Sea Level are dependant to the factors listed below:

- Flow direction and speed,
- Wind direction and speed,
- Tidal events,
- Variations in atmospheric pressure,
- Other factors including seismic and wave motions between Akdeniz and Karadeniz.

According to the informatios obtained from the fishers in the region, it has been determined that tidal events do not have a considerable influence on sea level. In consequence of the assessment made by considering all factors, variation in sea level has been determined as around 0,2 m (Bogulavsky *and others*, 1998).

According to the literature informations, nutritive elements carried by the rivers disembogueing Karadeniz and containing nitrogen and phosphor compounds enable evolvement of microscopic sea plants composed the base of food chain in the sea and swimmed passively.

These organisms either have been consumed as a food by the microscopic animal organisms (zooplankton) within the food chain or have been almost completely decomposed by the bacterias after they die and subside to the deep waters. For the actualization of this process, bacterias require oxygen.

But at the deep waters of Karadeniz, there is not enough dissolved oxygen available. For this reason bacterias make for other resources in order to find oxygen and they use the oxygen in the sulfide which is available affluently in the sea water. When the oxygen aparts from sulfide, hydrogen sulfide, a stinking and fatal gas, has been composed of.

As a result of this, parts deeper more than 180 m of Karadeniz, excluding privatized bacterias, are in dead position. Every pollutant carried by the rivers must have not been thought as harmfull. Food increase arised from fertilizers, detergents and sewages in Karadeniz initially had increased the efficiency of the sea and influenced improvement of some fish species such as anchovy.

But, it is not a secret that these have already deranged the delicate balance between different plant and animal species within sea ecosystem.

In the last quarter of the century, food salt density in especially North and west sections of Karadeniz has increased in considerable amounts. In carrying the food salts to Karadeniz atmosphere is a significant resource however the role of the rivers is great.

Sea Ecology

Changes in Black Sea Eco-System and Effects of these Changes on Fauna

The eco-system of Black Sea was exposed to serious changes as a result of eutrophication resulted from the increase of food coming to Black Sea through the great rivers during last 20-30 years. The first of these changes was observed as an increase in the jellyfish biomass (Aurelia aurita) and phytoplankton expansions in abnormal level in 1980. Then, the whole eco-system was basically affected after Mnemiopsis leidyi, a species of one lobe Ctenophora is included in the environment. The mentioned species has competed with anchovy for edible zooplankton and consumed the anchovy eggs and larva. The dominant existence of Mnemiopsis leidyi species in Black Sea is one of the most important reasons of the sharp decrease of anchovy and other pelagic fish species.

The great rivers have had an important role in the change of the ecological characteristics of Black Sea. The amount of food has increased substantially in the plankton populations, especially in North and west parts, as a result of changes such as the increase in the pollution level and the decrease in the water amount discharged by North rivers to Black Sea during last 20-30 years. The rivers have the biggest share in the increase of food in Black Sea in spite of the inputs with atmospheric resources. The Danube River is the most important food resource with its 817.000 km2 of basin. This increase in food level in Black Sea has created an unavoidable eutrophication in Black Sea and caused to the increase of algae and organic materials (Kıdeys and Niermann, 1993).

The smallest change in the food balance may cause to the changes first in the phytoplankton populations and then in the all food chain of the whole eco-system. The strong phytoplankton increase and events called as 'red-tie' may occur due to the eutrophication. According to Vinagradov (1990) the chlorophyll-a values measured in 1989 are 1,5-3 times more than the values measured in 1970 (Kıdeyş ve Niermann, 1993).

The increase in the number of some Copepods until 1980s (for instance, *Acartia clausi*, *Paracalanus pensus*, *Oithana nana*). However, the decrease was observed in the number of the mentioned zooplankton species because of the increase in the biomass of the gelatinous organisms (Kıdeys and Niermann, 1993).

The biomass of Aurelia was recorded as 25 gr/m³ of living weight in all Black Sea in the beginning of 1980s. This amount is equal to approximately 350-400 million tons (Kıdeys and Niermann, 1993). It is not definitely known that Aurelia feeds with the larva and eggs of anchovy but it was found that it is an important predator and consumes the feed marsupial herring as a result of the studies done by Bailey and Batty (1983, 1984), Zhong (1988) and Moller (1984) in Germany (Kıdeys and Niermann, 1993).

The sudden decrease in the amount of the mentioned fish was observed after Mnemipsis species was seen in Black Sea in 1987 although the increased Aurelia biomass had effect on hunted anchovy and other pelagic fishes.

The reproduction period of Mnemiopsis is the same with the spawning period of anchovy. This situation is one of the reasons of the decrease in the number of Copepod or biomass of other zooplankton in Black Sea. Mnemiopsis spread in 1,8-2 kg/m^2 rate in open waters in 1988 and its total biomass in Black Sea in the summer season of 1989 was calculated as 800 million tons (living weight) (Vinogradov, 1990). Consequently, 15-40 times of decrease was observed in zooplankton rate (Kıdeys and Niermann, 1993). The reason in the sudden decrease in the anchovy eggs and larva concentrations in 1989 is not only because of eutrophication but also the attack of Mnemiopsis (Niermann *vd.*,1994).

Only the little part of the organic materials of which the production increased because of the food in Black Sea can be consumed by pelagic fishes. The significant part of these organics are used by Mnemiopsis or accumulated with the sedimentation on the sea bed. Mnemiopsis deposited on the sea bed after they are died since they do not have natural consumers. Thus, the organic material sedimentation rate has increased and the light input has decreased due to this reason. This state prevents the photosynthesis and oxygen production and causes to the increase of H2S production. As a result, the anoksik deep waters get up to the upper layers, the death of benthic organisms increases and the species and sea fauna along of Black Sea shore decrease rapidly (Kıdeys and Niermann, 1993).

Many animal and plant species as characteristic species of Black Sea were either disappeared or are represented with few amounts in 1940s and 1950s after the ecological balance was changed.

Phytoplankton Structure

The smallest change in the food balance may cause to the changes first in phytoplankton populations and then on whole eco-system.

The decrease in the number of the species of phytoplankton as a stress indicator and proportional differentiation among taxonomic groups when there is over food loading in an environment. Especially, the pikoplankton (≤2 µm) and nanoplankton (5-20 µm) species including microflagellat and coccoid forms have been increasing rapidly to the disadvantage of species belong to Diatomea group and had superiority from quantitative and qualitative aspects in the environment.

The beginning of the over reproduction in Black Sea in the spring is directly related to the balance of the water colons. The amount of the food concentration in summer is close to the low limit values. However, the layer between termoclin and euphotic zone layers provides sufficient light and food fort he under surface phytoplankton development. The phytoplankton increase in autumn is due to the environmental conditions and usually seen between October and December. In case the food is not sufficient found in the environment, the reproduction seen in autumn is observed in December-January and transforms into winter reproduction. In some cases, the reproduction during January-March period is related to the spring reproduction through the combined structuring. This reproduction may differ from year to year since it occurs under various environmental factors (Oğuz *vd*., 1996).

It is seen that the solute and particle organic material amount in the sea water and sediment is 2-3 times more than the level in 1960s. It is supposed that the increase in the organic material is resulted from over algae reproduction and increase in the amount of global phytoplankton together with the amount of the materials carried by the rivers (Cociasu *vd*., 1981).

There is not much data in the shorelines of Turkey related to the subject since the studies mentioned above were mostly conducted in Russia, Romania and Bulgaria shores of Black Sea. However, the physical, chemical and oceanographic studies were also conducted in the shores of Turkey.

Phytoplankton Studies Conducted in Black Sea

Phytoplankton has been the subject of the countless research since they provide the data required fort he definition of the bio-ecologic characteristics (biomass structures and seasonal changes in taxonomic compositions, biological features, over reproduction, distinctions among the regions, etc), ocean and eco-systems and form the first ring of the food chain. In addition to these, the differences in the plankton populations were also studied in order to analyse the physical and chemical changes in Black Sea recent years.

The first phytoplancton species studies in Black Sea were conducted by Russian researchers at the end of the last century. The Russian researchers have conducted studies especially related to the present phytoplankton taxonomic structures, vertical – horizontal distribution, seasonal changes and bio-ecologic features on Novorosyisk, Odessa, Batumi, Sevastopol Gulf, the Crimean shores and open waters of Black Sea.

The studies on phytoplankton in Rumania shores were started in 1950s. The first studies in Bulgaria shores in Black Sea were conducted related to the phytoplankton quantitative Dynamics, taxonomy, bio-ecologic characteristics and reproduction.

The rate of diatom to the dinoflagellats has changed significantly in many regions during last decades. Bologa (1986) reported that the rate of dinoflagellats was %67 (209 species)

between 1960 – 1970 and this rate has decreased to %46 (172 species) between 1972 – 1977. This situation is an indicator of a qualitative change in phytoplankton groups. The number of dinoflagellat species have increased from 60 to 77 during the same period. These qualitative changes in phytoplancton explain the presence of new species in the eco-system. The *Gonyaulax polygramma* (Dinophyceae), *Raciborshiella salina* (Volvocales), ve *Eutroptia lanowii* (Eugleninae) species which were firstly seen in the environment, were observed in Black Sea in high intensity in recent years (Mihnea, 1985). The *Hemialus hauckii*, *a species of diatom, was observed in high intensity along the South – east shores of Black Sea* (Feyzioğlu, 1990). This species is known as a transition species in the waters turning from oligotrophic to eutrophic characteristics (Kimor, 1985). The proportion of Rumania phytoplankton diatoms was %92,3 between 1960 – 1970 and this rate has decreased to %62,2 between 1983 – 1988 however the rate of dinoflagellats has increased from %7,6 to %30,9 during the same period as quantitative.

The increase in the biomass and cell number of phytoplankton is the unavoidable results of the eutrophication. For instance, it was reported by Mihnea (1985) that the cell number of diatom Skeletonema costatum found in one liter of sea water was 1×10^4 - 4×10^{6}' between 1962 – 1965 and this rate has increased to $8,3\times10^7$ in 1984. In similar way, the number of dinoflagellat *Exuviella* (= *Prorocentrum*) *cordatum was a few millions in 1960s and it has increased to* 1×10^7-1×10^8 cell/L value between 1975 and 1983. The studies, which have been conducted during last 20 – 30 years along Rumania shores of Black Sea, reported the series increase in phytoplankton reproduction. For instance, the average biomass of phytoplankton between 1983-1988 was ten times more than the value evaluated between 1959-1963. The species number in high intensity values (1×10^4 cell/L) between 1960-1970 was just only 38 and this number increased to 61 between 1971 – 1982 and 72 between 1983 – 1988. The rate of *Exuviella cordata* red-tide has increased in all parts of Black Sea. During the explosion in 1986, the Euxiella biomass in Burgaz Gulf has reached at 1×10^9 cell/L (1 g/L) (Sukhanova *vd.*, 1988). The *Noctiluca miliaris*, another dinoflagellat having red-tie, has reached at 100 g/L of intensity in the influx of the Danube River (Vinogradov *vd.*, 1989). The Nocticula explosion have been an ordinary characteristic of certain regions since 1976-1977 (Caddy and Griffiths, 1990). The phytoplankton explosions affect the vertigal light permeability and cause to the decrease in the solute oxygen content. This situation may result in the increase of the upper limit of the layer without oxygen in Black Sea.

The effect of the eutrophication is not only limited with shore waters but it can also be observed in the open waters of Black Sea. For instance, the chlorophyll values measured in 1989 was 1,5-3 times more than the values measured in the same season in 1970 (Vinogradov, 1990). Similarly, the amount of microbial population has increased 2-3 times than the amount measured 20-30 years before.

The plankton dynamic in the Bosporus and surroundings among the studies conducted in Turkey was researched by Uysal (1993). The same researcher studied the phytoplankton along Turkey shores as quantitative during 1989 spring, 1990 spring and winter seasons.

Karaçam and Düzgüneş (1990) determined the species and intensity of phytoplankton on the surface of Trabzon coasts. Benli (1987) demonstrated the amount and sedimentation speed of the sedimentary plankton with a sediment collector. Benli (1987) also examined the amount of the particle material and sedimentation speed in the same research. The researches related to the distribution of the present phytoplankton populations along Turkey coasts of East Black Sea, Feyzioğlu (1990), the study of the phytoplankton species as quantitative and qualitative in East

Black Sea, Feyzioğlu and Tuncer (1994), the seasonal changes of the phytoplankton species on Trabzon coasts in East Black Sea, Feyzioğlu (1996), and the seasonal changes in phytoplankton species Dynamics in Turkey coast eco-system in East Black Sea were conducted. In addition to all these studies, Oğuz (1996) has explained data related to the cycle of the annual phytoplankton reproduction in Black Sea by using a physical – biological model.

Gönlügür (1995) determined 57 phytoplankton species in the study conducted between 1993 September and 1994 September in the inner harbour of Sinop peninsula. 26 of these species are belonged to Pyrrophyta and 31 of these species are belonged to Chrysophyta..

Zooplankton Structure

The number of the zooplankton studies conducted in the frame of the scope studied in the Project is not high. 25 zooplankton species were determined as a result of the research conducted by Gönlügür (1995) and six of these species were belonged to Protozoa and two were belonged to Coelenterata, one was belonged to Ctenophora an done was belonged to Chordata classifications. At the same time, the meroplancton species were also determined belonged to Annelida, Mollusca, Cirripedia and Malacostraca classes.

As stated in the previous sections, millions of organic and inorganic materials are found in Black Sea every year. However, the number of the studies conducted in Black Sea in order to determine the effect of eutrophication on zooplanktons is not sufficient. It is unavoidable that the changes in the quality and quantity of phytoplankton because of eutrophication affect the structure of zooplanktons. In 1984, the red-tie patches were formed by reaching at siliat *Mesodinium rubrum* (Lochmann), 280 g/m³ values in the coasts of Varna in Bulgaria (Tumantseva, 1985). In 1961, the zooplancton biomass was 2,56 mg/m³ and this value increased to 18,30 mg/m³' in 1967 and to 16,96-155,56 mg/m³' in 1976 and 1977 (Balkaş, 1990). The number of some copepods such as *Acartia clausi*, *Paracalanus parvus*, *Oithona nana has increased significantly until 1980s* (Balkaş., 1990), however it has decreased due to the high hunting pressure caused from increasing biomass of the gelatinous organisms (especially such as jellyfish *Aurelia aurita and ctenephore Mnemiopsis leidyi*) (Shushkina and Musayeva, 1990a, 1990b). It was observed that the copepods have reproduEIA in high amounts in the areas where there is not hunting pressure. For instance, an intensive Calanus ponticus layer is observed on the layer without oxygen in which the predators are not available (Vinogradov and Shushkina, 1982; Vinogradov., 1992).

Some important biological and ecological characteristics should be examined in detail since two gelatinous zooplankton species (jellyfish *Aurelia aurita and* ktenofor *Mnemiopsis leidyi*) had high biomass in Black Sea. The information related to two species are given below in this context.

Aurelia aurita

Aurelia aurita, known as jellyfish, is the member of Knidaria filumun (skifozoa class) having burner capsules called as nemotosist. They are soft, gelatinous and transparent since they contain water more than 95% of their body mass. Aurelia aurita if found in high amounts mostly in eutrophia regions.

Aurelia aurita is separate syngamia and the insemination occurs within the body. The inseminated egg gets out of the body through the egg mouth and develops within the water and reaches at the planua larva period. After a short plankton life period, the planula stack on a base

proper for the sea bottom and transforms into a structure called as Schizostoma. The schizostoma transforms into strobila after a while. At the end of this development, the organism is divided into transverse parts and forms the pelagic young jellyfish called as efira. As it is understood in the light of these explanations, the life of Aurelia is formed of two phases as agamogony (polip) and syngamia (jellyfish).

Although Aurelia aurita is a characteristic species in Black Sea fauna (Zenkevitch, 1963), its population has increased significant in recent years. Between 1950-1962, the biomass of the jellyfis was determined as 1,4 g living weight (Shushkina and Musayeva, 1983). Shushkina and Musayeva (1983) used 1,4 g living weight value and calculated the biomass in 0-50 meters of depth in Black Sea as 30 millions tons (Vinogradov and Shushkina, 1982). In the beginning of 1980s, the biomass of *Aurelia was calculated as* 25 g living weight/m^3. This value is equal to 350-400 millions of ton for whole Black Sea (Shushkina and Musayeva, 1983). IOn the assumption that it feeds as %6 of its body weight as calorie Shushkina and Musayeva (1983) determined that jellyfish consumes %25 of zooplankton amount to be used by fishes. The zooplanktons including Paracalanus, Pseudocalanus, Calanus, Acartia, Oithona, Kladocer and Appendikularia species are the primary food resource of Aurelia (Shushkina and Musayeva, 1983).

Any evident related to the use of anchovy eggs and larva by Aurelia aurita as food is not available. However, the studies should be done against this possibility. Because it was determined that it has an important predator on many fish (such as, *Gadus morrhua*, *Platychthys flesus*, *Pleuronectes platessa and Clupea harengus*) (Bailey and Batty, 1983, 1984; Zhong, 1988). Similarly, Möller (1984) determined that the jellyfish in Kiel Gulf, Germany consumes the herring larva with vitellus in great amounts. However, any decrease in the anchovy population was not observed because of the increased Aurelia biomass until 1987 *Mnemiopsis was seen as mass in Black Sea.*.

Mnemiopsis leidyi

Mnemiopsis is a member of comb jelly filumun known as sea nu tor ctenophora. The ctenophoras are soft, gelatinous and transparent, such as Cnidarias filum, since their body consists of water more than %96. Mnemiopsis is macrophage while the jellyfish is microphage and it can feed on huge organisms (1 cm and more), (Vinogradov, 1989).

Mnemiopsis is hermaphrodite like all other cthenophoras. When they grow, the egg and sperm pass through various channels and are discharged from genital openings between the scallop plates. The insemination occurs in water and the inseminated eggs directly developed as mature animals. Ctenophoras, especially the members of *Mnemiopsis* genus, have high reproduction capacity. *Mnemiopsis mccradyi*, after its formation, can reproduce 8000 eggs in 13 days during 23 days (Baker and Reeve, 1974). The growing rate of this species is at a level which can be compared with the phytoplankton (Reeve, 1978). This high growing speed can be achieved only with a great desire for food.

It was observed that Mnemiopsis biomass has been changing continuous during the year in its original habitat. Kremer and Nixon (1976) determined that the autumn and winter population of *Mnemiopsis is not high in* Narragensett Gulf (1-2 animals/10^4 m^3), but it is higher than 50 individual/m^3 in summer. In many other studies, the time between April and September was determined as the term when Mnemiopsis leidy reached at the maximum level in North Atlanticf (Hirota, 1974; Kremer and Nixon, 1976). This term is same with the insemination period of anchovy

in Black Sea.

It is known for a long time that Mnemiops is an effective predator on zooplankton (Burrell and Van Engel, 1976; Mountford, 1980). Reeve (1978) stated that one of the most important feature of the feeding behaviour of *Mnemiopsis* is that the food consumption of the organism is proportional to the food amount in the environment. It is believed that this situation causes to the decrease in copepod and biomass of other food zooplankton. It was determined that the zooplankton deaths in Chesapeake Gulf in the estuary of York River in a high level such as %73 caused from hunting pressure of Mnemiopsis (Kremer, 1979). It was also determined Govoni and Olney (1991) that *Mnemiops feeds on the larva and eggs of many fish species such as Anchoa mitchili, a type of anchovy.*

It is known that Mnemiopsis is found in the ballast waters of the ships plying to Black Sea from North Atlantic. This ctenophora species was first reported in the North shores of Black Sea in the autumn of 1987 (Vinogradov, 1989). There is still a confusion related to the species name of this ctenophora. The mentioned living thing was first described as mnemiopsis leidyi but then it was claimed that it is a M. mccrady (Zaika and Sergeeva, 1990). It is not absolutely known that weather two ctenophoras are the same species or not but this is a high possibility (Kıdeyş and Niermann, 1993). In 1988, *Mnemiopsis* had a high biomass values such as 1,5-2 kg/m² gin open waters and spread to all Black Sea. In the summer of 1989, the present population of *Mnemiopsis* in Black Sea was determined as 800 millions tons (Vinogradov, 1990). This increase caused to the series changes in the plankton populations. The decrease in 15-40 times was seen in copepod and other food zooplankton biomass (Shushkina and Musayeva, 1990a). This increase in the biomass of *Mnemiopsis* resulted in %5 decrease of *Aurelia* biomass (Vinogradov, 1991). The all present evidences Mnemiopsis has an important role in the decrease of anchovy in Black Sea since it consumes the egg, larva and food of anchovy.

Beroe ovata

It is known that the plankton species affect the food chain in Black Sea. As expected, the new species in the environment have competed with the present species in the environment and usually replaced with them. However, the changes of Beroe ovata in the eco-system cannot be definetly known after it is seen in Black Sea.

The body of Beroe ovata is in caecum shape and the adults are white and pink. It is an cosmopolit form. The highest biomass values of Beroe ovata species were determined as 54 g/m² in January and 13 g/m² in March in the research conducted in Sinop Peninsula (the data related to this research conducted by the Basic Sciences Department of Fishery Faculty and supported by TUBITAK has not published yet). The beroe species were highly observed in the environment in the same study.

It was also determined that there was a high intensity of beroe in the areas out of station and the places near to the coasts and shallow waters. April, May and June are the months when the amount of beroe is at high levels along the coast regions.

Beroe ovata, without tentacle and of which the height can be up to 16 cm, may be fed with gelatinous makoplanton in the same with the other ctenophoras and swallow the animals in the same size with it (Özel, 1998; Demirsoy, 1998). It was observed that Beroe ovata consumed the other species when Beroe ovata species collected from shores were put in the same aquarium

with Mnemiopsis leidyi species. However, almost any study was not conducted about this species.

Ichthyoplankton Studies

The primal study on ichthyoplankton was done by Cunningham in 1885 and the larva and eggs were described (Yüksek and Gücü, 1994). However, the ichthyoplankton studies had a great importance because of the wearing effects of over hunting on the stocks while it had no importance until the end of 1800s. During those years, it was thought that the trawling nets had given damage to the fish eggs. The important studies were conducted by Sars (1879) in this matter and it was determined that many species had pelagic eggs and thus did not damage to fish eggs as a result of these studies.

The first important study on the description of fish larva and eggs was published by Mintosh and Masterman (1897). The more detailed study conducted by Ehrenbaum (1905, 1909) had followed this study.

The ichthyoplankton researches in Turkey started with the study titled as 'Morphologies and Ecologies of Eggs and Larva of Some Bony Fish in Sea of Marmara' conducted by Arım (Demir) in 1952-1957. This study was conducted in the certain stations in Black Sea and Marmara and the eggs and larva of five species having importance in piscary were analysed as ontogenetic, morphological and ecological (Arım, 1957). The mentioned species are the anchovy (*Engraulis encrasicolus*), sardine (*Clupea pilcardus*), mackerel (*Scomber scomber*), iscad (*Trachurus trachurus*) and red mullet (*Mullus barbatus*). The researches published by Arım (Demir) are listed below

- Eggs and Larva of Marmara Deep Sea Fishes, 1958;
- Biological, Ecological and economical Characteristics of Iscad (*Trachurus trachurus* (L.)- Horse mackerel and *Trachurus mediterraneus* (STRD)- Jack mackerel) found in Sea of Marmara and Black Sea; and
- Variation of Anchovy Eggs Sampled in Black Sea, Sea of Marmara, Aegean Sea and Mediterranean, 1959.

Mater, who had studied on the same subject, had also important contributions to the development of the studies on ichthyoplankton in our country. Mater, firstly studied on the distribution and mortality of anchovy eggs in Izmir. Mater then analysed the distribution of fish larva and eggs found in the Bosporus enter of Black Sea with Cihangir (Mater and Cihangir, 1990). The larva was determined belonged to 10 species in %63 of eggs sampled in this study. Blue whiting had the second turn with %13,6 rate. Anchovy larva formed %30 and blue whiting formed %20 of the larva samples.

Yüksek (1993) examined the amount and distribution of pelagic eggs and larva of teleost fishes in the North of Sea of Marmara. In this study, it was determined that the eggs of species such as D. anularis and M. barbatus are spawning in warm months and S. sprattus and G. mediterraneus species are spawning in cold months.

Yüksek and Mater (1993) examined the spawning periods, distribution, amount and mortality of 40 species in the study on the pelagic larva and eggs of teleost fishes.

The scientists from different countries conducted studies on ichthyoplankton in Black Sea since 1940s.

Slastenenko determined the fish species and ecologies living in Black Sea with the study called 'Fishes in Black Sea Basin' (1955-1956). The information related to the spawning characteristics, egg types and sizes of fishes were given in this study.

The ichthyoplankton studies conducted by Dekhnik (1973) is one of the guideline studies in the determination of the egg and larva of the fishes living in Black Sea. His study called as 'Black Sea ichthyoplankton'is an important resource fort he researchers.

The purpose of the study conducted by Niermann (1994) between 1991-1992 and reproduction season (June – July) was to determine the distribution of eggs and larva in all Black Sea. One of the most important findings of this study is the determination of the change in the spawning areas of anchovy in Black Sea. It was determined that anchovy was leaving its traditional spawning areas in North-East Black Sea and chose the South-East coasts of Black Sea as the new spawning areas. Also, it was determined that the eggs and larva of anchovy is usually distributed on the sides near to the surface of the water (0-3 m) but eggs and larva can be seen up to 70 m of depth and M. -leidyi, one of the ctenophoras, is an important predator for anchovy.

Mater and Cihangir (1997) arranged the amount and distribution of eggs of anchovy and scad in the study done in 34 stations in the economical region of Turkey in South-East Black Sea. The eggs ware found in an irregular distribution in the study conducted in the reproduction period that (july 1992). The results of this study are given below:

- The number of anchovy eggs is approximately 25,2 (SD 28,3) per square mater.
- The number of scad eggs through Bosporus is approximately 3,5 (SD 6,79) per square meter in the site.
- The eggs are mostly seen in the enter of the Bosporus and the number of anchovy and scad eggs in this area is approximately 135 and 3-14 per square meter respectively.

It was determined in the study related to the anchovy eggs in Black Sea conducted by Gordina (1997) in July 1992 that the linear measurement of anchovy eggs differed from region to region. The results of this study are given below:

- Sizes of eggs found in North region:
  Long axis : 1,18 mm (1,00-1,37 mm)
  Short axis : 0,74 mm (0,62-0,87 mm)
- Sizes of eggs found in South region:
  Long axis : 1,11 mm (0,95-1,25 mm)
  Short axis : 0,66 mm (0,50-0,80 mm)
- The shape of the eggs found in South Black Sea is oval and they are long.
- The shape of eggs found in North Black Sea is oval and bigger than the ones in South Black Sea. The long eggs are mostly found in shores.
- The shapes and sizes of the anchovy eggs are not related with the temperature and salinity. The changes in the sizes of eggs show that Marmara anchovy migrates to Black Sea

The recent changes in Black Sea caused to the change of ecology of pelagic fishes. These changes, especially significant in anchovy forming the most part of fishes in Black Sea (*Engraulis encrasicolus*). In parallel to the increase of the amounts of food salts carried to sea through the rivers, the stocks of anchovy in Black Sea, thus the hunting rates, have increased to 500 thousands of tons for whole Black Sea first and then to 300 thousands of tons for Turkey

(Kıdeyş, 1994). However, the stock and hunting amounts of anchovy have suddenly decreased at the end of 1980s because of the increasing amount of food salts have reached at eutrophication level, over hunting and ctenophore Mnemiopsis leidyi having strong competition capacity. The amount of anchovy hunted on Turkey coasts has decreased to 50-60 thousands of tones and the same situation was observed in the other Black Sea countries. The anchovy amount hunted on Turkey coasts has started to increase due to the improvement in the eco-system in the last few years. The ecological changes in anchovy and other pelagic fishes are not the situation observed only in adult fishes but the early life phases of the fishes were also affected seriously. Few larva and eggs were found in North-west region, that was previously known as the main spawning area, but too much larva and eggs were found in south-east Black Sea that was previously known as unimportant spawning area in the past (Niermann., 1994).

It was determined that the temperature is one of the most important factors affecting the egg distribution as a result of studies related to the matter. It was also determined that the temperature of sea water should be above 20^{o}C fort he spawning of anchovy (Deknik, 1954). As a result of studies conducted on this matter in June 1991, when the temperature was under the seasonal normal (<20^{o}C), very few eggs found and no larva was observed (Niermann, 1994). However, too much larva and eggs were observed by the same researchers during the studies conducted in July 1992 when the temperature was between 21^{o}C - 23^{o}C. Also, the number of eggs found in east Black Sea, 1-2^{o}C warmer than west, were more than the number of eggs found in various parts of Black Sea in this period.

The fish and ichthyoplankton species found in the researches conducted by Middle East Technical University (METU) Marine Sciences Institution in 1991, 1992 and 1993 are given in the Table IV.26(TÜBİTAK, Project no YDABÇAG 446/G). The larva and eggs of total 36 fish species were found in the ichthyoplankton samples and 15 species were determined in 1996 as a result of the studies conducted by this time.

Table IV.26: Number and percentage of Fish egg and larvas of Fish Types Met in Samples in 1996 within 100 m^2

No	Specie	Egg	%	Larva	%
1	*Arnoglossus kessleri*	0,2	<0,1	0,0	0,0
2	*Blennius pava*				
3	*Blennius tentacularis*				
4	*Blennidae sp.*				
5	*Boops boops*				
6	*Ctenolabrus rupestris*				
7	*Crenilabrus cinereus*				
8	*Diplodus annularis*	0,0	0,0	0,4	0,9
9	*Engraulis encrasicolus*	868,5	96,5	35,2	74,1
10	*Gaidropsarus mediterraneus*				
11	*Gobius niger* veya *Aphia minuta*				
12	*Gobius* sp1.	0,0	0,0	3,4	7,2
13	*Gobius* sp2.				
14	*Gobius* sp3.				
15	*Lepadogaster lepadogaster*				
16	*Merlangius merlangus*	10,3	1,2	1,9	4,1
17	*Mugil auratus*				
18	*Mugil cephalus*	0,4	<0,1	0,0	0,0
19	*Mugil soui*	0,2	<0,1	0,0	0,0
20	*Mugil* sp.	0,2	<0,1	0,0	0,0
21	*Mullus barbatus*	6,5	0,7	0,0	0,0

22	*Ophidium barbatum*				
23	*Platichtys flesus*				
24	*Pomatoschistus minutus*				
25	*Pomatomus saltatrix*	1,7	0,2	0,0	0,0
26	*Sarda sarda*	1,9	0,2	0,0	0,0
27	*Scomber scombrus*				
28	*Serranus scriba*	0,2	<0,1	0,0	0,0
29	*Solea lascaris*				
30	*Spicara smaris*	0,0	0,0	0,2	0,5
31	*Sprattus sprattus*				
32	*Sygnathus phlegon*	0,0	0,0	5,8	12,2
33	*Sygnathus rostellatus*				
34	*Sygnathus thyple*				
35	*Trachurus trachurus*	15,4	1,7	0,2	0,5
36	*Uranoscopus scaber*				
Total number within 100 m^2		905,5	100	47,1	100

Fish Types in Karadeniz

There isn't any precise figures presently about fish types living in Turkiye seas. Most significant reason of this is the economical value of the fish types living in our coastals is not much and sufficient studies have not been performed on the matter. Slastenenko (1955-1956) has reported 189 types living in Karadeniz out of which 155 live in sea and 34 live in large mouth of rivers fed Karadeniz. Notwithstanding, in recent years because of overfishing and pollution, reducement has been actualized in some fish types. On the other hand, with exploring new types, this figure would have an increase. In "Turkiye Fauna Database Project" prepared for TÜBİTAK, detailed information has been given about all fish types already found in all our seas including Karadeniz (Turkiye Vertebrates Species List, 1996). Fish species met in studies performed until today in Sinop peninsula by 19 Mayıs University Sinop Faculty of Aquaculture Basic Sciences Department are given on Table IV.27.

Out of these species, *Mugil soui* (gray mullet) has been found for the first time in Turkiye coastals (TÜBİTAK, 1997).

Table IV.27: Fish Species Found in Littoral Waters

Specie	Family
Squalus acanthias (LINNAEUS,1758)	Squalidae
Raja clavata (LINNAEUS,1758)	Rajidae
Dasyatis pastinaca (LINNAEUS,1758)	Dasyatidae
Acipencer stellatus (PALLAS, 1771)	Acipenseridae
Acipencer nudiventris (LOVETZKY,1828)	Acipenseridae
Acipencer sturio (LINNAEUS,1758)	Acipenseridae
Acipencer guldenstaedti (BRANDT, 1833)	Acipenseridae
Huso huso (LINNAEUS,1758)	Acipenseridae
Alosa caspia bulgarica (DRESNSKY, 1934)	Clupeidae
Sprattus sprattus phalericus (RISSO,1826)	Clupeidae
Sprattus sprattus sprattus (LINNAEUS,1758)	Clupeidae
Engraulis encrasicholus ponticus (LINNAEUS,1758)	Engraulidae
Salmo trutta labrax (PALLAS, 1811)	Salmoniidae
Anguilla anguilla (LINNAEUS,1758)	Anguillidae
Belone belone (GÜNTHER,1866)	Belonidae
Aphanius fasciatus (CUVIER ET VALENCIENNES, 1821)	Cyprinidontidae
Syngnathus acus (LINNAEUS,1758)	Syngnathidae
Hippocampus hippocampus (LINNAEUS,1758)	Syngnathidae
Gasterosteus acuelatus (LINNAEUS,1758)	Gasterosteidae
Merlangius merlangus euxinus (NORDMANN,1840)	Gadidae
Gaidropsarus mediterraneus (LINNAEUS,1758)	Gadidae
Serranus scriba (LINNAEUS,1758)	Serranidae

Dicentrarchus labrax (LINNAEUS,1758)	Serranidae
Pomatomus saltator (LINNAEUS,1766)	Pomatomidae
Trachurus trachurus (LINNAEUS,1758)	Carangidae
Trachurus mediterraneus (STEINDACHNER,1868)	Carangidae
Sciaena umbra (LINNAEUS,1758)	Sciaenidae
Umbrina cirrosa (LINNAEUS,1758)	Sciaenidae
Mullus barbatus ponticus (ESSIPOV,1927)	Mullidae
Mullus surmeletus (LINNAEUS,1758)	Mullidae
Diplodus annularis (LINNAEUS,1758)	Sparidae
Diplodus sargus (LINNAEUS,1758)	Sparidae
Spicara maena (LINNAEUS,1758)	Centracanthidae
Spicara smaris (LINNAEUS,1758)	Centracanthidae
Chromis chromis (LINNAEUS,1758)	Pomacentridae
Labrus bimaculatus (LINNAEUS,1758)	Labridae
Symphodus cinereus (BONNATERRE,1788)	Labridae
Trachinus araneus (CUVIER,1829)	Trachinidae
Trachinus draco (LINNAEUS,1758)	Trachinidae
Uranoscopus scaber (LINNAEUS,1758)	Uranoscopidae
Sarda sarda (BLOCH,1793)	Scomberomoridae
Gobius niger (LINNAEUS,1758)	Gobiidae
Gobius cobitis (PALLAS,1811)	Gobiidae
Mesogobius batrachocephalus (PALLAS,1811)	Gobiidae
Blennius ocellaris (LINNAEUS,1758)	Blennidae
Callionymus festivus (VALENCIENNES,1837)	Callionymidae
Mugil cephalus (LINNAEUS,1758)	Mugilidae
Mugil soui	Mugilidae
Liza aurata (RISSO,1810)	Mugilidae
Atherina boyeri (RISSO,1810)	Atherinidae
Atherina hepsetus (LINNAEUS,1758)	Atherinidae
Scorpaena scrofa (LINNAEUS,1758)	Scorpaenidae
Trigla lucerna (LINNAEUS,1758)	Triglidae
Psetta maxima maeotica (PALLAS,1811)	Bothidae
Platichthys flesus luscus (PALLAS,1811)	Pleuronectidae
Solea vulgaris (QUENSEL,1806)	Soleidae

Studies About Karadeniz Macrofauna

While number of macrozoobenthic species in Karadeniz is proximately 1.785, 266 out of these are from brackish water of littoral zone, 150 are from Istanbul Bosphorus, rest are from Romania coastals (Mutlu, 1990).

Besides it has been known that 125 mollusc and 261 crustacean species are available in Karadeniz (Mutlu, 1990).

Mutlu (1990) carried out a study related to the present benthic living things of which the sediment samples were taken from 20 stations along Black Sea coasts of Turkey in 1988 August – September and 1989 January. 40 barnacle and 37 mollusc species were reported in this research.

The list of present species in Turkey was given in the study titled as 'Biological Values of Turkey' (1990) that was published by Turkey Environment Issues Fund'.

The studies were carried out related to the invertebrates and macro algaes found in upper sides of Akliman and Hamsaroz Gulfs (Sinop) of West Black Sea in 1987. This study was the first one carried out in the mentioned region and 51 species were determined in this study. 20 of these 50 species are algae; one is phanerogame and remained 30 species were Cnidaria, Plathelminthes, Nemathelminthes, Annelida, Mollusca and Arthropoda filums organisms. There are also other studies carried out related to the intervebrates along the coasts of Sinop (Ateş, 1997; Sezgin, 1998; Bat., 1998, 1999). Decapod Crustaceans and Amphipod Crustaceans were studied in detail along the coasts of Sinop by Ateş (1997) and Sezgin (1998).

Ateş (1997) determined the *Eriphia verrucosa*, *Liocarcinus depurator*, *Xantho poressa*, *Pachygrapsus marmoratus*, *Carcinus aestuarii*, *Brachynotus sexdentatus*, *Palaemon adspersus*, *Palaemon elegans*, *Crangon crangon* (, *Pisidia longimana*, *Diogenes pugilator* ve *Upogebia pusilla* species in the study carried out on Gerze and Hamsaroz Coasts of Black Sea. *Liocarcinus depurator and Brachynotus sexdentatus* species were recently reported for Turkey coasts of Black Sea (Ateş and Sezgin, 1999; Ateş, 1999).

Sezgin (1998) reported total 35 species in the samples of supra, medio and upper infralittoral zones taken from six stations in Sinop Peninsula. Among these species, the *Leptocheirus pilosus* (Zaddach, 1844), *Orchestia cavimana*, *Orchestia stephenseni*, *Orchestia mediterranea*, *Hyale crassipes*, *Gammarellus angulosus*, *Atylus massilensis and Ampelisca pseudospinimana* were firstly reported on Turkey coasts of Black Sea (Sezgin, 1998, 1999; Bat, 1999; Sezgin and Bat, 1999).

Karadeniz Pollution

Despite the problems created by pollutants such as pestisites, PCB's (polichlore biphenile), metals and radiation are expanding day by day, we have to say that these pollutants are not the first degree factors in fishing activities. Especially the results obtained from Sinop peninsula and its environment from the pollution studies are very satisfactory. According to the results of pollution studies which has been carried out fort he 10 years in 19 Mayıs University Water Products Faculty Basic Sciences Department, this region is found to be clear (by means of fish, algie and sea water). The heavy metal (copper, zinc, cadmium, lead, iron, manganese, nickel, etc.) levels found in the present organisms as a result of obtained samples have been compared with other studies and values set by the international institutions (MAFF, 1995; The Food Safety Regulations, 1992). The species sampled may be listed like belov (Öztürk, 1991 ve 1994; Öztürk ve Öztürk, 1994; Öztürk *vd*.,1994a,b ve 1996a,b; Öztürk ve Bat, 1994; Bat *vd*., 1998, 1999):

- **Algae and sea grass**: Enteromorpha linza, Cystoseria barbata, Ulva lactuca, Cymodocea nodosa;
- **Invertebrates**: Patella coerulae, Idotea baltica, Eriphia verrucosa (giant crab), Rapana venosa (snail), Palaemon elegans (shrimp), Carcinus aestuarii (crab), Mytilus galloprovincialis (mussel)
- **Fish**: Alosa bulgarica (shad), Trachurus trachurus (scad), Mullus barbatus (red mullet), Merlangius merlagius euxinus (blue whiting), Engraulis encrasicolus (anchovy), Belone belone (gar fish), Pomatomus saltatris (blue fish)

It was found that the level of the heavy metals in Black Sea was lower than the values determined by the other studies about the subject and the international organizations as a result of the studies carried out related to the pollution.

IV.2.9 Thermal and Geo-Thermal Water Sources (Their chemical and physical characteristics, flow rates, present and planned usages)

The geo-thermal sources are mostly found in Havza district of the province. They are the health foundations that have been utilized about 2000 years and their flow rate is 20 L/s. Ladik Hamamyağı Thermal Spring is in 13 km North to Ladik district centre. It has a long history and usage and the flow rates of Hamamyağı thermal spring are not too high and the water temperature is 35ºC.

There are not thermal and geo-thermal water sources in the Project site and surroundings.

IV.2.10 Protected Environment (National Parks, Watery Areas, Natural Monuments, Natural Protection Areas, Bio-genetic Reservation Areas, Biosphere Reservations, Natural Site and Monuments, Archaeological, Historical and Cultural Sites, Special Environment Protection Areas, Touristic Regions)

The Project site and study area are placed in Yeşilırmak Delta. The Important Bird Areas of Yeşilırmak Delta (ÖKA) is placed in 15 km west of the foreseen project site.

The Second Ordinary Meeting in 2008 of National Watery Area Commission was held in 06.11.2008 as stated by T.R. Samsun Governorship Environment and Forestry Directorate and the Watery Protection Areas of Yeşilırmak Delta were identified (see Appendix 1). According to this determination, the project site is placed out of the Watery Protection Areas of Yeşilırmak Delta.

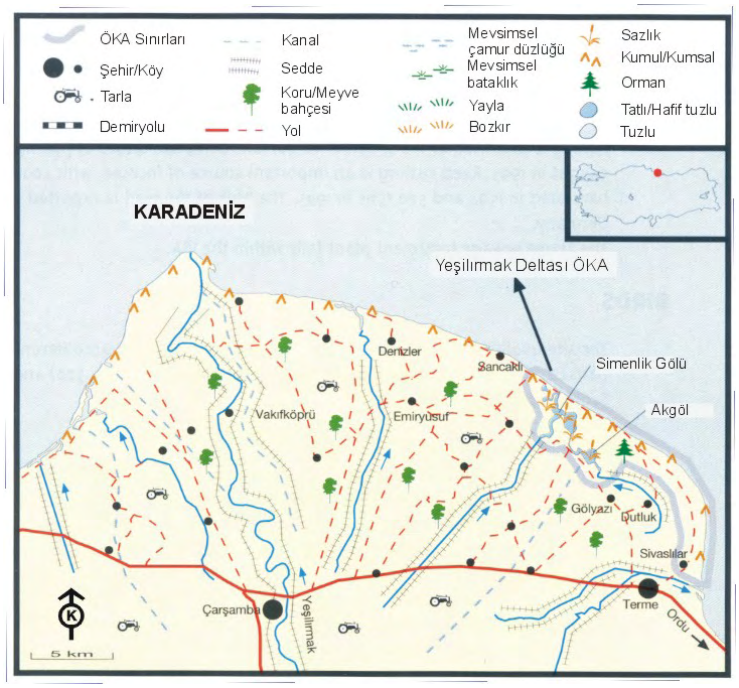
In addition to this, the examinations were carried out in the Project site by the authorities of T.R. Samsun Governorship Culture and Tourism Directorate and it was determined that the mentioned site is not the area which was declared as the touristic area and centre determined by Act no 3634 and not near to the touristic facilities. The letter of T.R. Samsun Governorship Culture and Tourism Directorate related to the subject is given in the Appendix 1.

The information related to the area among the fields which are vital for birds is obtained from the publish titled as 'Vital Bird Areas' issued by Samsun II Environment Report and Society for the Protection of Nature.

Yeşilırmak Delta

Overall Information

Yeşilırmak Delta is one of the biggest Deltas in shore of Black Sea of Turkey. A major part of the delta has been dried and converted to an agricultural area. There is Simenlik Lake-Akgöl, Marshy Land complex, sand dune areas and a wider forestation area in eastern part of delta and back of these lands which have partially been protected their natural characteristics (See. Figure IV.27). 200 ha of Simenlik Lake-Akgöl having totally 1900 ha surface area is an open water area and its remaining part is marshy place and quicksand. Many villages have been established in the delta by opening new agricultural areas and production of hazelnuts and paddy increased significantly. There are oak and ash tree high forests. There are also rocky lands in more marshy sections of the area.



Source: Branch Office of Nature Conservation and Hunting and Wild Life, 2005

Figure IV.27: Important Bird Fauna in Yeşilırmak Delta

Ixobrychus exilis, cochlearius cochlearius, ardeola ralloides, marsh harrier , black-winged stilt and river bulbul most probably species those incubating and reproducing in the area. Delta is also extremely important for migratory aquatic birds such as anas platyrhynchos, pluvialis apricaria, aythya ferina, pakta, pterocles alchata during winter season.

Fishery is popular in Simenlik Lake-Akgöl. 6 tons of fish was caught in the year 1995. Nutgrass cut in 1994 was 400 tons and in 1995, 500 tons is another source of way of living for the region. Terme treatment facility locates within the boundaries of Specially Protected Environmental Area.

According to Land Hunting Law of No. 4915 and dated 11/07/2003 within Yeşilırmak Delta; and in the view of directions of General Directorate for Natural Protection and National Parks dated 21.08.2003 and numbered B.18.0.DKMPG.0.03.04.265.00/61-1807, for the purpose of eliminating disputes those may rise between local people and our entity in Wilde Life Protection Area, the boundaries of the land has been submitted to the Ministry position as totally reserving a surface area of 3306 ha by setting to ultimate and net border lines by respecting to both Ramsar Area and also the natural boundaries.

Birds

Special environment protection status has been granted for Ardeola Ralloides reproducing in Specially Protected Environment Area (30 pairs) and Netta Rufina over wintering (maximum 520) and Melanitta Fusca (maximum 870) populations.

Other reproducing bird species are Nycticorax nycticorax (9 pairs), Egretta garzetta (30 pairs) and çeltikçi bird (7 pairs). Bubulcus ibis is frequently observed and estimated that it is reproduced in Delta. There is a limited number of aqua birds in the region (7750 Anas platyrhynchos, 3000 Anas crecca, 5400 Aythya ferina, pakta and 1600 Anas akuta included). By intense hunting activities in marshy lands these birds have to spend their time on sea in daytimes

and fed in the delta in night times.

Protection and Problems

- Simenlit Lake – Akgöl watery area complex and fields on 16.042 ha surrounding it were included in the Site for the Protection of Wild Life statute since 1975.
- The dams have been constructed on Yeşilırmak River, 519 km, since 1966 and the lower catchment area of the river was set. The dams related to the special protection areas are Suat Uğurlu and Hasan Uğurlu dams completed in 1981 (total water holding capacities are 1255 hm^3 and produced energy amount is 1490 GW hour / year). The activities related to the flood protection on 67.000 ha of field in the lower catchment area of the river were carried out in the frame of the Project implemented in 1968. DSİ had completed the improvement activities of 16.000 ha of field in the South and east parts of Terme in 1970. It had also developed the drainage of 20.000 ha of field between 1992-1996. The current projects have foreseen the watering of 82.700 ha field in the catchment area. Thousands of hectares of land were dried by the official organizations and region public for years. In the light of these activities, it can be seen that approximately 70.00 ha of field of Yeşilırmak Delta were improved for the purposes of agriculture and residential areas in the last 40 years. The all lakes included in the inner regions (Dipsiz and Kuş lakes are the primaries) were destroyed. Karaboğaz River was previous flowing to Simenlik Lake on which there were two small icelands but then it has changed its direction so that the area of the lake has become smaller and divided into two parts as Simenlik Lake and Akgöl as a result of this direction change.
- The pine planting for the stabilization of the sand dunes are a great threat to the natural sand dune vegetation cover. Especially the salix and alnus planting in the boggy fields may cause to the disappearance of these sensitive habitats.
- The feeding of Simenlik Lake and Akgöl with the discharge channels returning from agriculture fields caused to the eutrophication in the lake and coverage of all open water fields with rush. Although there is not sufficient data related to this matter, it was foreseen that the pollution of lakes resulted in the significant decrease of the fish species hunted.
- The level of hunting is very high in the region although it is closed to hunting.

IV.2.11 Forest Lands (The amount of forest lands, types and amounts of tress on this area, magnitude of the area covered, purpose of current and planned protection and/or utilization purposes, distance of project and units to the nearest forest land if project area is not a forest land, 1/25.000 scaled stand map)

Investigations were conducted within the Project area located in Terme District Dumantepe Village Akçay territory by Republic of Turkey, Ministry of Forestry, General Directorate of Forests, General Directorate of Forests of Amasya and Samsun Directorate of Forest Administration for the purpose of determining weather the project area is a forest land. The letter prepared according to the issue is submitted in Annex-1. Accordingly, since no Forest cadastral survey is performed in the area, the assessment is made per confidential country map with SAMSUN f38 d2 map section no with a scale of 1/25000 printed in 1957. Immovable property was considered that it locates on NON FORESTRY since it remains on open land according to confidential country map. In addition, “Investigation Assessment Form As Basis for EIA (Environmental Impact Assessment) Document” approved by Regional Directory of Forestry of Amasya is submitted in Annex-1.

IV.2.12 Flora and Fauna (Species, endemic species, wild life species and biotypes, species protected under national and international legislations, scarce and endangered species and their location on the area, protection decrees for them; living environments of game animals and their population) showing of vegetation types of project area on a map, protection measures to be taken for creatures those may effect by project activities (during construction and operation phase), realization of flora study on the land during vegetation period and clarification of this period

Flora

Black Sea Region locates in Euro-Siberian Territory. Euro-Siberian Territory is a floristic territory reaches from Island to Kamçatka and located in south of sub-arctic region. The dominant vegetation in this floristic territory are forests. However besides that there are other formations created by climatic and location aspects. This territory mainly divides to the following sections:

1. Atlantic
2. European territory
3. North European territory
4. Mid Europe territory
5. Caucasian territory
6. Colchis and Euxine territory
7. High mountains and Alpine mountains of Europe
8. Siberia territory.

"Flora of Turkey and the East Aegean Islands (Davis, 1988)" has been utilized for the diagnosis of species as a fundamental source. Fundamental sources of "Grand Flora Guide" prepared by Şinasi Akalın and "Turkish Flora Names" prepared Prof. Dr. Turhan Baytop was benefited for Turkish names of flora. Generally fixed taxons in the level of species, sub-species and varieties in effected are and in its vicinity belongs to Pteridophyta, Dicotyledones and Monocotyledones groups. Taxons belong to Euro-Siberian, Mediterranean, Euxine Irano-Turanien flora elements. Moreover there are multi-territorial taxons. Despite study area and its vicinity locates in Euxine province, Mediterranean flora elements being located in significant numbers is a result of similar Mediterranean climatic conditions in the territory. Therefore, it is possible to observe a few amount of Mediterranean propagating species in Black Sea Region. These are especially frequent is Mid Black Sea region.

Methodology

Open area studies were conducted by our side in 2007-2008 for the purpose of determining risks and protection status of components consisting floral structure and flora of the territory under the scope of Natural Gas Combined Cycle Plant within the boundaries of Samsun Province. Flora samples were collected from the land during open area studies. These collected wet plant samples were dried as compatible with the method. The fundamental source called "Flora of Turkey and East Aegean Islands" was benefited for the definition of dried plant samples. The list of diagnose plant species are given in Appendix-7.

The systematic locations of plants those have been determined to locate on the area in the floristic list are given in alphabetical order to facilitate controls. Family names given in first column, taxsons is second column, endemism condition in third column, Phyto-geographic region given in forth column if known and Turkish name of plant is given in fifth column. Fundamental sources of "Grand Flora Guide" prepared by Şinasi Akalın and "Turkish Flora Names" prepared

Prof. Dr. Turhan Baytop was benefited for Turkish names of flora.

In sixth and last column of the table given in Apendix-7 danger category of taxon is specified. The danger categories of plants has been prepared according to criterions fixed by IUCN commission and Ekim et al, and also it was benefited from the source called “Red Book of Plants in Turkey” published by “Association for the Protection Of Nature of Turkey”.

The abbreviation and definitions used for the fixation of danger categories of plant species:

EX: Extinct
EW: Extinct in nature
CR: Under extreme danger
EN: In danger
VU: Harmed
NE: Not evaluated
LC: Under less danger
DD: Inadequate data
NT: Candidate to be under danger

Habitat Classes:

1- Forest
2- Maquis
3- Frigana (Plants mostly barbed, short and forming ball pillows
4- Culture areas (Gardens etc.)
5- Dry meadow
6- Dump meadow, Marsh and Wet Land Area
7- Road side
8- Rocky

Ambient Abundance Classes:

1- Few and far between
2- Few
3- Mid level abundant
4- Abundant
5- Very abundant

Endemism:

L- Local endemic
B- Regional endemic
Y- Frequent endemic

Floristic Analysis

As a result of the survey performed regarding floristic structure of Samsun Natural Gas Combined Cycle Plant Project field, 128 species, 159 kinds, 6 sub-kinds and 2 subspecies belonging to 36 families have been determined in the project area. Distribution of the plants determined from this area as per phytogeographical regions is as follows; Mediterranean element 9, Eur.-Sib. element 28, Ir.-Tur. element 1, ve Auxin element 11. 79 species are whose phytogeographical region is unknown or belonging to more than one phytogeographical regions. 129 of plant types determined the region are in LC (Under a little duress) category. There is no endemic plant types availbale in the project construction site.

Preservation Measure

The endemic or plant species under protection are not available in the site of Samsun Natural Gas Combined Cycle Power Plant Project. Because of this reason any precaution is not required in order to protect the plant species.

Vegetation

The Natural Gas Combined Cycle Power Plant Project site in Samsun is the agriculture field. Most of the plant species were determined on the unplanted fields. They were also determined in the moist soils near to the sea.

Result

The plant species of which the commerce is forbidden and under protection in accordance with CITES (the treaty related to the international trade of the plant and animal species of which the generation are in danger) signed in Washington in 03.03.1978, are not found when the floristic lists of Samsun Natural Gas Combined Cycle Power Plant Project is assessed. Also, the plant species under protection in accordance with the Treaty for the Protection of Europe Wild Life and Environment (BERN) approved by Turkey as official party are not determined in the project site and its surroundings.

Fauna

The wild fauna species and habitats belonged to Amfibia, Reptilia, Aves and Mammalia classes in the project site and its close surroundings were examined and evaluated in the frame of the studies carried out about the inland fauna. During this study, the literature resources were used and the fauna species in the effect area or possibly in the effect area were listed. The information related to the extend area, habitat features and risk situations in Turkey were also stated with the species.

The updated Appendix lists in force of criteria of Bern Treaty signed by Turkey and many countries in Europe and approved at international level for the protection of birds were also used.

The Table showing Red List of Birds in Turkey (Species List in Red Data Book), arranged by Kiziroğlu (1993) related to the fauna in Turkey was added as Appendix in 2006 publish of European red List (ERL) arranged by IUCN.

Also, the criteria of EVRDB (European Vertebrate Red Data Book) were taken as base in this evaluation.

In addition to these, the protection lists of 2008 – 2009 arranged by T.R. Ministry of Environment and Forestry, General Directorate of Nature Protection and National Parks, central Hunting Commission, were revised and the protection situation of bird species in the area was examined.

The evaluation was made in order to determine the protection situation of bird species in the project site and its surroundings in accordance with Bern Treaty criteria. The following lists were taken into account among the bird species determined in the region according to the protection lists:

- Bern List Appendix-II (List of Species Under Strict Protection),
- Bern List Appendix-III (List of Species Under Protection).

Also, the evaluation was made in compliance with ERL list arranged and updated by Society of Protection of European Nature (IUCN) and the species included in 'Close to Risk' category (=NT) and 'The Least Risk' category (LC) were determined.

The bird species, which were determined in the project site and its close surroundings as a result of evaluation done by EVRDB, are included in the Appendix Lists of Bern Treaty and Protection Lists of Central Hunting Commission.

According to the evaluation results done by in compliance with the Lists of central Hunting Commission of General Directorate of Nature Protection and National Park, the lists of animals are included in:

Appendix-I "List of Wild Animals under Protection"
Appendix-II "List of Game Animals under Protection
Appendix-III "List of game Animals Permitted for Hunting in Certain Periods" .

The endemic bird species were not found among the bird species recorded in the project site and its close surroundings.

Possible Impacts of the Acitivity on Terrestrial Fauna and Precautions that must be Taken

The requirements related to the species included in the Appendix Lists of Bern Treaty (Appendix II and Appendix III) among the species found in the activity site and its close surroundings were stated in the related articles of the treaty. The all countries, which are the parties of Bern Treaty, are responsible for the protection of the habitat of all wild species included especially in the Appendix II in accordance with the same Treaty Article 6. It is stressed in Bern Treaty Section II that the all countries, which are the parties of the treaty, should pay attention to the areas important for the immigrant species included in the Appendix II and Appendix II.

In addition to these, the followings were forbidden:

- The all intentional hunting and killing figures,
- The destroy or damage of the rest and reproduction areas of these species,
- The disturbance of wild fauna species especially in the reproduction, feeding and wintering periods,
- The damage to the eggs of these species, these eggs should not be collected even if they are not alive.
- The store and inland trade of these species alive or not.

The matters mentioned above should be strictly followed related to the wild animal species included in Bern Treaty Appendix II and III during the all activities carried out in the project site.

The regulations related to the wild fauna species included in the Appendix of the Treaty were stated in the Article 7. The all countries shall service for the protection of the wild fauna species included in the Appendix III and they should take the legal and administrative precautions. According to these requirements, the all management activities related to the species included in the Appendix III shall not endanger the populations of these wild animal species.

The protection precautions shall be implemented for the species included in the protection lists related to 2007 – 2008 Hunting Period determined by Central Hunting Commission of General Directorate of Nature Protection and National Parks. The list of flora found in the project site and its surroundings are given in the Appendix 7 and Appendix 8.

Sea Ecosystem

As a result of the proximity of the proposed Project field to Karadeniz coastal line, information about general Ecology of Karadeniz has ben compiled within project. Findings obtained from studies executed in this sense has been explained in Section IV.2.8.

IV.2.13 Fuel Resourcesı (From which linet he natural gas to be received, distance of the Project field to natural gas pipeline)

It has been planned that natural gas to be used within Project to be supplied from Blue Stream Natural Gas Pipeline operated by Petroleum Pıpelıne Cooperatıon. An application regarding the matter will be made to Petroleum Pıpelıne Cooperatıon and best location for gas receiving will be determined.

Natural gas amount to be used in the plant for each incineration turbine is 32×10^3 kg/hour. In order to meet aforesaid gas supply, a branch duct with a diameter of 12" has been planned to be taken from Samsun-Ankara Natural Gas Main Transmission Line with 48" diameter, a pipeline with 12" diameter has been planned to be built from this point to the borders of plant facility and a A Type Pressure Reducing and Measuring Station has been planned to be established. Consequently, pressure of gas given to the facility will be 40 barg.

IV.2.14 Places with High Landscape Value and Recreation Areas

There is neither a place with high landscape value nor a recreation area close to the Project fields.

IV.2.15 Lands under Governance and in Possession of Competent Bodies of Government (Military Forbidden Zones, areas allocated to public institutions and associations for certain purposes, restricted areas with decree of council of ministers numbered 7/16349 etc.)

In the immediate North border of Project field, Samsun-Trabzon highway is located. Besides, in the South of the highway, Çarşamba-Ünye-Fatsa Natural Gas Pipeline which is stil under construction by Petroleum Pıpelıne Cooperatıon (see Figure II.4) is available.

IV.2.16 Determination of the Current Pollution Load of the Region (with respect of air, water , soil and noise)

In comparison with other provinces, Samsun province could be counted as a neater city in respect of environment pollution. Environment pollution has started with population growth and industrialization.

Especially in winters air pollution have been making itself more evident. By Region Hıfzısıhha Institute, two point measurements have been performed, results have been communicated to Directorate of Provincial Environment and Forestry. Air pollution in the province has been mostly arised from characteristics of the fuels used for heating purposes. Besides for determination and preventing air pollution arised from vehicles, exhaust gas measurements have been executed by Environment Protection Foundation with collaboration of Directorate of Provincial Environment and Forestry.

The barrage which will serve as Çakmak Barrage Samsun Potable Water Project of Samsun potable water has been built on Abdal River in the South of Çarşamba Plain and in the 20

km of southwest of Çarşamba District.

Being out of the important water resources, Kızılırmak and Yeşilırmak also contain a great pollution with agricultural activities particularly wastes of settlement units around.

Pollution of Karadeniz coast of Samsun is substantially due to domestic wastewater. Besides; Provincial Directorate of Environment and Forestry has been executing studies for determination of the characteristics of waste waters evolved out of industrial facilities and about their discharging standards-compliance.

Solid wastes have been causing a considerable environmet pollution in Samsun. While current solid waste storage location is about to complete its life, if the required improvement studies will not be performed, it will cause serious environment problems. Solid wastes collected by Metropolitan Municipality have been dumped into Yılanlıdere site. Being the current location a water resource constitutes a much more important problem. In districts, solid wastes have been dumped at random places, currently a considerable part of it poses problem because any preliminary survey about location selection has been performed.

Noise pollution has just being attracted attention in Samsun Province, propensity of public for this matter has been observed to increase.

Determination of Available Air Quality

Available air quality in the region plays an essentail role in determination of possible pollution values after establishment of the stipulated facility. Most practical way to be used in assessment of air quality in the region is to compare the long-term measurement values to be obtained from available tracking stations with “limited values” given in “Air Quality Assessment and Management Regulations’ which became effective by being published in the Official Gazette No. 26898 and dated 06.06.2008. But, in and around Terme district in which the stipulated facility to be established, as there is no available tracking stations by which long-term air quality values could be provided, for determination of local air quality purpose, within EIA study, a short-term tracking programme had been executed.

For determination of air quality in the region purpose, field studies had been performed with passive sampling method diffusion tube procedure between the dates of 28.11.2008 – 15.12.2008. During this study, NO_2 levels in the region in which the stipulated facility to be built have been measured.

Locations on which air quality tracking studies had been performed, within the borders of impact area of stipulated plant field, have been selected as best representing way of current abient conditions. In determination of measurement spots, spots in which air current of the region is static have been abstained from, regions to be able to get impacted from dominant wind direction, emmission to be arised from flue gas emmissions have been considered. Coordinates belonging to aforesaid locations are shown in Table IV.28 and on Figure IV.28.

Table IV.28: Air Qauality Measurement Spots and Their Coordinations

No.	Initial Measurement	Final Measurement	Measurement Location	Coordinate
1	28.11.2008	15.12.2008	Göbü Village	X: 0347982 Y: 4554257

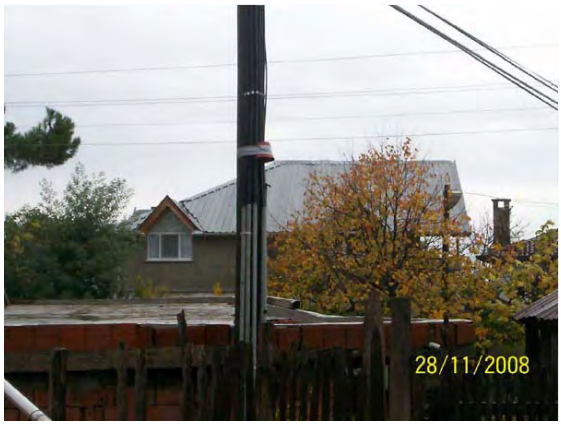
2	28.11.2008	15.12.2008	Dumantepe	X: 0342557 Y: 4552916
3	28.11.2008	15.12.2008	Koçuklu	X: 0341450 Y: 4557568
4	28.11.2008	15.12.2008	Gökçeağaç	X: 0341264 Y: 4557646
5	28.11.2008	15.12.2008	Sakarlı	X: 0338315 Y: 4558566
6	28.11.2008	15.12.2008	Uzunardıç	X: 0336792 Y: 4559647

Figure IV.28: Measurement Spots for Air Quality

Within tracking programme, NO_2 measurements have been executed with sampling method diffusion tube procedure. While placing these tubes in determined measurement points, their positions have been adjusted in such manner that the air current will not be blocked on the open end of the tubes. During placing, because the NO_2 gas concentration was low for dry NO_2 sedimentation, the regions in which the sedimentation would be higher had been stayed away. Similarly, as the NO_2 gases cumulated on the open end of the tubes as a result of low air current prolong the diffusion mechanism of absorbed air, regions in which the air current is static have been stayed away.

During studies, electric/telephone poles have been utilized as connection spots.

Sampling tubes have been attached to the surface vertically in such manner that the coloured cover in which the absorbent is located to be overlapped with a help of a PVC adhesive (see Figure IV.29). Sampling starts with uncovering the polyethylene cover underlain by. These covers have been preserved in the meantime as they will be utilized again at the end of sampling duration.



No. 1: Göbü Village

No. 2: Dumantepe

No. 3: Koçuklu

No. 4: Gökçeağaç

No. 5: Sakarlı

No. 6: Uzunardıç

Figure IV.29: Diffusion Tubes Used for Determination of Current Air Population

Obtained measurement results is given on Table IV.29.

When air quality measurement results are compared with limit values given on Aır Qualıty Evaluatıon And Management Regulatıon, It has been determined that NO_2 concentrations determined in all measurement spots are under UVS which is 100 μg/m³ and KVS which is 300 μg/m³ (for related report see Appendix-9).

Table IV.29: Air Quality Measurement Values

Sampling Location	NO_2 Concentration (μg/m³)
No. 1 Göbü Village	10,2
No.2 Dumantepe	9,8
No. 3 Koçuklu	10,7
No. 4 Gökçeağaç	37,8
No. 5 Sakarlı	28,3
No. 6 Uzunardıç	13,3

Quality Determination of Current Water

Essential reasons for groundwater pollution are senseless usage of pesticides and fertilizers, discharg of domestic wastes directly to the soil and discharge of urban and industrial wastes / waste water to environment without treatment. After discharge of solid, liquid or gas wastes to the environment, as a result of its moving into groundwater depending on climate conditions, structure of the soil and time, pollution is formed.

Surface water resources on the Project field and working area are Akçay Creek and Karadeniz (BlackSea). From the settlement areas, spot pollution is being discharged to Akçay Creek.

Akçay Creek

Non water circulation between surface and deep water layers prevents the transportation of the oxygen dissolved on the surfaceto the layer in deep. As a result of this, low dissolved oxygen concentrations can be observed in the deep layer depending on reservois conditions. But, this formation observed in summer months (stratification) has been able to be observed in all dead waters in which the required circumstances have provided and is a natural result of a lake ambience.

Other creeks and streams in Ordu province generally cleanly flow, within these in the Districts Ordu-Ünye-Anasu-Nuribey, environs houses' canalizations have been flowing into Çamurlu and Anasu creAppendixs. Besides disposals have been disposed into these creAppendixs. For this reason, an unhealthy environment has been arised in these aforementioned creAppendixs.

Within the Project, any intervantions (e.i., water intaking or discharging) will be performed to Akçay Creek. Alongwith this, as it was mentioned by DSİ Regional Directorate, Akçay Creek is a flood creAppendix. In the literature, any special hydrophilic flora-fauna study relating to Akçay Creek has been discovered. But, for the purpose of tracking the pre-project and in the course of Project quality of Akçay Creek, before the construction activities of the project, in the construction

and operating periods of the Project, a seasonal tracking study will be performed in accordance with Water Pollution Control Regulation Table 1.

Karadeniz (Black Sea)

pH Value and H_2S Content of Karadeniz

Depending on the stratification on the above section of Karadeniz, oxygen amount in the sea, with the growing depth, has been decreasing rapidly. After 150-200 m, an oxygen-free region has been observed. Under this section, sulphate concentration in the sea water decreases, for this reason H_2S amount has been increasing.

Characteristics of Sea water: (i) Oxygen is not found in deeper sections more than 200 m. H_2S concentration increases to 11 mg/L in the sections close to the sea ground. (ii) Though the pH concentration is high on the water surface, does not change in proportion with depth, keeps between values 6,4 and 8,7.

With the purpose of determination of sea water quality, a sample from the sea water near the Project area has been taken and this sample has been analyzed according to the parameters mentioned on Water Pollution Control Regulation(WPCR) Table 4. Analysis reports are given in Appendix-10 (also see Table IV.30). Sea water sample has been taken from a point close to Akçay Creek in Karadeniz by Derinsu Sualtı Mühendislik ve Danışmanlık Ltd. (Derinsu Underwater Engineering and Consulting Company Ltd). In abstraction, protection and transportation of the samples, considerations mentioned in Water Pollution Control Regulations Sampling And Analysis Methods Notification became effective by being published on Official Gazette dated 07.01.1991 and numbered 20106 has been considered.

Table IV.30: Sea Water Analysis

Parameter	Analysis Value	Criteria*
pH	7,3	6,0-9,0
Color and Opacity	Natural	Natural
Floating Substance	None	-
Suspended solid substance (mg/L)	3,2	30
Dissolved Oxygen (%)	97,5	More than %90 of Saturation
Fissionable organic contaminants	-	-
Crude oil and petroleum products (mg/L)	-	0,003
Radioactivity	-	-
Üretkenlik	-	-
Toxicity	-	Not to be found
Phenols (mg/L)	0,02	0,001
Various heavy metals		
Copper, (mg/L)	0,0167	0,01
Cadmium, (mg/L)	0,0155	0,01
Chrome, (mg/L)	0,024	0,1
Lead, (mg/L)	0,0279	0,1
Nickel, (mg/L)	< 0,0001	0,1
Zinc, (mg/L)	0,0258	0,1
Mercury, (mg/L)	< 0,001	0,004
Arsenic, (mg/L)	< 0,001	0,1
Ammoniac, (mg/L)	< 0,025	0,02

* Values given on WPCR Table 4

Discharge to Karadeniz (Black Sea)

According to the studies executed by Samsun Environment Management Branch Office

in 2006, primary reasons for the pollution observed in Karadeniz are domestic liquid waste, domestic solid waste, industrial waste, agricultural activities and maritime activities. Primary food and pollution discharges to Karadeniz are performed by rivers disembogued to the sea. Foods transported by the rivers are used by phytoplanctons and are converted into organic substances. Efficiency condition of Karadeniz depends on food amount transported by the rivers. But in last 30-35 years, because of domestic and industrial discharges to Karadeniz, eutrophication has increased considerably. Number of phytoplanctons has reached to its peak in the last decade. Besides with some toxic types entering into Karadeniz fundamental changes has been experienced exploded in food chain (Çelikkale *and others*, 1998).

Determination of Current Soil Quality

Project field planned for Samsun Natural Gas Combined Cycle Plant Project has already been used for agricultural purposes. Land use ability class of the field is VIII and it is not an appropriate land for agriculture. In this sense, supposedly soil quality is very low currently, besides determination of soil quality has not been required.

Determination of Current Noise

Noise reduction works executed around Project field are presented in Acoustic Report in Appendix-11.

IV.2.17 Other Characteristics

There are any other characteristics except the informations given in the sections above with regard to characteristics of physical and biological environment and usage of natural resources within the project.

IV.3 *Characteristics of* Socio-Economical Environment

In this section, general informations about socio-economical condition of Project area of Samsun Natural Gas Combined Cycle Plant and its surrounding are given. Samsun Province and Terme District have explored within the report. Socio-economical condition of the region has been explored at the required detail level in order to assess the impacts of the aforesaid plant accurately.

IV.3.1 Economic Characteristics (Main sectors composing economical structure of the territory, importance and place in territory and country economy, other informations)

Main industries having importance in territory economy are discussed in detail in the following sections.

Agriculture

Agriculture is the main industry out of the industries composing of economical structure of Samsun province. Four main products cultivated economically in the province are wheat, corn, paddy, tobacco and hazelnut. Bafra and Çarşamba plains having an important place in province agriculture have an agriculture area of 122.410 ha in total. As an industry plant, sunflower is being cultivated. In meadow, lea and forage crop plantations have been increased in line with forage crop supports being executed by Ministry of Agriculture and have still been increasing. Our province has a considerabl suitable potential with respect of field crops. (Samsun Governorship, 2006)

Rich soil of Çarşamba plain located in this province has caused agriculture to have a high percentage within the industries composing economical structure. Products produced in Terme District are a wide-variety of mainly barley, paddy, beans, soybeans, chickpea, sugar beet, sunflower, peach, hazelnut and apple. On the rich areas of the district vegetable growing has also been making. Especially; vegetables such as tomato, paprika, eggplant, cucumber, fresh beans etc have been cultivating and marketing in wholesale market hall in order to delivered to requiring provinces (see Section IV.2.5).

Animal Husbandry

Samsun province is one of the high-potential provinces in animal husbandary and production. In the South sections of the province with highland and flatland characteristics animal husbandary is the most essential source of income. Animal asset data of this province in year 2006 is given on Table IV.31 comparatively for Samsun Province and Turkiye. Apiculture in the province also can be counted as another animal husbandary activity (see Table IV.32). In Samsun province; animal products such as meat, milk, chicken meat etc are composing of the most essential animal productions.

Table IV.31: Animal Asset in Samsun Province and Turkiye

	Samsun	Türkiye	Payı (%)
A-Ovine	**195.017**	**33.050.656**	**0,59**
1-Sheep	184.153	26.616.912	0,69
2-Hair Goat	10.864	6.433.744	0,17
B-Bovine	**297.144**	**10.971.880**	**2,71**
1-Beef Cattle	284.882	10.871.364	2,62
a-Culture	31.696	2.771.818	1,14
b-Crossbreed	141.407	4.694.197	3,01
c-Native	111.779	3.405.349	3,28

Source: Samsun Agriculture Provincial Directorate

Table IV.32: Apiculture Condition of Samsun Province for 2006

Apiculture Condition	Year 2006
Number of hives (quantity)	82.988
Honey production (kg)	1.261
Beewax (kg)	105

Source: Samsun Agriculture Provincial Directorate

Forestry

41% of the Samsun province lands are covered with forests. Poplar and poplar sapling arboriculture is one of the economic activities made progress lately throughout the province.

Fishery

Samsun province; with its coastal extending along Karadeniz, with two big rivers such as Kızılırmak and Yeşilırmak and four large dam lakes established on these rivers and with its other natural lakes has a great potential in termsof aquaculture products. In the province that provides significant opportunities in terms of aquaculture products, other aquaculture products have been used economically as well as every kinds of fishes have been fished. In Terme District and affiliated villages; at waterways, lakes and sea fishery activity has been executed with commercial purposes.

Industry

Samsun province is the largest metropolitan city in East Karadeniz Region. Because of the population density of the city, its trade and industrial life is alive. Settlement and production areas of the city are much available for investment than the other Karadeniz provinces. City, because of its strategic importance, provides advantage and superiority considering other provinces in the region.

Being the first sea door to Karadeniz basin and being the first land door to Central Anatolia characteristics have an importance in the commercial structure of the region. Employment in the region has been getting more difficult by reason of population concentration. Privatization of the public investments in the region as soon as possible has an importance in terms of leading the people and enterpreneurs in the region to appropriate and rantable investments. Region is very suitable in terms of leading small and medium sized enterprises and establishing them.

Samsun province located in the middle of Karadeniz coastal line is one of the cities having the largest acreage in our coastal line with its acreage of 9579 km²'. In spite of presence of large industry enterprises in the province since history of the Republic by reason of the characteristics of the province, as a result of prominence of an agro-economy in the province, city stil could have not been an industrial province, large industrial facilities could have not created the required acceleration in development of small enterprises in the region.

As the city is the first door to Karadeniz from Central Anatolia, business life of the city has always been alive. Especially; production of agricultural products and agriculture based-on production, constant efforts of employment to be condensated within this field could have not shown the required potential in establishing employment.

For a solution for employment constriction in the city especially after 1980, small industrial areas have been established both in around the city and in its districts in accordance with advancing industry age and employment has started to canalise towards labor intensive small

enterprises gradually. Most important products produced in Samsun and its vicinity are cement, fertilizer, copper, artificial jute, automobile spare parts, pumps in various sizes, furniture and textile, confection and medical tools.

Alongwith large and medium scaled enterprises, there are small facilities making labour intensive manufacturing, heating boiler, plastic PVC facilities, small facilities producing agricultural tools and machines, copper products, construction irons, plastic bags, multifarious confectionery, jam and commercial kitchen appliances and refrigerator within small-scaled enterprises.

Samsun as a trade city has started industrialization with public investments as similar with all around our country. In the city, there are five public industrial facilities. These industrial facilities are Karadeniz Copper Enterprise Inc., Samsun Compost Industry Inc. A.Ş. (TÜGSAŞ), Ballıca Cigarette Factory and Çarşamba Sugar Factory and Tekel Tobacco Enterprise Factory (Samsun Provincial Environment Condition Report, 2006).

Mining

There are no known metallic mine, industrial raw material or primary energy source in Samsun center county. Throughout the province, solely there are lignite coal in Havza and Vezirköprü, thermal water in Havza and Ladik, mineral water in Bafra and Çarşamba. Mining in Terme district takes an important place within industries composing economy.

Trade

Presence of the biggest seaport on Karadeniz coast and railway network reached to the seaport in Samsun province, coming of the highway connecting Middle and East Karadeniz Region to Central Anatolia and other regions of the country aboard through this province has been effective in development of the province in trade industry.

Tourism

In Samsun province, tourism is not well-developed. Insufficient usage of current resources (thermal, health, business, coastal and marine tourism) and disinvestment cause the province to lag behind in tourism. In Samsun city center there are five big hotels.

Labor force

According to the data of SIS from year 2000, in Samsun province, employment participation rate within population at the age of 12 and over is %59 and essentially differs by gender. Employment participation rate for male population is %71 while for femail population is %48. Employment participation rate of male population is %83 whilst it is %61 in city center and %58 in district centers. Employment participation rate tremendously differs according to settlement place for female population. Every 84 of 100 women in the village is employed whilst this rate is %18 in city center and %13 in district centers.

IV.3.2 Population (Urban and rural population rate in territory, population movements; migrations, population growth rates, other informations)

Administrative Segmentation

According to the general population census results of Samsun province in 2007, its total population is 1.228.959 and it has 15 districts. Out of these, Terme district is the settlement which is expected to be affected maximum from the project. While the total population of Terme district is 74.833 according to 2007 population census results, out of this population, 28.411 live in urban and

46.422 live in villages (www.tuik.gov.tr).

Urban and Rural Population

Ratio of 2000 and 2007 population census results to urban and rural population rates is presented on Table IV.33. Accordingly, rural population ratio of Terme District is higher in comparison with urban population, this ratio has shown a decrease in 2007.

Table IV.33: Urban and Rural Populations

Year	Region	Total Population	Urban (%)	Rural (%)
2000	Samsun Province	1.209.137	53	47
	Terme district	82.608	30	70
	Turkiye	67.803.927	65	35
2007	Samsun Province	1.228.959	59	41
	Terme District	74.833	38	62
	Turkiye	70.586.256	70	30

Source: State Institute of Statistics

Population Magnitude and Population Growth Rate

Population of Samsun Province and Terme District in 2007 is respectively 1.228.959 and 74.833. Values of population in city and village are given on Table IV.34.

Table IV.34: Urban and Village Populations and Annual Population Growth of Samsun Province and Terme District

Region	Population in year 2000			Population in year 2007		
	Total	Urban	Village	Total	Urban	Village
Samsun Pro.	1.209.137	635.254	573.883	1.228.959	725.111	503.848
Terme District	82.608	25.052	57.556	74.833	28.411	46.422
Turkiye	67.803.927	44.006.274	23.797.653	70.586.256	49.747.859	20.838.397

According to 2000 population census, population density of Samsun province and Terme district are given on Table IV.35. Accordingly, while the population densities calculated for Samsun province and Terme district are respectively 133 person/km² and 189 person/km², these values are over Turkiye average of 88 person/km² (SIS, 2000).

Table IV.35: Population Densities in the Region (2000)

Region	Population	Area (km^2)	Population Density (person/km^2)
Samsun Province	1.209.137	9.083	133
Terme District	82.608	436	189
Turkiye	67.803.927	769.604	88

Source: State Institute of Statistics

IV.3.3 Social Infrastructure Services in the territory (Education, health, endemic diseases existing in the region, cultural services and availability of these services)

Education

All kinds of education institutions available in Samsun province. University 19 Mayıs in the province had established after University Karadeniz located in the region. In the province, there are 1084 primary schools, 7 private primary schools, 58 general high schools, 8 private high schools, 50 occupational and technical high schools and 9 private educational schools (Samsun Governorship, 2006).

According to the 2000 population census, Literacy ratio of Samsun province is proximately %86 and is very close to average of Turkiye (%87). Literacy ratio of Terme district is %89,3 and this value is over averages of Turkiye and Samsun. Distributions of literates in the aforementioned province and district according to last educational institution are given on Table IV.36.

Table IV.36: Population Distributions for Samsun Province According to Literacy and Alma Meter Educational Institution

Literacy	Terme District	Samsun Province	Turkiye
Illiterate	1.827	147.540	7.589.657
Literate	15.629	922.313	52.259.381
Literacy unknown	-	6	10.205
Non-graduated	3.900	257.158	12.886.331
Primary School Graduate	6.484	419.894	22.166.827
Elementary Education	707	27.489	1.719.479
Secondary School Graduate	1.218	56.174	4.161.798
Technical School (equivalent to Secondary School) Graduate	34	1.611	146.232
High School Graduate	1.791	85.935	6.096.662
Technical School (equivalent to High School) Graduate	693	30.140	1.916.845
College and Faculty graduate	802	43.859	3.151.964

Source: State Institute of Statistics, 2000

Health

Number of medical establishments and beds in Samsun province recorded by year 2004 are respectively 19 and 4057 (see. Table IV.37). According to 2006 records of Samsun Provincial Directorate of Health, provider health personnel list is given on Table IV.38.

Currently there are 1 hospital and 10 health care centers within the borders of Terme District.

Table IV.37: Number of Hospital and Beds in Provinces

İl	Association	Number of Hospitals	NUmber of Beds
Samsun	Public Hospital	17	3.956

Source: State Institute of Statistics, 2004

Table IV.38: Numbers of Health Staff

Health Staff	Samsun Province
Specialist	484
Practitioner	566
Dentist	86
Pharmacist	14
Health Technician*	1040
Nurse	1333
Obstetrician	833
Other	1765

* Health Technician: Including Health Officer, Radiograph, Laboratory, Anaesthesia, Orthopedy, Dental, Eudiometer, Environment Health, First Aid technicians.

Source: Samsun Provincial Directorate of Health, 2006

IV.3.4 Urban and Rural Land Usages in Project Area and Immedeate Surroundings

The Project area is located approximately 76 km east of Samsun Province center and 18

km east of Terme district center. Closest settlement units to the Area are Akçay and Hacıoğlu districts which are in the immediate west of the area. Lands around the Project area have already inspected and non-topsoil and non-agricultural areas are shown on Figure IV.23. There is no housing estate near the Project area.

IV.3.5 Income and Unemployment (Distribution of the income to Business Branches in the Region, maximum, minimum and average income per capita in respect of business branches)

As the definition of economically working population is the ratio of the population over 12 years old to the segment who is working or related to a work or unemployed but a jobseAppendixer. Distributions of economically working male and female population in provinces and districts covered by the project is given on Table IV.39. As it can be seen form the table, in Samsun province, whilst the economicaly active male population is proximate to Turkiye average, female population is over average of Turkiye. Additionally distribution of economically non-active population (12-65+) in Samsun province and Terme district covered by the Project is given on Table IV.40. As it can be seen from the table, male student percentages within economically non-active population in the said settlements are higher than country average.

According to 2000 population census, while employed and umemployed population throughout Samsun province are respectively 505.115 and 35.900, the ratio of laboring force population to non-laboring force is 1,4. Similarly, according to 2000 population census results, while employed and unemployed population in Terme district center are respectively 5382 and 1371, the ratio of laboring force population to non-laboring force is 0,6.

Table IV.39: Economically Working Population (12 years and over)

Population Info		Samsun Province	Terme District
Total	M	438.850	9.205
	F	482.257	9.637
Employment	M	287.321	4.658
	F	217.794	724
Unemployed	M	22.158	940
	F	13.742	431
Non-laboring Force	M	129.364	3.607
	F	250.717	8.482
Unknown	M	7	-

Source: State Institute of Statistics, 2000

Table IV.40: Economically Nonworking Population and Its Distribution (%)

Region	Retiredi		House wife	Student		Other	
	Male	*Female*		*Male*	*Female*	*Male*	*Female*
Samsun Province	28,75	6,12	63,80	54,68	25,05	16,57	5,02
Terme District	30,36	2,28	78,76	45,13	15,19	3,77	0,01
Turkiye	28,94	4,21	73,39	51,40	19,38	19,65	3,02

Source: State Institute of Statistics, 2000

IV.3.6 Other Specifications

There is no considerations to be added here.

V. EFFECTS OF THE PROJECT ON THE AREA DEFINED IN THE CHAPTER IV AND THE PRECAUTIONS TO BE TAKEN

(In this chapter, effects of the project on the physical and biological environment and the legal, administrative and technical precautions to be taken in order to prevent, minimize and ameliorate these effects are separately specified in detail under the headings, V.I and V.2.)

In this chapter, effects of Samsun Natural Gas Combined Cycle Plant Project on the physical and biological environment and the legal, administrative and technical precautions to be taken in order to prevent, minimize and ameliorate these effects are separately specified under the section V.I (construction and installation phase) and the section V.2 (operational phase). In the section V.3, effects of the project on socioeconomic environment are presented.

V.1 Preparation of the Area, Activities to be performed in the Phase of Construction and Installation, Effects of these Activities on the Physical and Biological Environment and the Precautions to be taken

It is planned to complete the construction and installation activities within approximately 14 months following the activities for preparation of the area in the first stages of the proposed project. In this phase, amount of the personnel to be employed is envisaged as approximately 900 people. Under the project, preparation of the area, the possible environmental effects in the phase of construction and installation and the precautions envisaged against these effects are given in this chapter in line with the EIA format specified by Turkish Republic, Ministry of Environment and Forestry.

Under the construction works of the plant, foundations, main and auxiliary buildings, finishing works, installation of heating, ventilation and sanitation systems and final area arrangement activities will be performed. The points to be taken into account during the area arrangement activities are as follows:

- Energy blocks and switch area will be elevated for 1 m with structural fill.
- Other parts of the facility will be elevated for 1 m with traditional filling method.
- Intake structure will be dug in an approximate dept of 12 m.
- Cooling water and discharge lines will be constructed in sea.
- Water, electricity and telephone lines will be provided in the central points.
- Internal routes will be completely drained and they will have hard surfaces as much as possible.
- A good lightning infrastructure, easily-controlled wire fence and appropriate control points will be provided.
- Fire system and appropriate connection routes will be provided.
- Administrative units will be arranged.

A service building will be constructed near the main entrance gate outside the wire fence and entrance of the unauthorized people into the area will be kept under control.

V.1.1 Under the Works to be Performed for Preparation of the Area and Constructions of the Units (including the transportation infrastructure), Where and How Much Excavation will be made, Where, How or What For the Soil, Rock, Sand, which is the remainder of the Excavation will be transported and used: Materials, Tools and Machines to be used, Dust Emitting Mechanical Operations such as Crushing, Grinding, Transportation and Storage, Precautions to be taken against Diffusion of Dust

Works to be Performed on Land

Based on the soil structure of the envisaged project area, energy blocks and switch area will be mounted on the pile foundations and elevated for 1 m. To this end, 1800 posts, which have a length of 24 m, will be used. Similarly, area in which other units of the facility are situated will be elevated for 1 m by using the traditional filling method. Materials, which could be necessary during the filling operations, will be supplied from the borrow pits within the provincial boundaries of Samsun. In this context, no excavation activity will be performed for the area of the plant.

Under this project, excavation activity will be performed for the structure concerning the water discharge system and the pipeline within the water discharge system (see Figure V.1). Possible amount of excavation during this phase is estimated to be 28.320 m^3. It is possible to calculate this value as follows:

Pipeline Route (A1)
Length of Pipe : 205 m
Width of Corridor : 11 m
Depth of Channel : 6 m
Amount of Excavation : 205 m × 11 m × 6 m = 13.530 m^3

Discharge Reservoir (A2)
Width : 30 m
Length : 70 m
Depth of Excavation : 7 m
Amount of Excavation : 30 m × 70 m × 7 m = 14,700 m^3

Total Amount of Excavation : 13.530 m^3 + 14.700 m^3 = 28.230 m^3

All of the excavation activities to be performed with conventional construction equipment will be carried out within the entirely purchased areas. No explosives will be used during the excavation operations. Details with regard to this issue are given in Section V.1.2. Construction materials to be used during the construction activities such as sand, construction iron and rolled iron and cement will be supplied from the region and shipped to the facility area. Requirements such as food, transportation, accommodation services and labor are planned to be provided from the settlement areas in the region.

Excavation wastes are to be reused as much as possible for several construction activities to be performed in the area (for example, area arrangement fill, foundation fill etc.). The excavation material will be checked for conformity as the filling material. Surplus excavation material will be disposed of in the area designated by Terme Municipality in line with the provisions of " Excavation Soil, Construction and Debris Wastes Control Regulation ", which entered into force

upon publication in Official Gazette dated 18.03.2004 (no: 25406). The excavation material will not be continuously stored in the area and it will be temporarily stored in an area with an approximate size of 100 m^2 (for a maximum period of one week). During the storage activities, provisions stipulated in the Article 41 of " Excavation Soil, Construction and Debris Wastes Control Regulation ", which entered into force upon publication in Official Gazette dated 18.03.2004 (no: 25406), shall apply.

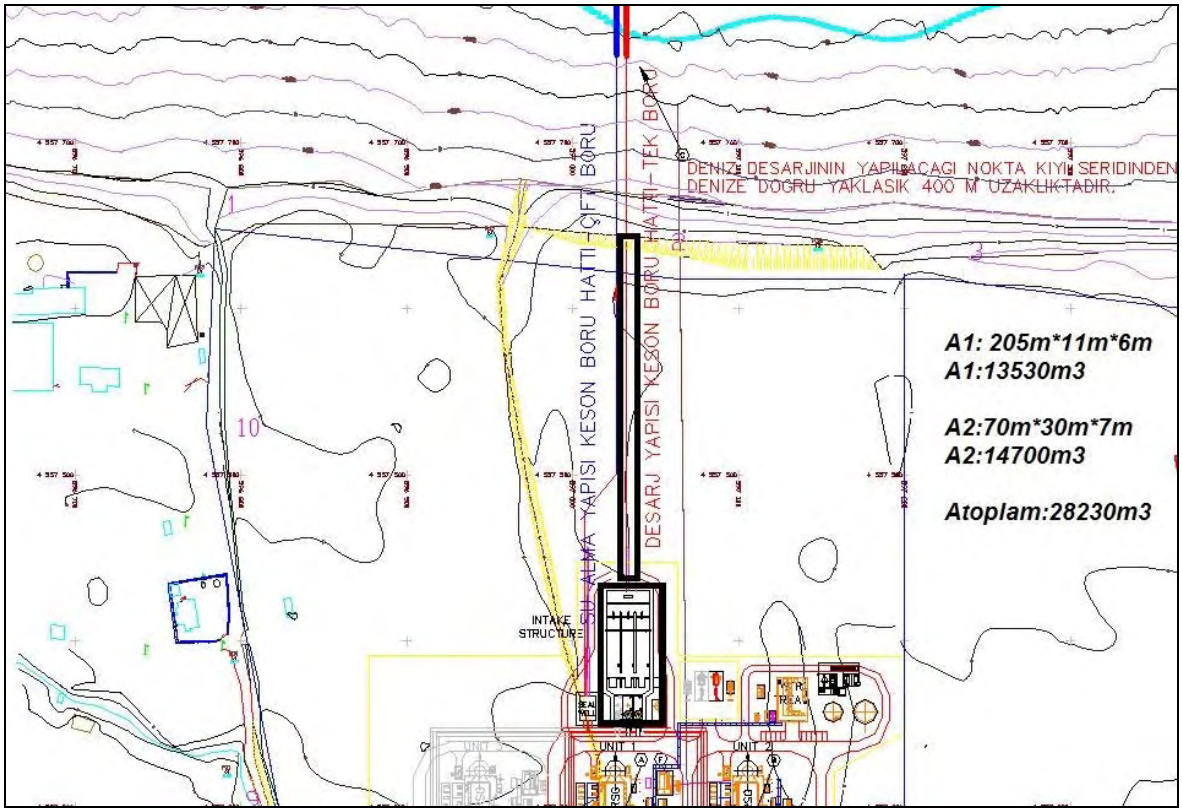


Figure V.1: Excavation Areas on Land

Before commencement of the construction activities, topsoil will be scraped and stored in a separate unused section in the area. Inclination of the earth masses will not be higher than 5% during the storage operations and it will be covered with nylon covers and their bases will be kept away from water. In this way, soil loss arising out of precipitation will be prevented. Additionally, during preservation of topsoil, provisions stipulated in the Article 14 and the Article 41 of " Excavation Soil, Construction and Debris Wastes Control Regulation", which entered into force upon publication in Official Gazette dated 18.03.2004 (no: 25406), shall apply. This soil, which is rich for minerals, will be used for landscaping at the end of the construction phase. It is envisaged that the topsoil will be approximately 1750 m^3. It is possible to calculate the amount of topsoil as follows:

<u>Pipeline Route (A1)</u>	
Length of Pipeline	: 205 m
Width of Corridor	: 11 m
Total Area	: 205 m × 11 m = 2255 m²
<u>Discharge Reservoir</u>	
Width	: 30 m
Length	: 70 m

Total Area : 2100 m^2
Depth of Topsoil : 0,40 m
Total Amount of Topsoil : 2255 m^2 × 0,40 m + 2100 m^2 × 0,40 m = 1742 m^3

There will be emissions of nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO2), hydrocarbons (HC) and particle materials (PM) caused by the fuel to be used by the construction equipment during the construction phase. However, amount of the emissions caused by this construction equipment will be much lower than the limit values stipulated in Regulation on Control of Air Pollution caused by Industrial Facilities because there are a lot of construction machines. In order to minimize the exhaust emissions, the construction equipment will be only be used if necessary, quality fuel will be used, periodical maintenance of the vehicles will be regularly performed and necessary maintenance operations and oil change will be performed in time. Besides, exhaust emission controls will be regularly carried out. Therefore, no negative effect is expected from these sources.

Equipment to be used in the Phase of Construction

Detailed information concerning the equipment to be used during the construction activities under the Project is given in Table V.20.

Table V.1: Equipment to be used in the Phase of Construction

Name	Quantity
Excavator	1
Dumper Truck	5
Water Truck	1
Excavator Loader	1
Compactor	2
Mini Double Cylinder	2
Cement Truck	1
Mixer Truck	1
Mobile Cement Pump	1
Mobile Crane - Area	1
Vibro Beam	3
Vibrator Convertor Set (2 C + 3 V)	5
Construction Iron Cutting Machine	2
Construction Iron Bending Machine	2
Power Floater	1
Mobile Crane - Area 50-60 tons	6
Mobile Crane - Area 100 tons	2
Mobile Crane - Area 150 tons	1
Mobile Crane - Area 250 tons	1
Mobile Crane - Area 600 tons	1
Mobile Crane - Area 30 tons	2
Man lift	6
Heating Stove	5
Projector	5
Air Compressor	2
Generator - Area	1
Generator - Offices and Area Facilities	1
Generator - Temporary Facilities	1
Mobile Crane - Main Workshop	1
Boom Truck	2
Linear Trailer	2
Farm Tractor / Trailer	1
Forklift	2

Name	Quantity
Pickup	8
Cars - Logistics	1
Cars - Managers and Engineers	20
Minibus	5
Ambulance	1

Activities to be Performed at Sea

Construction activities of the cooling water and discharge structures within the Project will be performed within Black Sea. The activities to be performed at sea are as follows:

- The activities will start by establishment of construction site.
- Pre-manufacturing and installation site will be constructed.
- Supplied materials will be stored in line with the order set out in the working program.
- Materials for bedding and blocking layer and crushed rock materials for protection layer will be supplied and stored in line with the order of use.
- Pre-construction surveillance and measurement operations will be performed.
- Loading area will be constructed for vessels.
- Safe, fixed anchor moor buoy system will be constructed.
- Land part of the pipe will be installed as planned. Excavations works will be carried out with crawler excavator with shovel on land and with shovel excavator with long boom installed on pontoon at sea. The scanned materials will be used for making the marshy ground suitable for work on land. It will be ensured that machines could operate between land structures and sea structure through improvement of the ground.
- Channel excavations at sea will be performed with a scanning machine with "cutter suction hopper dredger" which operates in self-absorption mode and a shovel excavator with long boom installed on pontoon and absorption pumps. Channel excavation will be performed depending on the project elevation levels, it will be ensured that natural slope is formed and channel trench will be smoothened during the Project.
- Trench ground will be smoothened with the desired inclination and ground cover will be provided through calculated bedding materials.
- Trench and bedding maintenance and cleaning operations will be performed before installation of the pipe.
- Pipes will be installed from land to sea in small parts.
- Pre-arranged short pipe parts will be lowered into the bottom of the sea and installed.
- Manifold connection of the pumping room will be provided through pressure coupling.
- Mounting tolerances will be continuously measured and necessary changes will be made on the basis of technical details.
- Underwater pipeline works will be performed in several phases and documented with video films.
- Foundation piles of the irrigation pipe structure will be driven with pile driving barge. The pipe structure will be constructed within dry dock to be formed in Samsun Port. The pipe structure will be carried through sea. The pipe structure will be mounted on piled foundation system under water and connection concrete injection operation will be performed under water. Necessary auxiliary elements of the pipe structure will be mounted under water.
- Land connections will be made and pre-fabricated pipe rotation units will be mounted.
- Pipe flanges will be mounted on each side of each pipe section and installed at sea.
- Pressurized flanges will be used for joints of pipe parts.

- Sea pipeline and shore pump structure lines will be mounted within service manholes.
- Distribution diffuser will be mounted with all system connection equipment such as amplifier, disconnector and terminal elements.
- Diffuser will be mounted onto the pipeline with a steel flange. Brackets and connection elements will be separately mounted.
- It will be ensured through trench excavation that there will be no accumulation of excavation materials on the edge of the channel.
- Suitable natural excavation material will be used as side and upper back-fill of the channel.
- Diffuser protection equipment will be mounted.
- Commissioning hydrostatic pressure tests will be performed in the pipeline.
- All the national / international occupational health and safety standards shall apply.
- Quality control supervision activities will be divided into phases and documented.

All the precautions will be taken in order to provide a safe working environment for occupational health and safety during the works. For navigation safety, the entire working area at sea will be equipped with marker buoys. The working area will be marked and closed to traffic during diving activities. International diving safety standards shall apply. Log records will be kept for depth, time and decompression time of each diver. Diving activities will be performed through diving gear with water pipe and communication system. Positions of divers will be visible with diving buoys and necessary information will be transmitted to all vessels at sea. In addition to the diving chief, a fully-equipped diver will wait in diving boat for emergency response. In the event that safe diving conditions are not available because of bad weather, heavy traffic and bad visibility, unmanned equipment will be used for underwater operations. Safety rules shall apply for all the activities in the same standards.

In order to minimize the turbidity at sea, excavation materials will be transferred to the excavation material ship at sea. In this way, dispersion of the excavation materials with flow will be kept at minimum level. Then, the excavation materials will be used as filling material for back-filling of the pipeline.

The Amount of Dust Forming in the Excavation Activities on Land

Excavation activities on land will only be performed in intake and discharge structures and the quantity of excavation materials is estimated to be approximately 28.230 m^3 (see Figure V.1). During these activities, dust will be formed while performing excavation activities in preparation and construction phases. Dust formation is more prevalent in alluvial grounds and less prevalent in compact grounds. In order to minimize dust formation, the route used by the vehicles will be moisturized especially when it is hot and arid and vehicles carrying excavation materials will be covered. All the activities will be performed in accordance with the provisions stipulated in " Industrial Air Pollution Control Regulation", which entered into force upon publication in Official Gazette dated 22.07.2006 (no: 26236)" and " Evaluation and Management of Air Quality Regulation", which entered into force upon publication in Official Gazette dated 06.06.2008 (no: 26898).

Dust will only be formed in the surroundings of the site during preparation of the area and construction of the units. In order to decrease the effects of dust emissions, the construction site will be kept moist. As the construction site is situated in Black Sea Region, the continuous moist nature of the region will be an advantage. In this way, the effect arising out of dust emissions will

be very low. In order to calculate the possible dust emissions, emission factors set out in Tablo V.2 are used.

Tablo V.2: Emission Factors of Dust Calculations

Activity	Emission Factor
Detonation	0,080 kg/ton
Demounting	0.025 kg/ton
Loading	0.010 kg/ton
Shipment (total distance with return)	0,7 kg/km-vehicle
Unloading	0.010 kg/ton
Storage	5,8 kg dust/ ha day

Source: www.EIAgm.gov.tr

The following data is used for calculation of emissions arising out of the excavation activities:

= 28.230 m³/months
Amount of Excavation Materials = 315 m³/day
Area of Excavation = 4355 m²
Area of Storage = 100 m²
Duration of Excavation = 3 months
Number of Vehicles = 5 pcs
Daily working time = 20 hours
Transfer distance of Excavation Materials = 100 m

There seems to be no need to use explosives as a result of evaluation concerning the geological structure of the site. The activities to be performed during the excavation activities are extraction, loading, shipment, unloading and storage of the excavation materials. Density of soil is taken as 1.8 g/cm^3.

Quantity of excavation materials = 1,8 g/cm³ × 315 m³/day × 10^{-6} m³/cm³ × 10^6 g/ton = 567 tons/day
Quantity of dust during extraction operation = 0,025 kg/ton × 567 tons/day × (1 day / 20 hours)

Quantity of dust during extraction operation = 0,7 kg/hour
Quantity of dust during loading operation = 0.01 kg/ton × 567 tons/day × (1 day / 20 hours)

Quantity of dust during loading operation = 0,3 kg/hour

Quantity of dust during unloading operation = 0.01 kg/ton × 567 tons/day × (1 day / 20 hours)
Quantity of dust during unloading operation = 0,3 kg/hour
Quantity of dust during storage operation = 5,8 kg/ha-day × 100 m² / (10.000 ha / 1 m²) / 24 hours/day = 0,002 kg/hour

Quantity of dust during shipment operation = 0,7 kg/km-vehicle × 5 vehicle/day × 2 km / 20 hours/day = 0,4 kg/hour

Total dust emission (Extraction+ Loading) = 0,7 kg/hour + 0,3 kg/hour = 1,0 kg/hour
Total dust emission (Unloading+ Storage) = 0,3 kg/hour + 0,002 kg/hour = 0,3 kg/hour

Given that the region is always moist and that moistening activities will be performed in the working areas especially in arid seasons, it is estimated that there will be a decrease of 70% in dust emissions arising out of shipment operation. In this way, dust emission arising out of shipment operation is estimated to be approximately 0,1 kg/hour. In this way, total amount of dust emissions during "Extraction + Loading", "Unloading + Storage" and "Shipment" operations while preparing the area for intake and discharge structures is estimated to be 1,4 kg/hour (1,0 kg/hour + 0,3 kg/hour + 0,1 kg/hour). This value is lower than the limit value, which is stipulated in Table 2.1, Appendix 2 of 'Industrial Air Pollution Control Regulation' as 1,5 kg/hour. In this context, there is no need for modeling activity.

V.1.2 Shipment, Storage, Use of Flammable, Explosive, Hazardous and Toxic Substances to be used during Preparation of the Area and Construction of the Units and the Tools and Machinery to be used for these Activities

There will be no detonation activity during preparation of the area and construction of the units. Diesel fuel (approximately 10.000 L) and gas (approximately 2000 L) of the construction equipment, fuels and chemicals to be used for welding operations such as oxygen, nitrogen and argon will be supplied from the related enterprises by delivery on site and it will be ensured that the sellers comply with the related legal responsibilities. Besides, the legislation concerning occupational health and safety shall apply during storage and use of the fuels and chemical substances. To this end, personal protective materials will be used and safe means of transport will be provided.

V.1.3 Operations to be performed for Ground Safety (carrying capacity, admissible stress, settlement calculations)

The proposed project area is within the 4th Level Earthquake Region in accordance with the Map of Turkish Earthquake Regions, which was published in 1996 by General Directorate of Disaster Affairs under Turkish Republic, Ministry of Public Works and Settlement. In this context, no problem is expected in terms of seismicity.

No landslide is expected as the area for construction of the plant is a level ground. Based on the soil structure of the envisaged project area, energy blocks and switch area will be mounted on the pile foundations and elevated for 1 m. To this end, 1800 posts, which have a length of 24 m, will be used. Similarly, area in which other units of the facility are situated will be elevated for 1 m by using the traditional filling method. Materials, which could be necessary during the filling operations, will be supplied from the borrow pits within the provincial boundaries of Samsun. In this context, no excavation activity will be performed for the area of the plant.

Necessary environmental drainage operations will be performed for rain water and storm water that could occur during construction phase and afterwards. During design of the drainage systems, the highest precipitation values observed in standard times and recorded by General Directorate of State Meteorological Service from Ünye Meteorology Station will be used (see Appendix-5).

In the event that it is envisaged that founded buildings such as offices, social and administrative buildings will be constructed within the site, geological - geotechnical and micro zoning report will be prepared according to the plan based on the criteria stipulated in the circular of General Directorate of Disaster Affairs dated 19.08.2008 (no 10337) and this report will be

approved by the related authority.

V.1.4 Areas and Methods for the Operations concerning Flood Prevention and Drainage

The project area is situated in the flood plain of Akarçay Stream. Rain water in the site will be controlled with in-site drainage and kept away from the site. Rain water will be accumulated through interception channels to be formed around the plant area. During design of the drainage systems, the highest precipitation values observed in standard times and recorded by General Directorate of State Meteorological Service from Ünye Meteorology Station will be used (see Appendix-5). In this context, all the flood and drainage precautions within the Project will be approved by the 7th Regional Directorate of General Directorate of State Hydraulic Works. Additionally, during the works, the related provisions of the Prime Ministry Circular (2006/27) on Stream Beds and Floods, which entered into force upon publication in Official Gazette dated 09.09.2006 (no 26284) shall apply.

V.1.5 Water Supply System and Plan, Amount, Characteristics, Source and Supply Method of Water, Amount and Characteristics, Purification and Discharge Area and Method of Waste Water within the Project

Water will be used for domestic use, concrete irrigation, dust prevention and fire fighting during the construction phase.

Water requirements during the construction phase of the Project will be met from the groundwater springs which are opened and used in the region. During these activities, permission will be obtained from Branch Directorate of Geotechnical Services and YAS in the related Regional Directorate of State Hydraulic Works in accordance with the Law no 167 in the event that new wells are to be dug. Drinking water required for the Project will be supplied through transportation.

During calculation of drinking and potable water required for employees, amount of water required by a person per day is taken as 150 L/day. In this way, the amount of water required by employees per day is estimated to be 135 m^3 (900 people x 150 L/person = 135.000 L).

For irrigation activities to be performed in order to minimize the dust formed during preparation of the area and the construction phase, it is envisaged that approximately 10 m^3 water will be used per day and this water is planned to be supplied from the groundwater wells, which are dug and used in the region.

Waste water to be formed during preparation of the area and the construction phase will be 135 m^3/day based on the assumption that 100% of the water with an amount of 135 m3/day required by the personnel as drinking and potable water will be waste water. After this waste water is treated in the package waste water treatment facilities to be established in the site, it is envisaged that this water is discharged into the nearest receiving environment in accordance with the provisions of Water Pollution Control Regulation, which entered into force upon publication in Official Gazette dated 31.12.2004 (no 25687). In the event that the water is used for irrigation after treatment, the provisions stipulated under the heading, Chapter 7 "Use of Treated Waste Water for Irrigation" of Communiqué on Technical Procedures under Regulation on Control of Water Pollution, which entered into force upon publication in Official Gazette dated 07.01.1991 (no 2078), shall apply. For these activities, necessary permits will be obtained for discharge. General information concerning package waste water treatment facility to be used in the area is given in Annex-12.Project of the proposed treatment facility will be approved in line with the Circular on

Approval of the Project for Waste Water Treatment Facilities no 2005/5.

Oily waste water in the construction site will be accumulated through a drainage channel and transferred to package waste water treatment facilities after the water is passed through oil filter. The remaining oil will be stored in a separate area with other waste oil in the area and disposed of through licensed recycling or disposal facilities in accordance with the provisions stipulated in " Waste Oil Control Regulation", which entered into force upon publication in Official Gazette dated 30.07.2008 (no 26952). Additionally, provisions stipulated in " Hazardous Substances Around Water Sources and Their Surroundings Pollution Control Regulation", which entered into force upon publication in Official Gazette dated 26.11.2005 (no: 26005), shall apply.

Most of the water to be used during operational phase of the project will be composed of cooling water. Amount of cooling water envisaged to be used in the facility is estimated to be approximately 59.200 m^3/hour. Cooling water will be obtained from and returned to Black Sea (see Section V.2.6). Besides, as for the potable water, based on the assumption that the number of personnel, that will work during the operational phase of the project, is approximately 80 people, daily water required for the personnel is estimated to be approximately 12 m^3 (80 people x 150 L/person =12.000 L). It is planned that this water will be supplied from the groundwater springs which are dug and used in the region. As for the drinking water requirements, this water will be transported to the facility. Domestic waste water which will be formed during the operational phase is estimated to be 12 m^3/day based on the assumption that 100% of the drinking water and potable water to be used by the personnel will transform into waste water. After treatment of this waste water, this water will be discharged into the sea with other process waste water in accordance with the provisions stipulated in WPCR. (see Section V.2.4)

Purification sludge, which will be formed during construction and operational phases, will be analyzed in accordance with the analysis methods in Annex-11 B and the parameters in Appendix-11 A of " Hazardous Wastes Control Regulation", which entered into force upon publication in Official Gazette dated 14.03.2005 (no 25755) and disposed of in line with the provisions of the same regulation. In that case, in the event that the wastes turn out to be hazardous wastes, wastes will be disposed of by licensed facilities. Otherwise, these wastes will be disposed of in the storage area for domestic wastes or this sludge will be used for agricultural purposes in line with the provisions of " Soil Pollution Control Regulation", which entered into force upon publication in Official Gazette dated 31.05.2005 (no 25831).

V.1.6 Effects of the Activities at Sea within the Project on Sea Flora and Fauna and the Precautions to be taken (especially the effects of construction activities concerning cooling water intake and discharge structures (water pipeline))

Activities to be performed at sea within the project area water intake and discharge lines to be installed in Black Sea for supply of cooling water for the power plant. In order to minimize the turbidity to be caused by the construction activities performed at sea, it is planned that the possible excavation materials are simultaneously transferred to the excavation material ship while opening the pipeline channel. In this way, dispersion of the excavation materials with flow will be kept at minimum level.

Additionally, given that the speed of flows is very low and the sediment structure is generally composed of silt and alluvium, it is envisaged that the sediment will be deposited in its area without spreading to a wider area. Besides, given that the construction activities will be

composed of excavation operations for one month and mounting operations for one month and sea environment in the project area and the surrounding area is not rich for sea flora and fauna, temporary activities in the sea environment will not result in a considerable and permanent negative effect on sea flora and fauna.

V.1.7 Types and Quantities of the Solid Wastes arising out of the Works to be performed between Preparation of the Area and Commissioning of the Units, Storage Areas and the Purposes of Use for these Wastes (detailed information will be provided on characteristics and lifetime of wastes and the permits obtained in line with the Regulation on Environmental Impact Assessment will be attached to the report)

Solid wastes that will be formed depending on the construction activities (excavation activities etc.) of the proposed project are examined in Chapter V.1. Besides, wastes such as domestic wastes arising out of the daily requirements of the personnel, domestic wastes, waste oil and packaging wastes will be formed. If the amount of domestic wastes arising out of the personnel during the construction activities of the power plant is taken as 1,34 kg/person.day (*source:* www.cedgm.gov.tr), daily solid waste quantity to be formed by 900 personnel during the construction activities will be 1206 kg (900 people x 1,34 kg/person.day).

Solid wastes within the project, which will be collected in accordance with the provisions of " Solid Wastes Control Regulation ", which entered into force upon publication in Official Gazette dated 14.03.1991 (no 20814), will be disposed of in the storage area for solid wastes designated by Terme Municipality. Packaging wastes (paper, cardboard, metal, glass, rubber, textile, plastic etc.) that will be formed during the construction phase of the project will be collected separately from the other wastes, carried in special closed vehicles which will not pollute environment in terms of appearance, odor, leakage and similar factors, stored in separate locations and disposed of in the licensed institutions in accordance with the provisions of " Packaging Wastes Control Regulation " (especially Chapter Five), which entered into force upon publication in Official Gazette dated 24.06.2007 (no 26562).

Excavation wastes that will be formed during the construction phase of the proposed project will be disposed of in the area designated by Terme Municipality in line with the provisions (Article 41) of " Excavation Soil, Construction and Debris Wastes Control Regulation ", which entered into force upon publication in Official Gazette dated 18.03.2004 (no: 25406). Topsoil will be used for landscaping.

Waste oil, vegetable waste oil and waste batteries and accumulators will be disposed of in accordance with the provisions of " Waste Oil Control Regulation" (Chapter Five), which entered into force upon publication in Official Gazette dated 30.07.2008 (no 26952) and 'Waste Batteries and Accumulators Control Regulation" (especially Article 19), which entered into force upon publication in Official Gazette dated 31.08.2004 (no 25569).

Maintenance operations, fuel delivery and oil change activities of the machinery will be performed in the related unit of the machinery park to be established in the proposed construction site / sites or licensed, authorized gas stations during preparation of the area within the Project.

In the event that these activities or operations are performed in construction site / sites, possible wastes, waste oil and similar petroleum products will never be left exposed in the area. Wastes, which are categorized as recyclable wastes, (accumulator, machinery parts, metal

accessories etc.) will be sold to the buyers of these materials. Waste oil that will be formed within the Project will be stored in the sealed tanks and transferred to the disposal facilities. Additionally, hazardous wastes arising out of maintenance and repair within the Project such as filter, oily tubes, gloves and contaminated materials will be disposed of in accordance with the provisions stipulated in " Hazardous Wastes Control Regulation ", which entered into force upon publication in Official Gazette dated 14.03.2005 (no 25755).

Medical wastes in the construction site will be separately collected and these wastes will be disposed of in accordance with the provisions of " Medical Wastes Control", which entered into force upon publication in Official Gazette dated 22.07.2005 (no 25883).

V.1.8 Sources, Levels and Cumulative Values of Vibration and Noise arising out of the Works to be performed between Preparation of the Area and Commissioning of the Units

In the construction phase, use of heavy construction equipment and construction activities will result in noise and vibration. During testing and operation of the power plant, high sound levels are expected for a few minutes on some days of the week. Activities, which result in this noise, include the activity of washing the pipes and tests concerning safety valve of the boiler.

Noise formed in the construction phase of the project will be local and temporary and it will end at the end of the construction phase. During this phase, in order to protect the health of employees and the people in the interaction area of noise, provisions of " Environmental Noise Assessment and Management Regulation (2002/49 - EC)", which entered into force upon publication in Official Gazette dated 07.03.2008 (no 26809) and " Occupational Health and Safety Regulation ", which entered into force upon publication in Official Gazette dated 09.12.2003 (no 25311), shall apply. In accordance with the above-stated provisions, proper personal protective materials such as helmet, ear muffs or ear protectors will be provided in order to ensure that the workers are not affected by this noise. Besides, periodical maintenance of the vehicles to be used in the Project will be performed and the noise level will be lowered.

Given the machinery to be used in the proposed power plant, effects of the vibration are not expected to reach outside the construction site.

Estimated noise level will be calculated in accordance with the provisions stipulated in " Environmental Noise Assessment and Management Regulation (2002/49 - EC)", which entered into force upon publication in Official Gazette dated 07.03.2008 (no 26809) (see Table V.3) and "Acoustic Report" of the Project is given in Appendix-11.

Table V.3: Environmental Noise Limit Values for the Construction Site

Type of activity (construction, demolition and repair)	Ldaytime (dBA)
Building	70
Road	75
Other sources	70

V.1.9 Size, Land Use Capabilities and Agricultural Crop Types of the Area required for Preparation of the Area and the Construction Area

The Project owner own the area, which is approximately 50 ha (see Annex-1). Before starting the project activities, in accordance with the Law no 5403 on Protection of Soil and Use of Land, which entered into force upon publication in Official Gazette dated 19.07.2005 (no 25880) and the Regulation on Protection and Use of Agricultural Lands, which entered into force upon publication in Official Gazette dated 13.06.2003 (no 25137), agricultural survey activities will be performed following EIA process; in line with the results of the survey activities, if necessary, an application will be submitted to the Board of Soil Protection in order to use these areas for non-agricultural purposes.

According to the soil maps prepared by Turkish Republic, Ministry of Agriculture and Rural Affairs, the project area has the IV and VIII class land use capabilities (see the related Table).

V.1.10 Species and Numbers of the Trees to be Cut down for the Area required for Preparation of the Area and the Construction Area, the Plant Species to be Cut down and the Area for this type of Work

As there is no natural forest vegetation in the construction site, only the trees in the individual parts will be cut down (see Figure II.7 and Figure II.9) As site arrangement activities are only composed of a small excavation activity and the species in the area are common in Turkey, it is not envisaged that valuable or rare ecosystem components will be extinct.

Flora species to be affected during the excavation works will be the species in the excavation area. Before commencement of the construction activities, topsoil will be scraped and stored in a separate unused section in the area. Inclination of the earth masses will not be higher than 5% during the storage operations and it will be covered with nylon covers and their bases will be kept away from water. In this way, soil loss arising out of precipitation will be prevented. This soil, which is rich for minerals, will be used for landscaping at the end of the construction phase. It is envisaged that the topsoil will be approximately 1750 m^3.

V.1.11 Types, Consumption Quantities and Possible Emissions of the Fuels to be used between Preparation of the Area and Commissioning of the Units

Basically, fuel will be needed for use of heavy construction equipment such as excavator, bulldozer and mixer during the construction phase. Generally, diesel fuel will be used and no gas (petroleum) will be used in small construction equipment. It is expected that the consumption of gas will be lower than the consumption of diesel.

Diesel engines, which are different when compared to the petrol engines in terms of working principles, emit lower carbon monoxide (CO) and hydrocarbons (HC) and higher nitrogen oxide (Nox) and particle substances (PM) than the petrol engines. Vehicles with diesel engines generally emit contaminants from sources such as exhaust and crankcase leakages. Use of closed injection systems and volatility of the diesel fuel in lower levels prevent vaporization losses. According to the emission factors of United States Environmental Protection Agency (USEPA), in the event that each heavy construction equipment, which is well-maintained and uses diesel fuel, is used in a speed of 0 and 30 km/h, it is expected that this construction equipment will emit 8,61 g/min CO; 1,38 g/min HC and 6,27 g/min NOx.

Except for the electrically operated construction equipment; daily contaminant emissions arising out of grader, excavator, bulldozer and mobile crane have been calculated. In these calculations, it is assumed that one machine from each construction equipment type is simultaneously operated and all the machines are continuously operated for 8 hours per day. CO, HC and Nox emissions calculated according to the emission factors of USEPA are given in Table V.20).

Emissions arising out of the machines to be used during the construction phase will be temporary. Besides, the expected total amount of emission is lower than the amount of emission arising out of any highway and it will not have considerable effects on air quality. Therefore, no measurement and monitoring program is envisaged for any air quality criteria during the construction phase.

Table V.4: Daily Contaminant (CO, HC, and NOx) Emissions arising out of Construction Equipment

Parameter	Emission factor (g/minute)	Duration (hour/day)	Daily emission (kg/day)
HC	1.38	8	2.7
NOx	6.27	8	12.0
CO	8.61	8	16.5

V.1.12 Noise Emitting Processes such as Crushing, Grinding, Transportation and Storage during Construction and Cumulative Values

During the construction activities, it is possible that several sources such as scraping of soil, excavation activities, and transportation activities on non-paved roads and construction materials that could fall from the vehicles will emit dust. In order to decrease the possible effects concerning dust emission and minimize the dust emissions, immediate surroundings of the related areas will be periodically irrigated. Besides, all the shipment vehicles, which will carry excavation materials in the site, will be covered. Cement to be used for the construction activities will be carried in pneumatic lime trucks and transferred in closed cycle through the silos in the construction site. Speed of the vehicles on non-paved roads will be limited to 30 km/h. Besides, it will be ensured that trucks do not carry the sludge on their wheels to highways on rainy days. In this way, effects of the dust formed during the construction activities on environment will be kept in acceptable levels. These activities will be performed during the excavation activities and operations for transfer of the excavation activities within the Project. The amount of dust formed during the activities which result in dust formation is estimated in Section V.1.1 and these values are compared to the limit value, 1,5 kg/h, set out in Appendix-2, Table 2.1 of Regulation on Air Pollution Caused by Industrial Facilities. According to this calculation, it is envisaged that the dust emissions arising out of the excavation activities comply with the limit values.

V.1.13 Areas and Ways for Meeting the Housing and Other Technical / Social Infrastructure Requirements of the Personnel that will work for the Works to be performed between Preparation of the Area and Commissioning of the Units and their Families

During the construction and mounting activities, that will last for 14 months, within the Project, at most 900 people will be employed. It is envisaged that most of the construction workers will be employed from the region and these personnel will be transported from the surrounding settlement areas to the construction site with service vehicles on daily basis. Prefabricated

dormitories will be constructed for workers coming from other regions.

V.1.14 Determination of the Level and Dispersion Effect of the Project on Underground and Ground Cultural and Natural Entities (traditional civic appearance, archeological remains, natural values to be protected) in the Project Area and Immediate Surroundings

In order to search the cultural and natural entities in the project area, authorized officers from Turkish Republic, Samsun Governor's Office, Provincial Directorate of Culture and Tourism performed inspection in the project area on 23.12.2008. The formal correspondence prepared with regard to this issue is given in Appendix-1. According to this correspondence, in the surface research performed in land and shore areas, no remains or findings were found in accordance with the Board of Protection of Cultural and Natural Entities no 2863 and it was determined that the area was out of the current protection areas. In the event that a cultural entity is found in site activities to be performed within the Project, the activities will be stopped, the related Museum Directorate will be notified of the situation and the activities will continue under the supervision of the related institution.

V.1.15 Risky and Dangerous Works for Human Health and Environment between Preparation of the Area and Commissioning of the Units

Within the construction activities of Samsun Natural Gas Combined Cycle Plant Project, possible risks concerning human health and safety are related to possible accidents that will occur during these construction activities. In this context, the contractor firm, which will perform the construction activities, will comply with knowledge and experience as well as internationally accepted security rules in order to ensure that the area will be safe for all employees and that excavation activities, scaffold and heavy construction equipment (cranes etc.) will be secure. It will be ensured that the employees will use personal protective equipment (helmet, glasses, gloves, safety belt etc.).

As the use of hazardous chemicals will be kept at minimum level during the construction activities of the Project, there will be no risk concerning transportation, storage and use of these chemicals. Besides, the contractor firm will take the necessary precautions in order to minimize the potential environmental pollution risks. All the activities within the Project will be performed in accordance with the related provisions of " Occupational Health and Safety Regulation ", which entered into force upon publication in Official Gazette dated 09.12.2003 (no 25311).

V.1.16 Assessment of Traffic Load and Effects of All Transportation Activities (inside and outside the Facility) within the Project

There are some transportation loads such as machinery, equipment, personnel and materials during the construction phase of the project. The construction activities will result in formation of an additional inconsiderable load on the regional transportation network. As Samsun-Trabzon highway will be used during shipment, it is not expected that the construction activities will create a considerable negative effect on Samsun-Trabzon highway because this road has a heavy traffic and the construction activities are temporary.

Besides, access routes within the power plant area will have an approximate length of 1,2 km and an approximate width of 8,5 m including the lanes with a width of two meters in both sides

of the road. Roads will be constructed with compacted geogrid material, which is spread on gravel with a thickness of 200 mm. Then, two layers of asphalt with a thickness of 150 mm will be poured onto this layer. The activities to be performed on highways will be coordinated with the 7th Regional Directorate of Turkish Republic, Ministry of Transportation, General Directorate of Highways and necessary permits will be obtained for the activities.

V.1.17 The Area, Method and the Used Plant and Tree Species for Site Arrangements such as Creating Landscape Elements and other Purposes (forestation, green area arrangements etc.) within the Project Area

Aim of the landscaping activities is to provide visual screening of the project area and create a good environment for the facility. In this context, it is planned that topsoil scraped from the surface during the excavation activities will be stored in an appropriate section of the construction area and spread on areas required within a landscaping project close to completion of the construction activities. Topsoil is rich for humus, active in terms of microorganism activities, suitable for growing plants and it has a depth of 5-40 cm from the ground. Topsoil dug from the ground will be stored in smooth shapes.

Topsoil silos will be covered with inorganic (polyethylene material etc.) or organic (cultivation of grass, herbaceous plants etc.) materials in order to provide protection against erosion, dehydration, weeds and keep the soil fresh. There should be no rock, gravel, sand, lime with a size higher than 5 cm, fuel leakage, other oil types or oily substances, goudron and similar rubbles and contamination inside topsoil.

After completion of the construction activities, generally, trees and native plants will be cultivated in the power plant area depending on natural vegetation and landscaping. Landscaping details will be completed after the power plant is commissioned.

V.1.18 Other Activities

In this section, there is no issue to be considered.

V.2 Activities to be performed in the Operational Phase of the Project, Effects of these Activities on the Physical and Biological Environment and the Precautions to be taken

Project lifetime of the power plant, which is planned to be commissioned in December, 2010, is 30 years. In the operational phase, amount of the personnel to be employed is envisaged as approximately 80 people. Under the Project, the possible environmental effects in the operational phase and the precautions envisaged against these effects are given in this chapter in line with the EIA format specified by Turkish Republic, Ministry of Environment and Forestry.

V.2.1 Specifications of all units within the Project, Units in which the activities will be performed, Capacities of the Units, Detailed process flow chart of each unit, basic process parameters, description of the process, specifications of the services, machinery, tools, vehicles and equipment to be used in the units other than the activity units

Combined cycle gas turbine energy power plant is a method of electricity generation with high efficiency. This efficiency is basically provided through combination of one gas and one steam turbine. This process includes burning of natural gas in two gas turbines through use of low NOx technology. This Steam Turbine (BT) and Gas Turbine (GT) are designed in single shaft configuration so that they can operate in single and common shaft. This single and common shaft, to which both turbines are connected, drives the generator. Generator is situated between BT and GT.

Gas turbines are only designed for burning the natural gas. Filtered air, which comes from external sources, is compressed in compressor section of each turbine, directed to the burning unit, in which it is mixed with natural gas and burned in this section. Hot gases, which are formed by burning the fuel, expand in the turbine section and this activity makes the turbine shaft rotate. Rotational mechanical energy generated by the turbine drives shaft of the generator and finally usable electricity energy is generated. Hot gases, which are formed by burning process, come out of the gas turbines and these gases are separately directed to the related waste heat boiler through the related pipes.

Waste heat boiler is a reheating unit with no additional ignition and three pressure levels and it makes use of the waste energy in the combustion gases formed by the gas turbine in order to create steam for the steam turbine. Each waste heat boiler has high pressure (YB), medium pressure (OB), low pressure (DB) and reheating (TI) units. Feed water is pumped from pipe coils in YB, OB and DB units of the waste heat boiler. Feed water absorbs the heat energy from the exhaust gases in the combustion turbine and turns it into steam while passing through these pipe coils. Besides, cold reheated steam, which comes from the steam cycle, is reheated in the reheating unit of each waste heat boiler. Exhaust gases formed in each gas turbine are released to the atmosphere through chimneys after passing through their heat recovery steam generators.

Main steam carries the steam generated in each heat recovery steam generator and expands in this turbine. This activity makes the turbine and generator shafts rotate and results in generation of usable electricity energy. Electricity energy generated through the gas turbine and steam turbine is connected to the common generator through a single shaft and then transmitted to transformers in order to increase the voltage of the generator to 380 kV. Then, the electricity is transmitted to the switch area in order to be transmitted to the national network.

Process flow chart of the system is given in Figure V.2: **Process Flow Chart**.

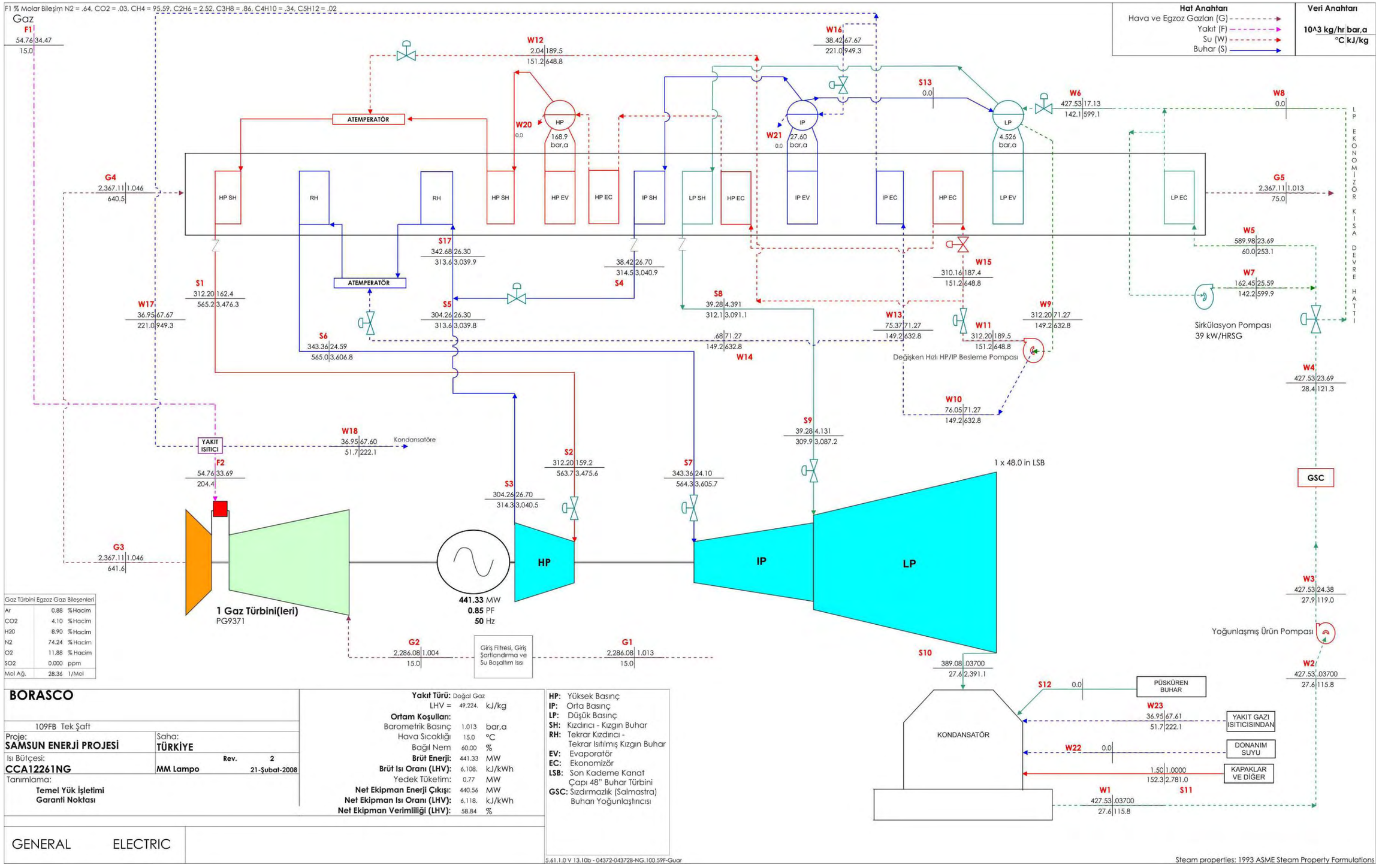


Figure V.2: Process Flow Chart

Single Shaft Gas Turbine - Steam Turbine Generator

In the proposed power plant, gas turbine in a block is designed and manufactured by General Electric (GE) and its model identity is gas turbine with PG 9371.

Gas turbine technology of General Electric is designed to meet the lowest emissions required in today's applications. Specially designed combustion chambers (equipped with cooling facility), which are covered with film and produced on the basis of impact, meet the environmental requirements at international level in high ignition temperatures and provide reliable operation. GE is the most experienced manufacturer of dry low NOx, dilution injection and SCR (Selective Catalytic Reduction) systems in the world for the emissions required today.

Gas Turbine is composed of four main parts on the same shaft:Air Compressor,

1. Combustion Chambers,
2. Turbine,
3. Generator (on the common shaft with the Steam Turbine).

Air passing through the filters is compressed in air compressor, its pressure is increased and its temperature rises as a result of this compression. Hot and pressurized air is used for burning the natural gas fed in the combustion chambers. Hot gas mixture formed as a result of burning (1375-1400 C) passes through a 3 level turbine and rotates the rotor at 3000 rpm (50 Hz). Mechanical energy, which provides this rotation action, is transformed into electric energy in the generator on the same shaft with 18 level compressor and turbine.

Other equipment and systems connected to the Gas Turbine are air intake system (filtration and separation station, pressure control block, control systems etc.) and exhaust system (exhaust chimney and compensators).

Waste Heat Boiler (AIK)

In the proposed project, two Waste Heat Boilers (AIK) with three pressure levels, which do not require additional ignition and fuel, will be installed. Main parts of AIK include condensate pre-heater; high pressure (YB), medium pressure (OB) and low pressure (AB) economizers; YB, OB and AB evaporators; heating and reheating parts.

Combustion waste gases, which exit from the gas turbine in high temperatures, pass through heat exchangers in the Waste Heat Boiler (AIK) in order to generate steam at three different pressure levels. Steam temperature reaches 560ºC at high pressure level.

Steam Turbine (BT)

Hot steam from the Waste Heat Boiler at three different pressure levels (160 - 25 - 5 bar) is directed to high, medium and low pressure turbines through the shafts. Hot steam expands and transforms thermal energy into rotation movement while passing through the flaps of steam turbine. Mechanical energy in rotation action is transformed into electric energy in steam turbine generator on the same shaft. "Waste" steam, whose energy is received in the exit of the low pressure steam turbine, is condensed in a condenser with water cooling, transferred to the boiler as condensate water for re-evaporation and the cycle continues in this way.

Cooling water, which gets hot while passing through the condenser, is cycled in single pass cooling systems

Equipment and systems connected to the steam turbine unit are control and lubrication system (for tanks and pumps); drainage system (gland steam condenser etc.) and High Pressure, Medium Pressure and Low Pressure steam by-pass systems.

Equipment and systems connected to the steam turbine in water-steam cycle are condenser, condensate pump, steam injector, water injector, cooling tower, circulation water pump and water turbine groups, transfer pump, storage tanks, electricity, instrumentation and main cooling control system, feed water pumps, degasifier and feed water tank.

Once Through Sea Water Cooling System

Once through cooling water system provides the system with cooling water in order to provide heat from main condensers, closed cooling water heat exchangers and condenser vacuum pumps. Once through cooling water pumps will provide suction from the inlet structure and transfer cold water to condensers, closed cooling water heat exchangers and vacuum pumps.

Heated water will be transferred to discharged water settling unit before discharging the water into Black Sea through gravity with transmission pipes. This unit is designed just before the discharge system and it is envisaged that this unit will have dimensions of 30 m × 70 m. Certain dimensions will be determined following implementation of projects. The capacity will be suitable for a total flow of 59.218 m^3/h to be discharged into Black Sea. Discharge process through discharge water settling unit will be continuously monitored for chloride and pH. In the event that the measured parameters exceed the standard level, alarm in the control room will operate.

Within the chemical dosing system in once through cooling water system, sodium hypochlorite will be provided for once through cooling water system in order to control microbiological decomposition. Chlorination rate will be adjusted in the control system with distribution and its duration will be controlled with a chronometer.

Detailed information concerning the system, which is operated through detailed engineering activities, is given in Annex-6. Cooling water flow is envisaged as 59.203 m^3/h.

Condensate and Feed Water Systems

Condensate system for each energy unit transfers the air ventilated in condenser into the low pressure economizer sections of the waste heat boiler. Feed water system for each waste heat boiler will provide suction at low pressure and provide feed water into its YB and OB economizer sections. Besides, each feed water system will provide water for YB and reheating sections of its waste heat boilers.

System designs are based on heat budget for maximum waste heat boiler load including additional requirements for waste heat boiler blow-off.

Condensate and Boiler Feed Water Treatment

Chemical feeding systems include the following chemical injections for condensate and YB and OB pulleys.

- One pH adjustment chemical will be provided for down-flow condenser of condensate conditioning unit of each unit.

- One oxygen cleaning chemical will be provided for down-flow condenser of condensate conditioning unit of each unit.
- One phosphate solution will be provided for YB and OB pulleys of each waste heat boiler.

- pH Chemical Feeding

Condensate pH will be adjusted with ammonium hydroxide solution. Common pH chemical feeding unit will be composed of one chemical feeding tank of 0.95 m^3 and three measurement pumps with 100% capacity. Chemicals will be fed in the way they are supplied.

- Oxygen Cleaning Chemical Feed

An organic oxygen cleaning system will be used for controlling oxygen concentration in condensate and feed water systems. Oxygen cleaning chemical feeding unit will be composed of one chemical feeding tank of 0.95 m3 and three measurement pumps with 100% capacity. Chemicals will be fed in the way they are supplied.

- Waste Heat Boiler Pulley Chemical Feed

Phosphate solution will be provided for YB and OB pulleys of each waste heat boiler in order to control pH and phosphate concentration of the pulley water to the extent that it is needed to operate the treatment program in a continuous and incessant manner.

Condensate Conditioning Unit

Condensate conditioning unit will be operated in each unit in order to prevent corrosion transportation and condensate leakage so as to provide purity and efficiency of the cycle. Condensate conditioning systems will have external regeneration, deep bearing, mixed bearing and ion change-resin. Conditioning regeneration system will be shared by two units. Each condensate conditioning unit will be composed of service pipes of two condensate conditioning systems with 100% capacity, deep bearing, mixed resin bearing and recycling pumps with 100% capacity.

Regeneration wastes will be transferred to chemical waste water neutralization tank through condensate conditioning reservoir and discharged to Black Sea through discharge water settling unit.

Closed Cooling Water System

Closed cooling water systems will be separately installed for each energy unit. Each system will have two closed cooling water pumps with 100% capacity, three heat exchangers with 50% capacity, three filters with 50% capacity and an expansion tank with automatic filling capacity and a separate chemical feed tank. Closed cooling water systems will use once through cooling water as heat sink.

Closed cooling water systems will provide clean, non-corrosive water for the users of the following facility:

- Steam turbine / Gas turbine generators
- Mineral oil and cover coolers of the feed water pump
- Sample coolers
- Air compressor coolers

Water Preparation and Treatment Unit

Raw water and feeding system and demineralization unit will be installed in water preparation and treatment system.

Demineralization System

Demineralization system will generate demineralized water for operation of steam cycle. Demineralization system will be composed of multiple environment filters, cation, anion and multiple bearing ion changers. Extracted water will be directed to demineralized water storage tank. Demineralization system will be installed as two units with 100% capacity. This system will have the generation capacity for demineralized water required in each facility. While one unit is in regeneration process, the other will be operational. System design makes it possible for both units to operate simultaneously in line with their capacities. Demineralization system will generate water with the following characteristics for steam cycle:

Specific conductivity, µS/cm @ 25ºC	<0,10
Total silica, µg/L (as SiO_2)	<10
Sodium, µg/L	<10
Sulfate, µg/L	<3
Chloride, µg/L	<3
Total organic carbon, µg/L	<200

Two multiple environment filters with 100% capacity will be used in order to keep away the solid substances suspended in water. Demineralized water will be supplied from unprocessed water / fire-protection water tank of the facility. Two original ion changer units with 100% capacity (including cation and anion changing channels) will be installed. Two mixed bearing ion changers with 100% capacity will be installed in order to condition the demineralized water in the final phase. Mixed bearing channels will combine cation and anion resins in a single channel. Cation, anion and mixed bearing changers will be ameliorated with sulfuric acid and sodium hydroxide. Regeneration waste water will be transferred to chemical waste neutralization system. This neutralization system will be shared by condensate conditioning unit and demineralization system.

Water extracted from the mixed bearing will be transferred to demineralized water storage tank of 1000 m^3. Two demineralized water transmission pumps with 100% capacity will be installed. Transmission pumps will distribute demineralized water from demineralized water storage tank to waste water boiler, auxiliary boiler and other various demineralized water users of the system.

Waste Water Treatment System

Surface drains will be collected in drain reservoirs of the equipment area and treated in oily waste water separator. Treated waste water will be transferred to the channels or discharge water settling unit for discharging into Black Sea in the final phase.

Regeneration waste water generated by demineralization and condensate conditioning systems will be subjected to neutralization process in common chemical waste water neutralization tank and transferred to the channel or discharged in discharged water settling unit.

Septic waste water will be collected through pipes based on gravity and transferred to package waste water treatment system in the area by altitude stations. Waste water generated as a result of this process will be discharged to the channel or discharge water settling unit for discharging into Black Sea in the final phase. Waste water generated as a result of cooled waste

heat boiler blow-off and auxiliary boiler will be discharged into the channel or discharge water settling unit for disposal. Gas turbine washing water will be collected in a common reservoir and kept for discharging into a tanker. Water collected in the tanker will be filtered through an oil separator. Waste oil collected in oil separator will be disposed of in accordance with the provisions stipulated in " Waste Oil Control Regulation", which entered into force upon publication in Official Gazette dated 30.07.2008 (no 26952). The remaining water will be discharged into the general drainage system of the power plant.

Drinking and Potable Water System

Drinking and potable water will be supplied from water network of the city in the southern part of the project area through branch duct and unprocessed water/fire-protection water will be transferred to the storage tank. Drinking and potable water will be circulated within the facility through branch connections to be installed in proper locations in order to supply water for emergency shower/eye wash stations. Independent emergency shower/eye wash stations might be used in locations outside the energy unit buildings. Toilet and kitchen facilities will be established in control building and administrative building.

Switch and Electricity Systems

Electricity energy generated by the proposed project will be transferred to the interconnected network in a safe, reliable and ready way through generators and booster transformers over 380 kV open switch area and 380 kV energy transmission lines within the power station. All electricity systems, transformers, projects of switch area and systems, selection, mounting, testing, commissioning and operation of equipment will be performed in accordance with Turkish Standard Institution, General Directorate of Turkish Electricity Transmission Cooperation. standards, the related regulations, national and international norms and standards such as IEC and VDE.

Connection point of the power plant to the system and voltage levels will be Kayabaşı 2 TM, 380 kV and Çarşamba TM, 380 kV (see Appendix-1). As for this issue, System Connection Agreement is to be signed with General Directorate of Turkish Electricity Transmission Cooperation.

Check and Control Systems

All measurement equipment and a central control system will be installed for local control and monitor systems in the proposed project. Within the central control system, a central control room, data-processing room and electronic control room will be available. Within the control system, automation systems, operation and monitor system, planning and configuration systems, data transmission - changes system and information system will be available.

Besides, gas turbine unit, steam turbine unit, waste heat boiler, water-steam cycle, cooling water system and separate control systems for other monitor systems and water discharge facility will be installed in the facility. In addition, Continuous Emission Monitoring System (CEMS) will be installed for monitoring chimney emissions.

Auxiliary Systems and Equipment

In the proposed system, as auxiliary systems and equipment, service air systems, service gas system, fire-extinguishing system, heating systems, ventilation system, air-conditioning system, auxiliary steam system, telecommunication equipment, emergency generator unit

operating through diesel fuel, auxiliary boiler, cranes and mechanical workshop equipment will be installed.

Cycle block and all auxiliary systems of the proposed power plant will be fed with air system through service air systems. Air compressors, coolers, separators, air dryers, filters, tank and other mechanical equipment will be installed in the system.

CO_2 and hydrogen gas allocation pipes and bottle shelves will be installed in the service gas system. While hydrogen is needed for generator cooling systems, CO_2 is used for cleaning hydrogen cooling systems under maintenance. CO_2 required for fire-protection of gas turbines will be supplied from AB distribution system provided for this purpose.

Fire-extinguishing system will be equipped with fire alarm system (automatic detectors, alarm devices, control and communication systems), fire extinguishing water center (pumps to be installed near unprocessed water tank), internal and external pipe ring and hydrant system, mobile fire extinguishers and fire-extinguishing systems (in transformers and electronic equipment) as well as white water, carbon dioxide (CO_2) and similar fire extinguishers.

Heating system will be fed through steam-hot water heat exchangers. Steam transferred to the heat exchangers will be supplied from the auxiliary steam system. The system will be equipped with hot water circulation pumps, expansion tank and similar equipment.

Ventilation system will meet the requirement of all buildings concerning ventilation. Required air will be supplied from air feeding units to be installed outside the building. The proposed power plant will be equipped with laboratory, main control room, electronic panel room and air-conditioning system for some rooms in the administrative building and other control rooms.

During normal operation of the facility, auxiliary steam system will receive very hot steam from waste heat boiler steam system through branch ducts. Pressure of this steam will be decreased and attenuated as needed for each unit.

Single auxiliary boiler, which is suitable for operating on natural gas fuel and installation in the open air, will be installed for the facility. The auxiliary boiler will be equipped with a chimney, feed water pump, deairator / degasifier and auxiliary equipment and it will generate saturated steam at an approximate amount of 40.000 kg/h for turbine cooling steam during commissioning of the facility. Operational pressure and temperature conditions of the boiler are estimated to be 10 barg. Auxiliary steam to be generated in this auxiliary boiler will be used for the following services / equipment:

- Steam turbine gasket
- Cooling steam for AB steam turbine
- Waste heat boiler spraying steam
- Heat source for gas turbine ice prevention system under ambient conditions lower than 5ºC

As telecommunication equipment, the facility will be equipped with telephone, intercom, speaker and similar systems.

Emergency generator unit will be equipped with a diesel generator unit in order to meet extraordinary emergency requirements.

One mobile crane will be available in cooling water pump buildings, machinery workshop and water treatment building. All the machinery, tools and devices required for maintenance and repair operations of the power plant equipment will be available in the machinery workshop.

V.2.2 Goods and/or Services to be Produced in the Project Units, Quantities of Final Products and By-Products, Amount, Area and Method of Marketing for these Products, Area, Method and Amount (how many people and/or how much area) for Provision of Produced Services

Final product to be manufactured in the potential energy power plant is electricity energy and it is envisaged that approximately 6.948.800.000 kW/h electricity will be generated per year. Approximately 2% of the total produced electricity energy will be used for internal consumption and 380 kV of this energy will be connected to the national network through transmission lines. Connection point of the power plant to the system and voltage levels will be Kayabaşı 2 TM, 380 kV and Çarşamba TM, 380 kV (see Appendix-1). As for this issue, System Connection Agreement is to be signed with General Directorate of Turkish Electricity Transmission Cooperation. (TEİAŞ). Electricity energy to be transferred to the national interconnected energy system might be conveyed to any point through interconnected energy transmission systems.

Energy transmission line has not been evaluated under this report; necessary procedures will be implemented for the energy transmission line in the future in accordance with " Environmental Impact Assessment Regulation", which entered into force upon publication in Official Gazette dated 17.07.2008 (no: 26939).

In the event that industrial and household use are taken into account in Turkey, given the fact that annual energy consumption per capita is increasing day by day, electricity energy to be generated by the proposed energy power plant will play an important role to meet annual electricity energy requirements of Turkey.

V.2.3 Quantities, Area and Method for Supply of Raw Materials, Auxiliary Materials required for the Project; Impacts of these Materials during Shipment and Storage; Elemental Analysis and Heating Value of the Fuel

Main raw material to be used in the Project is natural gas and the amount of natural gas to be used in the energy power plant is 32×10^3 kg/h for each combustion turbine. It is planned to supply the natural gas from Blue Stream Natural Gas Pipeline of Petroluem Pipeline Cooperation It is planned to install a branch duct in Samsun-Ankara Natural Gas Main Transmission Line (in a diameter of 48"), install a pipeline in an approximate diameter of 12" from this point to the boundaries of the power plant facility and establish an A type Pressure Reduction and Measurement Station in order to meet this gas demand. Finally, pressure of the gas supplied for the facility will be 40 barg.

Although the pressure of the gas to be supplied for the facility is 40 barg, A type Pressure Reduction and Measurement Station will reduce the gas pressure as the gas pressure to be used in the power plant is estimated to be 34,47 bar. This line will be equipped with necessary protection systems and necessary precautions will be taken in order to ensure that units of the gas line do not contain pressure while they are not operational. Besides, in case of a failure, emergency turn-off valves will be installed in order to stop gas flow. Therefore, it does not seem possible that the

facility will emit any amount of gas that will have a negative impact on the environment. As there will be no storage operation in the power plant, there is no explosion risk concerning storage.

Natural gas is composed of gases such as 97,5% methane (CH4) and 2,5% ethane (C2H6), I-butane (C4H10), N-butane (C4H10), I-pentane (C5H12), N-pentane (C5H10), hexane (C6H14), heptane (C7H16), nitrogen (N2) and carbon dioxide (CO2).

Besides, diesel (no:2) will be available for use in generators and vehicles in case of emergency.

Approximately 80 people will be employed in the operation phase of the power plant. Transportation will be provided with private vehicles and service vehicles in the project area.

V.2.4 Quantity, Area and Method for Processes concerning Water to be used in the Project Units; Pretreatments for Water (including Treatment Units and Units in which Water will be added as Make up - Feed Water); Water Preparation Main Flow Chart

Main process phase to be used for the water in the project is only steam generation process. Once through cooling system will be used for the energy power plant and sampling losses will be approximately 7.8 m^3/h in the system. Cooling water requirement is estimated to be approximately 59.200 m^3/h in the power plant. Water use process chart proposed within the Project is given in Figure V.3 with the related quantities.

Besides, as for the potable water, based on the assumption that the number of personnel, that will work during the operational phase of the project, is approximately 80 people, daily water required for the personnel is estimated to be approximately 12 m^3 (80 people x 150 L/person =12.000 L). It is planned that this water will be supplied from the groundwater springs which are dug and used in the region. As for the drinking water requirements, this water will be transported to the facility.

Domestic waste water which will be formed during the operational phase is estimated to be 12 m^3/day based on the assumption that 100% of the drinking water and potable water to be used by the personnel will transform into waste water.

After treatment of this waste water, this water will be discharged into the sea with other process waste water in accordance with the provisions stipulated in Water Pollution Control Regulation.

Quality of feed water and boiler water to be used in the power plant is as follows:

Feed water quality

Feed water quality will be as follows:

- pH > 9
- Oxygen, O_2 < 0.02 mg/kg
- Hardness -
- Total iron Fe < 0.02 mg/kg
- Copper, Cu <0.003 mg/kg
- Oil < 0.3 mg/kg

Boiler water quality

Boiler water quality will be as follows:

- pH 9 - 10.5
- Silica, SiO_2 < 1.8 meq/kg
- P alcalinite < 0.3 mg/kg
- Conductivity (25ºC) < 30 mS/m
- Phosphate, PO_4 2 to 6 mg/kg

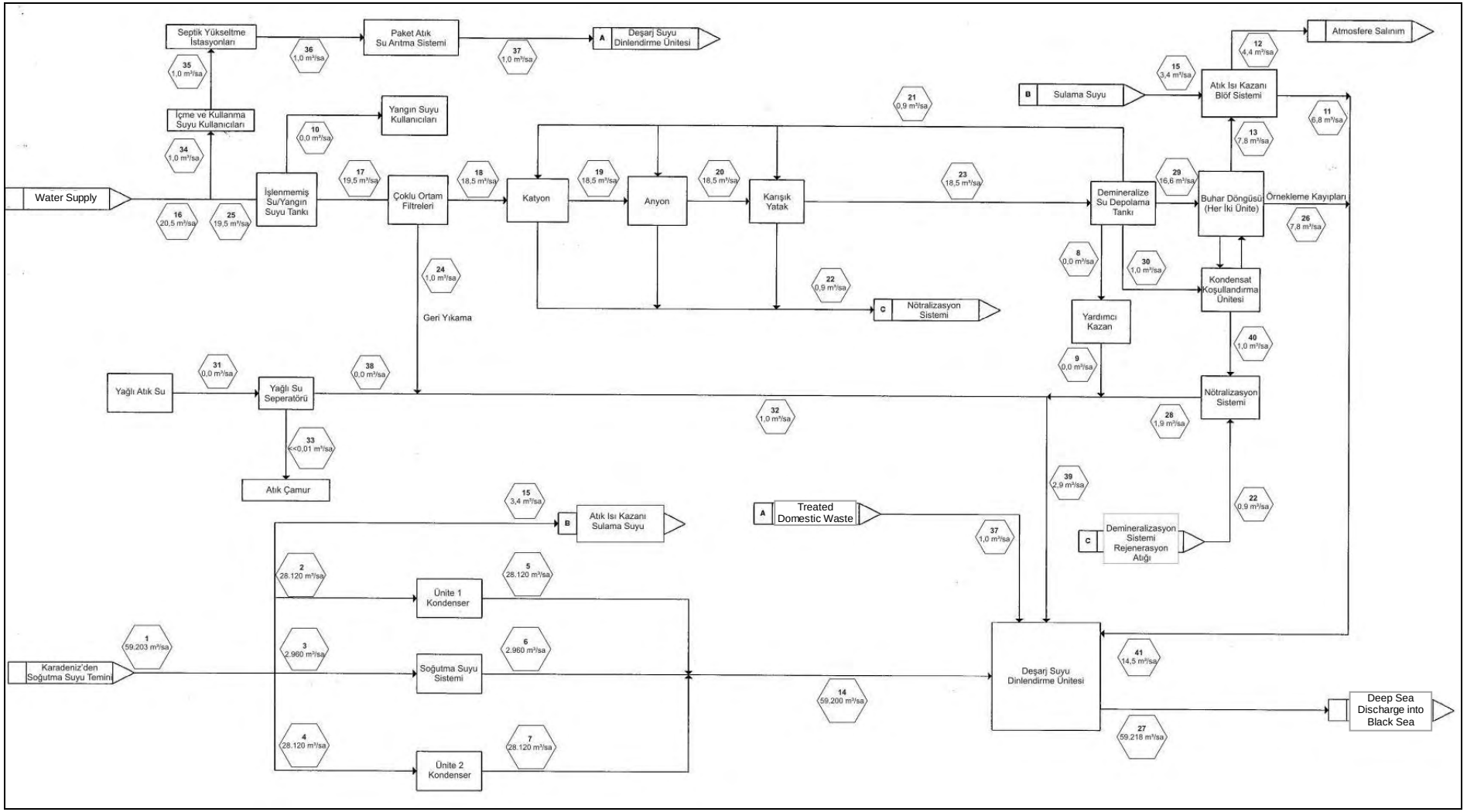


Figure V.3: Water Use Chart within the Project

Table of Water Budget Flow			
	Identification of Water Budget	Basic Load	
	Fuel	Gas	
	Loading	100%	
	Dry Thermometer Temperature, C	15	
	Relative Humidity, %	60%	
	Wet Thermometer Temperature, C	10.8	
Flow No.	**Flow Identification**	**Flow (m^3/hour)**	**Notes**
1	Sea water supply	59,203	
2	Unit 1 Cooling water supply for Condenser	28,120	
3	Cooling Water Supply for Cooling Water System	2,960	Note 7
4	Unit 1 Cooling water supply for Condenser	28,120	
5	Unit 1 Return of Cooling Water from Condenser	28,120	
6	Return of Cooling Water from Cooling Water System	2,960	
7	Unit 2 Return of Cooling Water from Condenser	28,120	
8	Demineralized water supply for Auxiliary Boiler	0	Note 5
9	Drainage / Blow-off of Auxiliary Boiler	0	Note 5
10	Fire-Protection Water Users	0	Note 5
11	Waste Heat Boiler Blow-off Cooled with Water	6.8	Note 10
12	Ventilation of Waste Heat Boiler Blow-off	4.4	
13	Waste Heat Boiler Blow-off	7.8	Note 9
14	Return of Cooling Water to Discharged Water Settling Unit	59,200	
15	Waste Heat Water Irrigation Water	3.4	
16	Supply from Public Water Network	20.5	
17	Supply of Water from Public Water Network to Multiple Environment Filters	19.5	
18	Water Extracted from Multiple Environment Filters	18.5	
19	Water Extracted from Cation IX	18.5	
20	Water Extracted from Anion IX	18.5	
21	Supply of Demineralized Water for Demineralized Regeneration System	0.9	
22	Demineralized Regeneration Waste Water	0.9	
23	Water Extracted from Mixed Bearing IX	18.5	
24	Back-washing from Multiple Environment Filters	1.0	Note 11
25	Supply of Water from Public Water Network to Unprocessed Water / Fire-protection Water Tank	19.5	
26	Sampling Losses	7.8	Note 8
27	Discharge into Black Sea	59,218	
28	Neutralized Regeneration Waste Water	1.9	
29	Supply of Demineralized Water for Steam Cycle	16.6	
30	Supply of Demineralized Water for Filter Regeneration System	1.0	

31	Oily Waste Water	0.0	Note 5
Flow No.	**Flow Identification**	**Flow (m^3/hour)**	**Notes**
32	Filtration of Oily Water Separator Waste Water and Back-washing	1.0	
33	Disposal of Oily Water Separator Sludge outside the Area	<<0.01	
34	Distribution of Drinking Water	1.0	Note 4
35	Waste Water Collection	1.0	
36	Waste Water for Package Treatment System	1.0	
37	Treated Waste Water for Discharged Water Settling Unit	1.0	
38	Oily Water Separator Waste Water	0.0	
39	Combined Power Plant Waste Water for Discharged Water Settling Unit	2.9	
40	Regeneration Waste Water from Condensate Conditioning Unit	1.0	Note 5
41	Combined Waste Heat Boiler Waste Water	14.5	

NOTES:

1. Water flows are based on specific process conditions for facility configuration given in Page 1 and unless otherwise specified, unit of water flow is m^3/hour.
2. Design is based on two 1x1 combined cycle energy designs, which will be made in Samsun and generate 880 MW nominal energy.
3. This calculation is based on GE heat budget dated 21.2.2008 (no: CCA12261 NG Rev.2).
4. Use of drinking water is estimated to be 1.0 m^3/hour.
5. Normally, there is no flow.
6. Cation-anion units is estimated to be regenerated once a day and mixed bearing is estimated to be regenerated once a week.
7. Cooling water flow in the cooling water system is estimated to be 5% of total cooling water flow.
8. Sampling and several system losses are taken as 1% high pressure condenser exhaust flow per unit.
9. Blow-off of the waste heat boiler is taken as 1% condenser exhaust flow per unit.
10. Irrigation water temperature for waste heat boiler is estimated to be 20 C; waste water temperature of the blow-off tank of the waste heat boiler is estimated to be 100 C and the blow-off temperature of the waste heat boiler cooled with water is estimated to be 60 C.
11. Back-washing of the multiple environment filters is taken as 5% of the flow toward the system.
12. Condensate conditioning unit is estimated to be regenerated once a week.

Figure V.4: Legend of Water Use Chart

V.2.5 Quantities, Physical, Chemical and Bacteriological Characteristics of Waste Water to be generated by All Units of the Project; Parameters to be used for Disposal in Waste Water Treatment Facilities and Quantities and Methods of Disposal; Quantities and Methods for Transfer of Waste Water for Receiving Environments following Treatment Processes

In the proposed power plant, water will be used for several purposes such as electricity generation and domestic consumption. It is planned that domestic water requirements such as administrative building, garden irrigation and fire-extinguishing water will be supplied from public water network of Terme District and this quantity is estimated to be 20,5 m^3/hour. Quantity of water to be used as process water from Black Sea is estimated to be 59.200 m^3/hour. According to these assumptions, maximum water requirement of the power plant is estimated to be 59.218 m^3/hour. Schematic projection of facility water utilization is given in Figure V.3.

Water to be supplied from ground water reserves will be allocated for users and waste water generated as a result of this process will be collected in a discharged water settling unit after it is treated in package waste water treatment facility. Some of the water will be collected in unprocessed water or fire-protection tank and this water will be used in case of fire. Some of the water in the tank will be collected in demineralized water tank after it passes through anion and cation filters and mixed bearing, used in condensate conditioning unit and included in steam cycle. Besides, if needed, it will be used for auxiliary boiler.

Water extracted from sea will be used as cooling water, filtered through condensers and collected in discharged water settling unit.

Water collected in discharged water settling unit will be discharged into sea.

Demineralized Water

In the proposed power plant, demineralized water will be required for use in condensate conditioning unit and steam cycle. Besides, this demineralized water, if needed, will be transferred to the auxiliary boiler. Water in an approximate amount of 18.5 m^3/hour will be transferred to the demineralization facility to be established in order to meet demineralized water requirements of the power plant.

Demineralization unit will be composed of H_2SO_4 and NaOH storage tanks, discharge pumps, neutralization tank and waste water pumps. There will be two lines in this unit and there will be one weak cation changing colon, one powerful cation changing colon, one weak anion changing colon, one powerful anion changing colon and one mixed bearing colon in each line. Besides, there will be one common degasifier, two (one reserve) degasifier air blowers, two (one reserve) degasifier pumps for two lines.

pNa-meter will be installed on the output line of powerful cation changing colons; conductivity meter will be installed on the output line of powerful anion changing colons and silica meter and conductivity meter will be installed on the output line of mixed bearing colon. 50% NaOH and 66^o<Bé H_2SO^4 will be used for regeneration of ion changing colons. H_2SO_4 and NaOH systems will be installed in separate rooms and drainage of H_2SO_4 and NaOH storage tanks will be connected to neutralization system.

Regeneration wastes (0.9 m^3/hour) of demineralization unit will be collected and

processed in neutralization system. Neutralization will be automatically performed through adjustable time relays and pH-meter. Following sufficient circulation, acid or base will be added according to the result from pH-meter. Then, 1.9 m^3/hour water extracted from neutralization system will be collected in discharged water settling unit.

Water extracted from demineralization unit (18.5 m^3/hour) will be collected in demineralized water storage tank and transferred to the system (16.6 m^3/hour) and condensate conditioning unit (1.0 m^3/hour) through a transfer pump. 0.9 m^3/hour of this water will be returned to the demineralization unit as regeneration water. Parameters of the water extracted from regeneration system will comply with the values in Table 20.7 of Water Pollution Control Regulation (WPCR)(see**Error! Reference source not found.**).

Tablo V.5: Waste Water Standards Envisaged for Discharge of Demineralization and Regeneration Waste Water to the Receiving Environment (WPCR, Table 20.7)

Parameter	Discharge Limits	
	Composite Sample for 2 Hours	Composite Sample for 24 Hours
Chloride (mg/L)	2000	1500
Sulfate (mg/L)	3000	2500
Iron	10	-
Fish BioExperiment (ZSF)	10	-
pH	6-9	6-9

Waste Water

In the proposed Samsun Natural Gas Combined Cycle Power Plant, separate systems are envisaged for rain water and waste water. Water cycle of the power plant is given in Figure V.3 and approximate flows of waste water generated by several units are given in Table V.20.

Table V.6 Quantities of Waste Water generated in the Facility

Source	Flow (m^3/hour)
Cooling Water	59,200
Waste Heat Boiler Blow-off	6.8
Sampling Losses	7.8
Waste Water of Neutralization System	1.9
Oily water separator	Intermittent
Filter back-washing water	1.0
Auxiliary boiler	Intermittent
TOTAL	**59,217.5**

Water in a total amount of 59.218 m3/hour will be generated in the power plant (see Figure V.3). Information concerning this water and treatment systems is summarized as follows:

- Domestic waste water (approximately 12 m^3/day) will be treated in accordance with the parameters in Table 21.1 of WPCR (see Table V.7) and transferred into the general drainage system of the power plant.

- Waste water of waste heat boiler blow-off, oily water separator, filter back-washing water and neutralization system will be transferred to the general drainage system of the power plant. Water in the general drainage system will comply with the criteria in Table 9.3 of WPCR (see Table V.8).
- Then, water in the general drainage system will be discharged into Black Sea with cooling water. Discharge process will be performed in accordance with the discharge limits set out in Table 9.6 of WPCR (see Table V.9) and the values stipulated in Annex-5 and Annex-6 of Regulation on Aquaculture. Besides, discharge operation will comply with the values set out in Table 23 of WPCR (see Table V.20).
- As for any waste water discharge into the receiving environment, necessary permits will be obtained from the highest administrative chief of the region in line with the approval of the regional environmental authority.
- Additionally, project of the proposed treatment facility will be approved in line with the Circular on Approval of the Project for Waste Water Treatment Facilities no 2005/5.
- As for the deep sea discharge structure, project of the proposed discharge facility will be approved in line with the Circular on Approval of the Project for Deep Sea Discharge Facilities no 2006/21.

Table V.7: Discharge Standards for Domestic Waste Water (WPCR, Table 21.1)

Parameter	Discharge Limits	
	Composite Sample for 2 Hours	Composite Sample for 24 Hours
BOİ (mg/L)	50	45
KOİ (mg/L)	180	120
AKM (mg/L)	70	45
pH	6-9	6-9

Table V.8: Sector Facilities for Coal Preparation, Processing and Energy Generation (Thermal Power Plants and Similar Structures) (WPCR, Table 9.3)

Parameter	Discharge Limits	
	Composite Sample for 2 Hours	Composite Sample for 24 Hours
KOİ (mg/L)	60	30
AKM (mg/L)	150	100
Oil and Grease (mg/L)	20	10
Total Phosphor (mg/L)	8	-
Total Cyanide (mg/L)	-	0.5
Temperature (ºC)	-	35
pH	6-9	6-9

Table V.9: Cooling Water and Similar Substances (WPCR, Table 9.6)

Parameter	Discharge Limits	
	Composite Sample for 2 Hours	Composite Sample for 24 Hours
Oil and Grease (mg/L)	20	10
AKM (mg/L)	150	100
Temperature (ºC)	35	30
pH	6-9	6-9

Table V.10: Characteristics of Waste Water suitable for Deep Sea Discharge (WPCR Table 23)

Parameter	Notes
Temperature	Irrespective of the dilution capacity of the sea environment, temperature of the water to be discharged into sea cannot exceed 35 C. Hot water discharges cannot increase the temperature of sea water, in which the first physical dilution (S1) of the diffuser is added, more than 1 C in summer season that covers June-September and more than 2 C in other months. However, in the event that the temperature of sea water is higher than 28 C, discharge will be performed in a way that will not increase the temperature of the receiving environment more than 3 C without imposing any limitation on discharge temperature of the sea water used for cooling purposes.
Total and fecal coli forms as the most probable number (EMS)	As a result of the total dilution performed with deep sea discharge, in the protection areas inhabited by people, time will be 90%, total coli form level will be lower than 1000 TC/100 ml and fecal coli form level will be lower than 200 FC/100 ml as EMS.
Solid and floating substances	There will be no visible solid and floating substances at the outlet of the diffuser except for a band whose width at that point is equal to the depth of sea water.
Other parameters	Limits given in Table 4 shall apply.

V.2.6 Information concerning Cooling (Main and Auxiliary Cooling Water) System, Cooling Water Flow Chart, Transmission Line (water intake and discharge structure), Chemical Substances to be Used and Quantities thereof; Characteristics of the Cooling Water and its Impacts on the Receiving Environment into which the Cooling Water is discharged (eligibility of waste water characteristics in comparison with the pollution parameters to be measured and monitored for discharge into the receiving environment and the standard values to be met); Evaluation of Sea Water Temperature Change according to Months, Modeling Study (thermal dispersion) in relation to the Temperature Change and the Precautions to be taken

Cooling water will be extracted from Black Sea and the quantity of cooling water is estimated to be approximately 59.200 m^3/hour. Distribution of the cooling water in the system is given in Figure V.3. There will be two water intake structures and these structures will be installed at the end of a pipeline which is approximately 700 m away from the power plant. Detailed sections with regard to the system are given in Appendix-6.

Distribution quantities of the cooling water in the system are given in Table V.20. Water circulated in the closed cycle will be collected in the discharged water settling unit after it is transferred from Unit 1 and 2 condensers and cooling water system and it will be discharged into Black Sea.

Table V.11: Distribution of the Cooling Water in the System

Units	Quantity (m^3/hour)
Unit 1 Condenser	28,120
Cooling Water System	2,960
Unit 2 Condenser	28,120

Drawings concerning design of the discharge system are given in Appendix-6. It is envisaged that the discharge line will be approximately 400 m^3. The last 100 m of the line will be composed of the diffuser structure (see Appendix-6). The diffuser is designed to create 11 separate exits. 11 diffuser exits in a height of 1 m and in a diameter of 800 mm are placed in opposite directions. A discharge modeling has been created in order to determine the progress of water during discharge of the cooling water and details concerning this study are given in Appendix-6. Points taken into account during the study and the results of the study are summarized as follows:

- Quantity of water to be supplied: 59.000 m^3/hour
- Quantity of discharge: 59.000 m^3/hour
- Discharge temperature: 23,6ºC
- Sea water temperature admissible for summer months: 19ºC
- Sea water temperature admissible for winter months: 14ºC
- There is no industrial facility that could affect discharge of the cooling water in the project area and in the surrounding area.
- Temperature increase to be caused by the discharged water in the sea water is lower than the limit values set out according to 'WPCR'. In that case, as for the temperature increase, the provisions stipulated in "WPCR", which entered into force upon publication in Official Gazette dated 31.12.2004 (no: 25687) (Table 23) and "Law on Aquaculture no 1380" and "Regulation on Aquaculture", which entered into force upon publication in Official Gazette dated 10.03.1995 (no: 22223), shall apply.
- The provisions stipulated in Table 4 of WPCR shall apply for the quality criteria concerning sea water.
- Discharge operation will be performed in accordance with the provisions in Table 9.6 of WPCR and necessary permissions will be obtained in line with the Article 36 of WPCR
- There will be equipment for continuous monitoring of the discharged water temperature and temperature value will be continuously controlled and reported.
- As for any waste water discharge into the receiving environment, necessary permits will be obtained from the highest administrative chief of the region in line with the approval of the regional environmental authority.
- As for the activities, provisions stipulated in "Regulation on Control of Pollution caused by Hazardous Substances around water sources and their surroundings", which entered into force upon publication in Official Gazette dated 26.11.2005 (no: 26005), shall apply.

As for the permits to be obtained following Environmental Impact Assessment process, an application will be made to Turkish Republic, Samsun Governor's Office, Provincial Directorate of Agriculture with the sketch of the pipelines with coordinates in order to obtain permission for water intake and discharge lines.

V.2.7 Areas and Quantities for the Main Fuels and Auxiliary Fuel to be Used within the Project and the Combustion Systems to be Used, Emissions, Impacts on the Current Air Quality (performing cumulative impact assessment by taking into account the current pollution load of the region), Mitigation Precautions and Efficiency Levels of these Precautions, Tools and Systems to be used for Measurements, Methods used for Modeling Study, Description of the Model, Meteorological Date used in the Modeling (Precipitation, Wind, Atmospheric Stability, Mixture Height etc.); Model Inputs, Model Results by taking into account the Worst Case Scenario, Possible and Remaining Impacts, Proposed Precautions, Places of the Outputs Obtained as a

result of Modeling on Land Utilization Map; Characteristics of the Filters to be Used, Maintenance of Filters, Precautions to be taken in case of Failure

In this section, fuels to be used in the proposed power plant, possible emissions as a result of the activities in the facility and the effects of these emissions on the local air quality are presented. In the section V.2.7.1, characteristics of the fuel to be used in the facility are presented and in the section V.2.7.2, emissions in the facility and the precautions to be taken for control of these emissions are summarized. The section V.2.7.3 covers the methods to be used for monitoring emissions. Definitions and limit values stipulated in Industrial Air Pollution Control Regulation and Air Pollution Evaluation and Quality Management Regulation are given in the section V.2.7.4 while methods and model inputs used in the modeling studies are presented in the section V.2.7.5. The sections V.2.7.6 and V.2.5.7 include results of the modeling activities performed in accordance with the legislation and a general evaluation on possible effects of these activities on the local air quality.

The Fuel to be Used

Each of the gas turbines of the power plant is estimated to consume approximately 32 x 10^3 kg/hour natural gas. Total amount of gas to be combusted in two gas turbine units is estimated to be 64x10^3 kg/hour. Thermal value of the natural gas will be at least 49.224 kJ/kg and at most 54.589 kJ/kg. It is planned to supply the natural gas from Blue Stream Natural Gas Pipeline of Petroleum Pipeline Cooperation. In the entrance of the facility, natural gas pressure reduction and filtration units will be installed. The supplied natural gas is composed of gases such as 97,5% methane (CH_4) and 2,5% ethane (C_2H_6), I-butane (C_4H_{10}), N-butane (C_4H_{10}), I-pentane (C_5H_{12}), N-pentane (C_5H_{10}), hexane (C_6H_{14}), heptane (C_7H_{16}), nitrogen (N_2) and carbon dioxide (CO_2). Detailed information on operation of the power plant is given in the section V.2.1. There will be no by-pass chimney in the proposed power plant and no fuel will be used in addition to the natural gas.

Emissions and Control of Emissions

In this section, emissions to be caused by the proposed Samsun Natural Gas Combined Cycle Power Plant and the precautions to be taken and the control technology to be used in order to minimize these emissions are summarized.

As the fuel to be used in the proposed power plant is natural gas, the most important contaminants that will be formed as a result of combustion will be nitrogen oxides (NOx) and carbon monoxide (CO) emissions. Besides, a little carbon dioxide (CO_2) gas will be released. As there is no sulfur element in the natural gas, there will be no sulfur dioxide (SO_2) emissions in the exhaust gas. Quantities of the contaminants in the exhaust gas and characteristics of the exhaust gas are given in Table V.12. Contaminants, control methods and emissions are given in detail under the following sub-headings.

Table V.12: Mass Flows and Concentrations of the Contaminants

Parameter	Value*	Concentration (mg/Nm³)**	
		Value	Limit Value***
Particle	0	0	Sootiness level during continuous operation is 3 according to Bacharach scale and sootiness level during start-up is 4 according to

Parameter	Value*	Concentration (mg/Nm³)**	
		Value	Limit Value***
			Bacharach scale
CO	72 kg/hour (20 g/s)	30 @15% O_2	100 @15% O_2
NO_x	120 kg/hour (33 g/s)	50 @15% O_2	75 @15% O_2
SO_x (in SO_2)	0	0	60 @15% O_2
Quantity of Exhaust Gas	2.384.610 Nm³/hour	-	-
O_2 Ratio	11.88%	-	-
Chimney Diameter	6,9 m	-	-
Temperature of Exhaust Gas	75ºC	-	-
Humidity Ratio	8.9%	-	-

* There are two chimneys in the facility. These values are valid for one chimney.

** Fuel thermal power of the facility is approximately 870 MW.

*** These are the values stipulated in Annex-5 A-8 of Regulation on Air Pollution Control Caused by Industry.

Calculations of Mass Flow:

NOx 50 mg/Nm³ × 662 Nm³/s = 33 g/s
33 g/s × 1 kg/1000 g × 3600 s/1 hour = 120 kg/hour

CO 30 mg/Nm^3 × 662 Nm^3/s = 20 g/s
20 g/s × 1 kg/1000 g × 3600 s/1 hour = 72 kg/hour

NO_x Emissions

There are two factors on formation of NOx emissions that will be released as a result of combustion process to be performed in the proposed facility. The first factor is the content of the nitrogen to be used in the combustion process. However, more importantly, NOx emission is formed because of oxidation of free nitrogen in the air at high temperatures during the combustion process. Factors that will be indicative for these emissions in the proposed facility are boiler combustion technique, burning temperature and pressure.

Special burners will be used for the gas turbines in the proposed power plant. Due to these burners, NOx emissions will be kept under the limit without any steam or water injection and it will be approximately 50 mg/Nm^3 (24 ppmv). This emission content is valid for both chimneys and few differences will be observed between the emission values of the chimneys depending on the combustion conditions when the power plant becomes operational.

According to Annex-5 A-8.3 of Industrial Air Pollution Control Regulation ; emission limit value of the nitrogen oxides (in nitrogen dioxide) is 75 mg/NM^3 in the facilities in which fuel thermal power is higher than 50 MW in the new gas turbines.

According to Annex-2 of Industrial Air Pollution Control Regulation ; "Hourly mass flows of the emissions released into the atmosphere from the chimneys of current and potential facilities or outside the chimneys shall be measured in the chimneys for the current facilities and determined

through the emissions released into the atmosphere outside the chimneys and emission factors for the facilities to be established. In the event that the hourly mass flow (kg/hour) values exceed the values specified in Table 2.1, Air Pollution Contribution Value shall be calculated on hourly basis, if possible, otherwise, it shall be calculated on daily, monthly and annual basis for the impact area of the facility". This value has been determined as 40 kg/hour for Nitrogen Dioxide (NOx (in $NO_{2)}$). NOx flow of each power plant will be 120 kg/hour for the proposed power plant and it will be 240 kg/hour in total. As this value is higher than the limit value specified as 40 kg/hour in Industrial Air Pollution Control Regulation , impact modeling has been applied to the air quality concerning this contaminant and the method and the results of this modeling are given in detail in the sections V.2.7.5 and V.2.7.6.

CO Emissions

CO emissions are created as a result of inefficient combustion. Proper concentration time and high temperature are required for providing controlled combustion. No considerable CO emission will be created at high capacity as a result of hybrid burners to be used in the power plant. Possible CO emission is approximately 72 kg/hour for each chimney.

According to Annex-2 of Industrial Air Pollution Control Regulation ; "Hourly mass flows of the emissions released into the atmosphere from the chimneys of current and potential facilities or outside the chimneys shall be measured in the chimneys for the current facilities and determined through the emissions released into the atmosphere outside the chimneys and emission factors for the facilities to be established. In the event that the hourly mass flow (kg/hour) values exceed the values specified in Table 2.1, Air Pollution Contribution Value shall be calculated on hourly basis, if possible, otherwise, it shall be calculated on daily, monthly and annual basis for the impact area of the facility". This value has been determined as 500 kg/hour for Carbon Monoxide. CO flow of each power plant will be 72 kg/hour for the proposed power plant and it will be 144 kg/hour in total. This value is lower than the limit value, which is stipulated in Industrial Air Pollution Control Regulation as 500 kg/hour. In that case, although there is no need for any impact modeling on the air quality concerning this parameter, this parameter has been included in the modeling study and the method and the results of this modeling are given in detail in the sections V.2.7.5 and V.2.7.6.

According to Annex-5 A-8.2 of Industrial Air Pollution Control Regulation ; "Carbon monoxide emission in waste gases cannot exceed the value of 100 mg/NM^3 during continuous operations." Total CO emission caused by the proposed facility is estimated to be 30 mg/NM^3.

CO2 Emissions

CO_2 is a product formed as a result of full combustion and it generally results in global greenhouse gas effect. Therefore, there are no local air quality and emission standards for CO_2. Combined cycle gas turbines operate more efficiently and create less CO_2 per MW electricity generation than the other power plants operating on fossil fuel. Besides, as the natural gas has higher calorific value compared to the other fossil fuels, lower CO_2 emission is created per MW energy generation. No air quality modeling study has been performed for this parameter.

Monitoring of Emissions

As specified in the section V.2.7.2, air contaminants in the exhaust gas of the power plant will comply with the limit values in Industrial Air Pollution Control Regulation . Additionally, the following provisions are available in Appendix-3, Article d of Industrial Air Pollution Control Regulation for continuous monitoring of exhaust gases in the same regulation:

"d) Continuous Monitoring of Emissions:

1) General

Recording devices are used for controlling whether the emission exceeds the limit values. These measurements are also necessary for determination of activities for gas cleaning facilities such as dust filter, gas cleaner and final burner and determination of emissions released by raw materials and processes.

Within regular measurements, in the event that the results of evaluation show that the following requirements are met in terms of operational hours within 1 (one) year,

1.1. In the event that average of emission measurements in any calendar month does not exceed the emission limit values,

1.2. In the event that 97% of all average values for 48 hours do not exceed 110% of the emission limit values as for the sulfur dioxide and dust,

1.3. In the event that 95% of all average values for 48 hours do not exceed 110% of the emission limit values as for the nitrogen oxides,

it is accepted that the limit values are respected.

2) Regular Measurement of Dust Emissions:

Combustion systems working on solid fuel and fuel-oil, whose thermal capacity is equal to- and higher than- 100 GJ/hour (27778 kW), and the facilities, which release dust emission of 15 kg/hour and more (including combustive particles), should be equipped with a recording measurement device which continuously measures dust emission concentration. Volumetric flow should be continuously measured in order to determine the mass flow caused by the facility.

Daily emissions of these substances should be determined in the event that the facilities release dust emission specified in (h) paragraph of Annex-1 and the facilities in the 1st class release emission in an amount more than 2 kg/hour and the facilities in the 2nd class release emission in an amount more than 5 kg/hour.

In order to ensure that the emission released as a result of changes in the operation conditions of a facility, failures in the waste gas cleaning facilities and similar reasons does not exceed the above-stated limit values even for a short period of time, the related authority may demand that regular dust emission measurements be performed for combustion system thermal capacities in the 1st paragraph and emission mass flows in the 2nd paragraph.

Measurement values shall be kept at least for 5 (five) years.

In the event that various combustion systems are connected to a chimney, total thermal capacity per chimney will be used.

3) Regular Measurement of Gas Emissions:

In the event that a facility releases emissions in quantities, which are higher than the limits specified for the following substances, the substances, which exceed these limits, should be regularly measured through recording measurement tools or controlled through automatic computer system and results of the measurement should be recorded. Volumetric flow should be continuously measured in order to determine the mass flow caused by the facility.

Sulfur dioxide	*60 kg/hour*
Chlorine	*1 kg/hour*

Organic compounds (taken as carbon)	*10 kg/hour*
Nitrogen Oxide (taken as NO)	*20 kg/hour*
Chloride compounds as inorganic gas (taken as Cl)	*1 kg/hour*
Hydrogen sulfur	*1 kg/hour*
Fluoride compounds as inorganic gas (taken as F)	*2 kg/hour*
Carbon monoxide (for Combustion Facilities)	*5 kg/hour*
Carbon monoxide (for Other Facilities)	*50 kg/hour*

Measurement values shall be kept at least for 5 years.

4) Regular Measurement for Combustion Control:

Combustion systems with liquid and solid fuel, whose thermal capacity is equal to- and higher than- 36 GJ/hour (10 MW), should be equipped with a recording exhaust gas analysis device (CO_2 or O_2 and CO) for combustion control.

In the event that various combustion systems are connected to a chimney, total thermal capacity per chimney will be used."

In this regulation, it is highlighted that exhaust gases are regularly monitored. In this context, "Continuous Emission Monitoring" (CEM) system will be installed for measurement of emissions released from chimneys of the central. This system will be equipped with self-operating electronic analysis devices for measurement of NOx, CO and O_2 concentrations and gas flow. Data obtained from CEM system will be transmitted to central information system. In the event that the values of exhaust gas emissions released from the facility exceed the limit values, necessary precautions will be taken and it will be ensured that emission values are reduced below the limit values. On-line connection will be made between the system and Provincial Directorate of Environment and Forestry for monitoring emission values. Additionally, approval will be obtained from Turkish Republic, Ministry of Environment and Forestry, Directorate of Measurement and Evaluation during installation of continuous measurement devices.

All monitoring activities will be performed in line with the standard techniques specified in Industrial Air Pollution Control Regulation . These activities will be performed through the equipment to be used in line with the instruction of the manufacturing firm on calibration, operation and maintenance. Calibration activities of the continuous measurement devices will be performed through internationally monitored, certified gases in accordance with the manuals of the devices and periods stipulated in the calibration certificates and the legislation and submitted to Turkish Republic, Samsun Governor's Office, Provincial Directorate of Environment and Forestry as monthly reports. Analyses, which cannot be performed through a device installed in the site and mobile equipment, will be performed by an authorized laboratory.

Location, whose concentrations are estimated to be at the highest level in the impact area of the Project, will be determined in coordinates through modeling and air pollution measurement station will be established at this point. In the event that this point is outside the provincial boundaries of Samsun, another air pollution measurement station will be established for monitoring air quality within the provincial boundaries of Samsun. The second station will be established through determination of the point at which the concentrations will be at the highest level within the provincial boundaries of the impact area for the Project. Necessary infrastructure will be established for providing on-line connection for both stations with Turkish Republic, Samsun Governor's Office, Provincial Directorate of Environment and Forestry. Additionally, meteorological parameters (temperature, pressure, wind) of the region will be monitored through a station to be established within the area.

Additionally, air quality monitoring activities will be performed during operational phase of

the power plant through diffusion tubes used for determination of current environmental data. In this way, concentration values of the exhaust gas emissions released from the power plant will be determined at ground level.

If needed, all data obtained through emission monitoring activities and detailed results on exhaust gas emissions and current air quality will be reported to Turkish Republic, Ministry of Environment and Forestry or Provincial Directorate of Environment and Forestry.

As the proposed project is under the scope of Annex-8 List A Article 1.1.d of Industrial Air Pollution Control Regulation , an emission permit on chimney emissions will be obtained from Turkish Republic, Ministry of Environment and Forestry following commissioning of the facility.

Air Quality Standards

Air Quality Evaluation Management Regulation Annex IA defines air quality standards on gas contaminants in two different categories: (i) Long Term Limit Value (UVS) (annual); (ii) Short Term Limit Value (KVS) (for 24 hours, 95%/year).

UVS and KVS values specified for these contaminants in Air Quality Evaluation Management Regulation are given in Table V.13.

Table V.13: Limit Values Specified in Air Quality Evaluation Management Regulation

Parameter	Unit	UVS	KVS
Nitrogen Dioxide (NO_2)	µg/m³	100 (Limit value annually decreases in equal quantities every 12 months until it becomes **60 µg/m³** (60% of the limit value) from 1.1.2008 to 1.1.2014)	300
Carbon Monoxide (CO)	µg/m³	10,000	30,000 (Limit value annually decreases in equal quantities every 12 months until it becomes **10 µg/m³** (33% of the limit value) from 1.1.2008 to 1.1.2014)

Calculation of Chimney Height

Chimney height for the proposed power plant was determined in accordance with the chart stipulated in Annex-4 of Industrial Air Pollution Control Regulation before modeling activities on air quality (see Figure V.3). Values concerning chimney height determined through the chart are calculated by taking into account the chimney diameter, temperature of the exhaust gas, flow of the exhaust gas and the contaminant emission.

In the chart, "d" value is the chimney diameter (in meters) and "t" value is temperature of the exhaust gas (in C) and these values for the proposed power plant are 6.9 m and 75 C, respectively. Similarly, "R" value is the volumetric flow of the waste exhaust gas under moisture free conditions (in Nm^3/hour) and "Q" value is the mass flow of the air pollutant gases released from the emission source (in kg/hour); these values for the proposed power plant are 2.384.610 Nm^3/hour (0 C temperature, 101.3 kPa, 15% O_2 and under dry conditions) and 120 kg/hour, respectively. "s" value in the chart is the emission factor used for determination of the chimney height and this value is taken as 0.1 for NO_2 contaminant parameter. In that case, "Q/s" value for NO_2 contaminant parameter is estimated to be 1200 kg/hour.

In the evidence of the above-stated values, the study performed for determination of the chimney height for the power plant is shown with red line in the chart given in Figure V.4. In that case, the estimated chimney height is approximately 40 m.

Besides, the chimney height, which is stipulated in Annex-4 of Industrial Air Pollution Control Regulation and calculated in line with the topographical conditions, is estimated through H=H'+J formula. In this formula, "J" value is calculated in accordance with "the chart for determination of J value" stipulated in Annex-4 of Industrial Air Pollution Control Regulation . Average elevation difference of an area in a diameter of 10H', which is formed by elevation of the power plant area and the center of the chimney location, is defined as J' value. J' value for the project area is 0 (zero). In the power plant, 10 H' radius length is calculated as 300 m (10 x 30 m). J'/H' value in the horizontal axis is calculated as 0 (zero) in accordance with "the chart for determination of J value" stipulated in Annex-4 of Industrial Air Pollution Control Regulation and J/J' value, which corresponds to this value in chart, is calculated as 0 (zero). Therefore, H value, which is calculated by taking into account the topography factor, is 40 m. In modeling activities on air quality, the chimney height is taken as 60 m. The chimney height in the facility will be 60 m.

Method Used for Modeling Study

Within the modeling activities, studies have been performed on how the contaminants (NOx and CO) emitted from the chimney of the proposed facility will spread within the project area (20 km x 20 km) under the current meteorological conditions and the possible concentration values at the ground level to be caused by these contaminants as a result of this dispersion.

Dispersion calculations have been performed through Industrial Source Complex-Short Term (ISCST) model, which was developed by USEPA (Bowman, 1987) and certified by the same authority for use in the environmental impact assessment studies performed in USA.

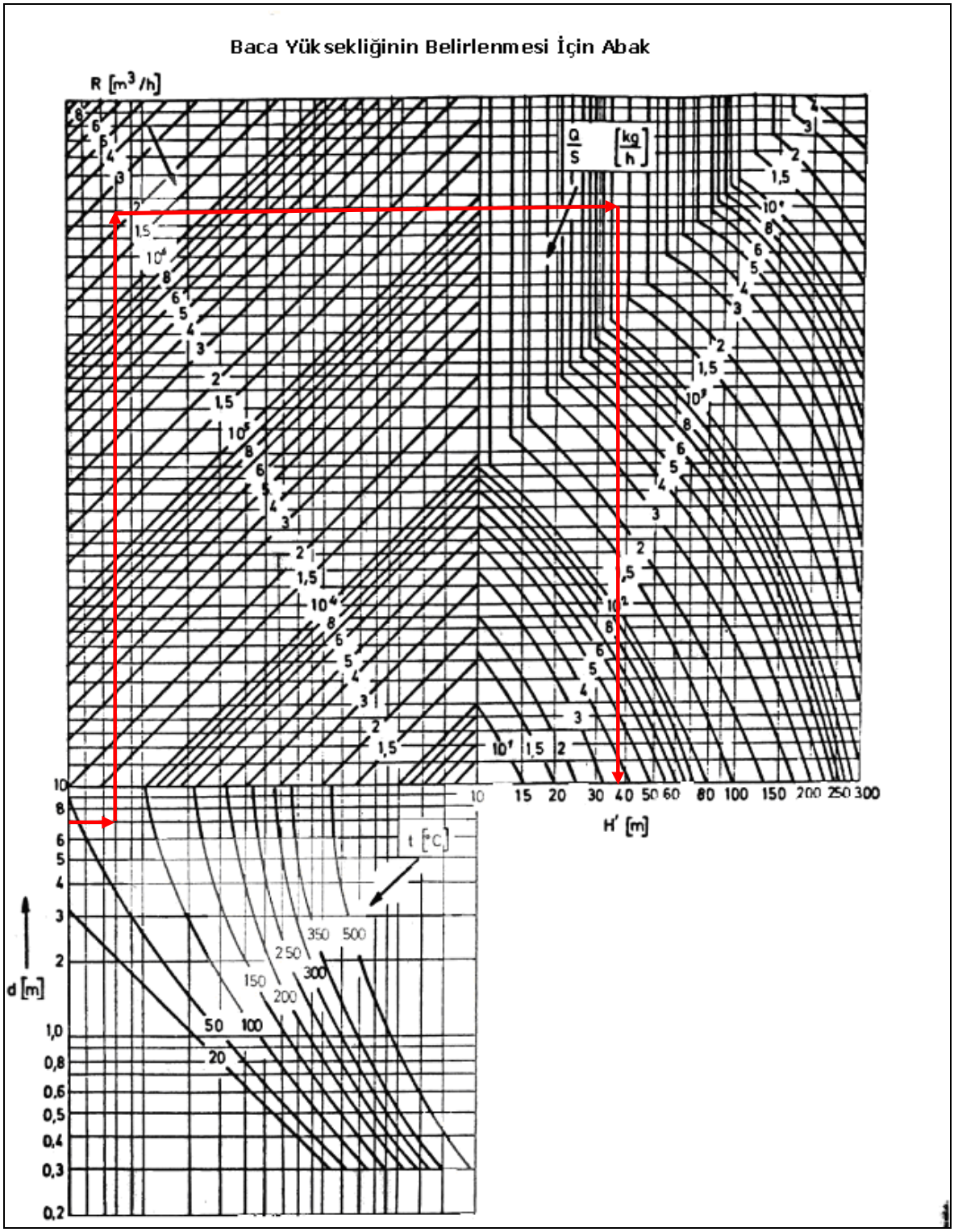


Figure V-4: Chart Used for Calculation of the Chimney Height

Besides, "building downwash effect", the incident in which the contaminants emitted from the source deposit by crashing onto the high building in the vicinity of the facility, has been studied. As there is no structure, which is higher than the chimney, in the power station, "building downwash effect" has been ignored for ISCST model.

ISCST model is one of the most advanced computer models, which can estimate hourly,

daily and annual ground concentration levels on the basis of the real-time data, which changes in the course of time. This model contains very different dispersion model calculations such as isolated chimneys and emitted contaminants (point, volume, area); besides, aerodynamic waves, turbulence and similar incidents, to which the contaminants emitted from any industrial region could be subjected, are taken into account.

ISCST model works in a network system defined by user and calculations are performed for corner points of each receiving environment element in the network system. Network system, in which ISCST model is used, is defined as polar or Cartesian; besides, separate receiving points might be specified outside the network system and detailed calculations might be performed at these points. Pasquill stability class is used for dispersion calculations. There is an option for rough terrain in the model. ISCST model uses the following four data types:

- Hourly meteorological data set including wind direction, wind speed, temperature, Pasquill stability class, mixture height, (depending on selection of the user) wind profile exponent and potential vertical temperature difference.
- Coordinates and height of each component in the network system, which is defined as receiving environment.
- Source data, which is specified by the user according to a starting point, including source coordinates, source height, diameter, contaminant output speed, temperature and flow.
- Besides, there are 31 optional program control parameters that could be used by the user.

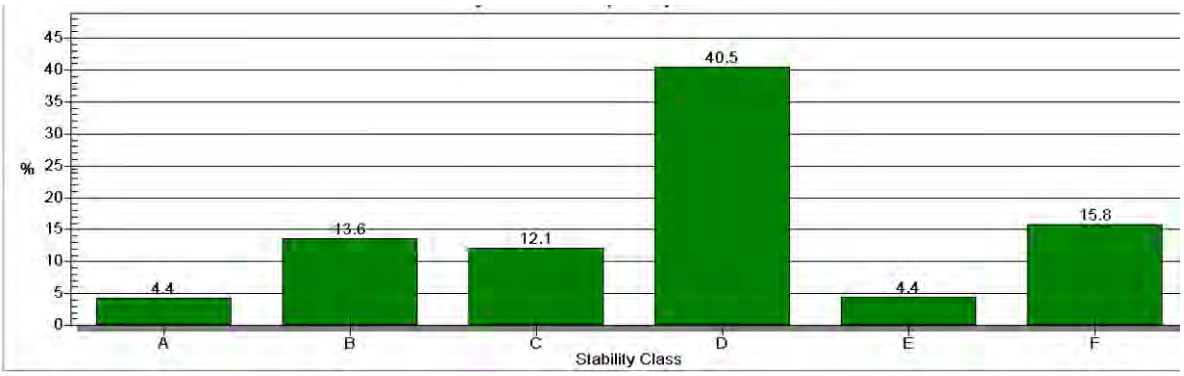
Model inputs used in this study are given in the subsequent parts of the report.

Meteorological Data Used in Modeling

Long term meteorological data required for the modeling activities are provided from the current meteorology stations in the region. The most important factor for selection of the meteorological station data in the modeling activities is that this data (especially wind data) represents the project area as good as possible. Another important factor is that meteorological data to be used for the modeling activities include values for temperature, pressure, cloudiness, wind speed and direction on hourly basis.

In this context, at first, a research has been performed on the meteorology stations in the project area for use in the modeling study on air quality. In this context, data recorded in Ünye Meteorology Station, which is close to the region and makes measurements on hourly basis, has been compiled and the wind regime recorded in this station between 2000 and 2007 has been taken into account. Of the data, which was recorded according to long term data, the data in 2003 has been observed as the most similar data and the measurements in 2003 have been used for the modeling study on air quality. Annual and seasonal wind roses concerning the above-stated station and year are given in Figure IV.5 and Figure IV.6 .

In the modeling activities, Pasquill stability classes have been calculated as a meteorology pre-program and used as input in the modeling study. Stability classes determined according to the data recorded by Ünye Meteorology Station in 2003 are given in Figure V.5. According to this data, the prevalent stability class in the region in D, which is neutral-stable".



A: Very unstable ***D: Neutral-Stable***
B: Unstable ***E: Stable***
C: Neutral ***F: Very stable***

Figure V.5: Stability Classes of Ünye Meteorology Station (2003)

Model Inputs

Receiving Environment System Used in Modeling

As specified in the previous paragraphs, it is necessary to define a working area for ISCST model and divide this area into receiving environment components. For this study, quadrangle area, which is defined as the receiving environment, is selected in such a way that the potential facility will remain in a point, which is close to the center. Network system includes receiving environment points, which are situated at intervals of 500 m, within the area of approximately 20 km (in east-west direction) x approximately 20 km (in north-south direction). Two and three dimensional maps of the receiving environment system are given in Figure II.2 and Figure II.3.

Through the model, ground level concentration values of NOx and CO have been calculated on hourly basis for the corner points of each receiving environment component. As for these concentrations, ground level concentration values, which correspond to the limit values specified in Air Quality Evaluation And Management Regulation, have been calculated for each receiving environment point and these values have been compared to the limit values specified for NOx and CO in the above-stated regulation.

Source Parameters Used in Modeling

Exhaust gas of the proposed power plant will include NOx and CO emissions. Source parameters used in modeling studies are given in Table V.20 . There is no other industrial facility, which could create cumulative effect within the impact area of the facility.

Table V.14: Source Parameters Used in Modeling Studies

ource	Coordinate			NOx Emission (g/s)	CO Emission (g/s)	Chimney Height (m)	Temperature of Exhaust Gas (C)	Output Speed of Exhaust Gas (m/s)	Internal Diameter of Chimney (m)
	x	y	z						
Chimney 1	345173	4556677	4	33	20	60	75	17.7	6.9
Chimney 2	345193	4556680	4	33	20	60	75	17.7	6.9

Results of the Model

In order to estimate the ground level concentration values to be caused by the values of exhaust gas emissions released by the power plant to be established within the boundaries of Terme District of Samsun Province, results of the modeling activities on air quality, which are performed under normal meteorology conditions and bad meteorology conditions, are given under the following sub-headings.

Normal Conditions

NOx Emissions

Results of the modeling activities on air quality are given in Table V.15 . According to these results, concentration values, which are estimated to occur at ground level in line with the modeling activities performed on daily (24 hours) and annual basis, are under the limit values stipulated in Annex-IA of Air Quality Evaluation And Management Regulation. Similarly, distribution of the concentrations within the working area is given in Figure V.6 and this distribution is shown as a land utilization map in Figure V.7. As for the ground level concentration values, the limit value specified in Air Quality Evaluation And Management Regulation, which entered into force upon publication in Official Gazette dated 06.06.2008 (no:26898), shall apply.

Table V.15: Results of Air Quality Modeling for NOx Emissions (Normal Conditions)

Period	Parameter	NO_x Concentration ($\mu g/m^3$)	Coordinate		Date
			x	y	
Annual	Short Term Value	35	347173	4553177	2003-12-25
	Long Term Value	1	339173	4554177	-
Winter	Short Term Value	10	351673	4552677	2003-02-12
	Long Term Value	0.47	339173	4554177	-
Spring	Short Term Value	26	350673	4553177	2003-05-18
	Long Term Value	1	339173	4554177	-
Summer	Short Term Value	20	347173	4553177	2003-07-09
	Long Term Value	1	345173	4555677	-
Autumn	Short Term Value	24	340173	4553677	2003-10-16
	Long Term Value	1	339173	4554177	-
January	Short Term Value	9	348673	4551677	2003-01-20
	Long Term Value	0.47	353673	4555177	-
February	Short Term Value	10	351673	4552677	12.02.2003
	Long Term Value	1	339673	4554177	-
March	Short Term Value	16	344173	4551677	05.03.2003
	Long Term Value	1	344173	4551677	-
April	Short Term Value	15	351673	4552677	12.04.2003
	Long Term Value	2	339173	4554177	-
May	Short Term Value	26	350673	4553177	18.05.2003
	Long Term Value	2	352173	4553177	-
June	Short Term Value	9	342673	4555677	25.06.2003
	Long Term Value	2	342673	4555677	-
July	Short Term Value	20	347173	4553177	09.07.2003

Period	Parameter	NO_x Concentration ($\mu g/m^3$)	Coordinate		Date
			x	y	
	Long Term Value	2	345173	4555677	-
August	Short Term Value	8	346673	4552677	08.08.2003
	Long Term Value	1	349173	4566177	-
September	Short Term Value	10	352173	4553177	30.09.2003
	Long Term Value	1	349173	4566177	-
October	Short Term Value	24	340173	4553677	16.10.2003
	Long Term Value	1	340173	4553677	-
November	Short Term Value	20	339673	4553677	28.11.2003
	Long Term Value	1	339673	4553677	-
December	Short Term Value	35	347173	4553177	25.12.2003
	Long Term Value	1	347173	4553177	-

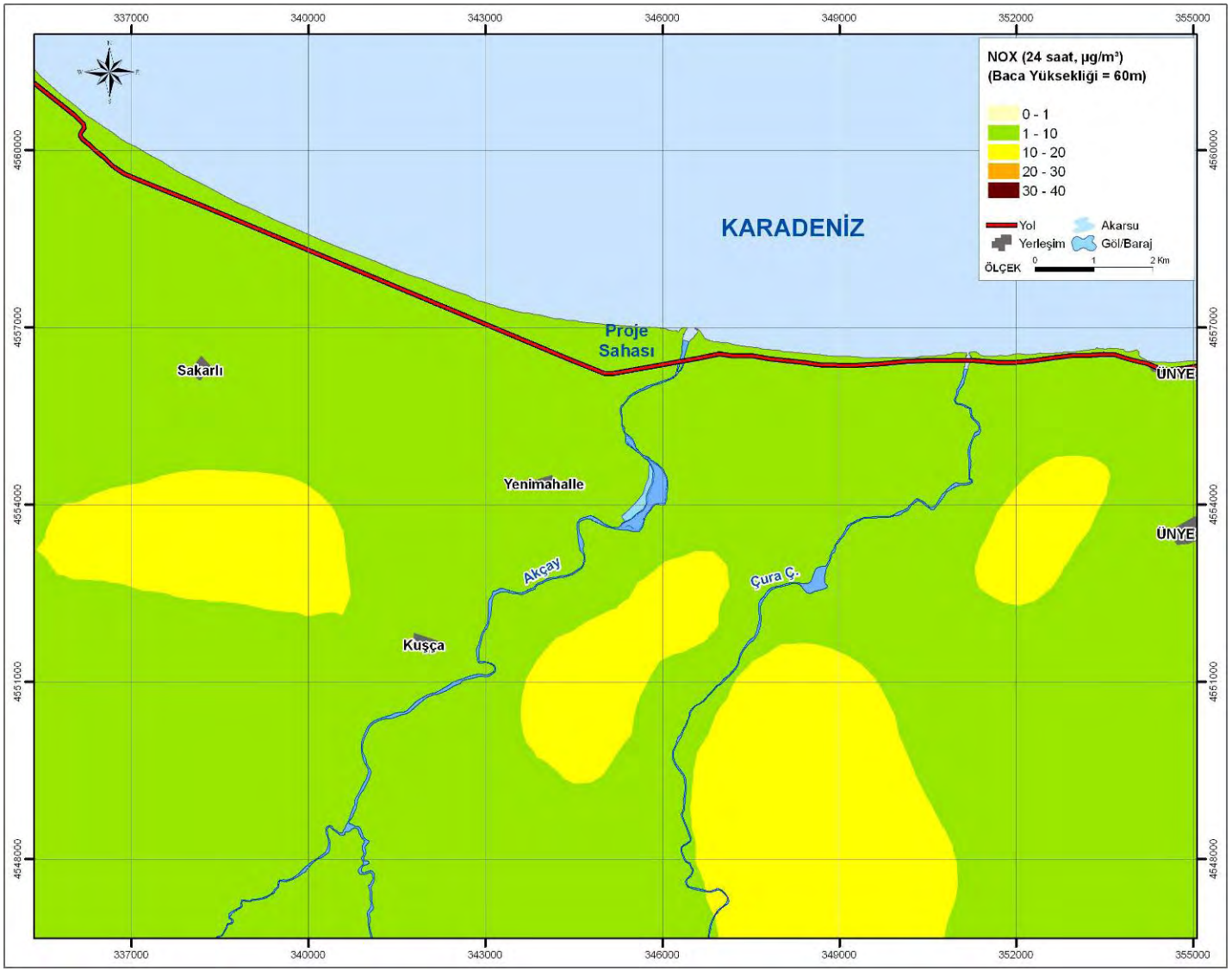


Figure V.6: Distribution of NOx Emissions within the Working Area (Short Term Values**)**

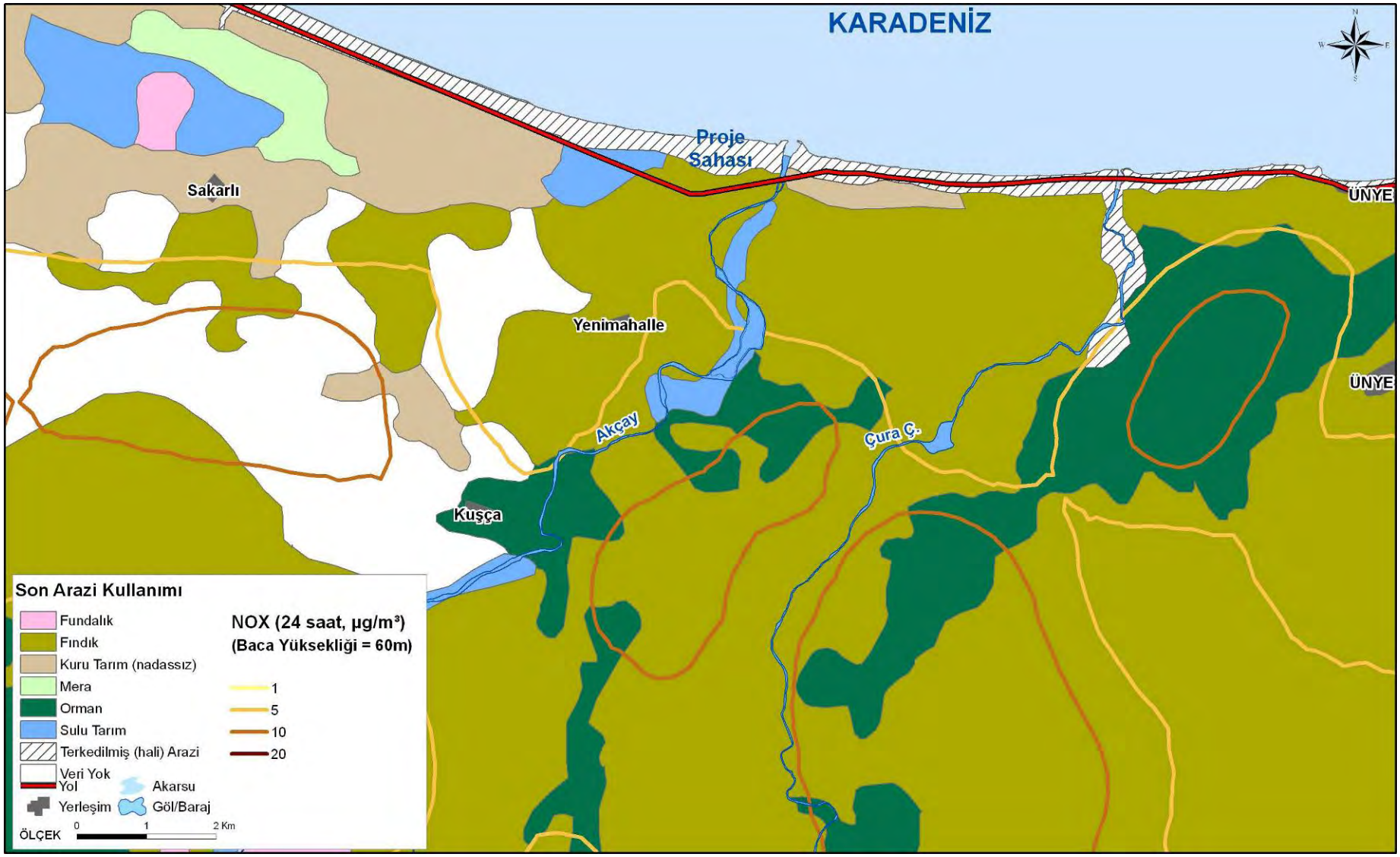


Figure V.7: Distribution of NOx Emissions in the Land Utilization Map (Short Term Values)

CO Emissions

Results of the modeling activities on air quality are given in Table V.20. According to these results, concentration values, which are estimated to occur at ground level in line with the modeling activities performed on daily (24 hours) and annual basis, are under the limit values stipulated in Annex-IA of Air Quality Evaluation And Management Regulation. Similarly, distribution of the concentrations within the working area is given in Figure V.8. As for the ground level concentration values, the limit value specified in Air Quality Evaluation And Management Regulation, which entered into force upon publication in Official Gazette dated 06.06.2008 (no:26898), shall apply.

Table V.16: Results of Air Quality Modeling for CO Emissions (Normal Conditions)

Period	Parameter	CO Concentration (µg/m³)	Coordinate		Date
			x	y	
Annual	Short Term Value	23	347173	4553177	25.12.2003
	Long Term Value	1	339173	4554177	-
Winter	Short Term Value	6	351673	4552677	12.02.2003
	Long Term Value	0.3	339173	4554177	-
Spring	Short Term Value	17	350673	4553177	18.05.2003
	Long Term Value	1	339173	4554177	-
Summer	Short Term Value	13	347173	4553177	09.07.2003
	Long Term Value	1	345173	4555677	-
Autumn	Short Term Value	16	340173	4553677	16.10.2003
	Long Term Value	1	339173	4554177	-
January	Short Term Value	6	348673	4551677	20.01.2003
	Long Term Value	0.3	353673	4555177	-
February	Short Term Value	6	351673	4552677	12.02.2003
	Long Term Value	0.4	339673	4554177	-
March	Short Term Value	10	344173	4551677	05.03.2003
	Long Term Value	1	344173	4551677	-
April	Short Term Value	10	351673	4552677	12.04.2003
	Long Term Value	1	339173	4554177	-
May	Short Term Value	17	350673	4553177	18.05.2003
	Long Term Value	1	352173	4553177	-
June	Short Term Value	6	342673	4555677	25.06.2003
	Long Term Value	1	342673	4555677	-
July	Short Term Value	13	347173	4553177	09.07.2003
	Long Term Value	1	345173	4555677	-
August	Short Term Value	5	346673	4552677	08.08.2003
	Long Term Value	1	349173	4566177	-
September	Short Term Value	7	352173	4553177	30.09.2003
	Long Term Value	1	349173	4566177	-
October	Short Term Value	16	340173	4553677	16.10.2003
	Long Term Value	1	340173	4553677	-
November	Short Term Value	13	339673	4553677	28.11.2003
	Long Term Value	1	339673	4553677	-
December	Short Term Value	23	347173	4553177	25.12.2003
	Long Term Value	1	347173	4553177	-

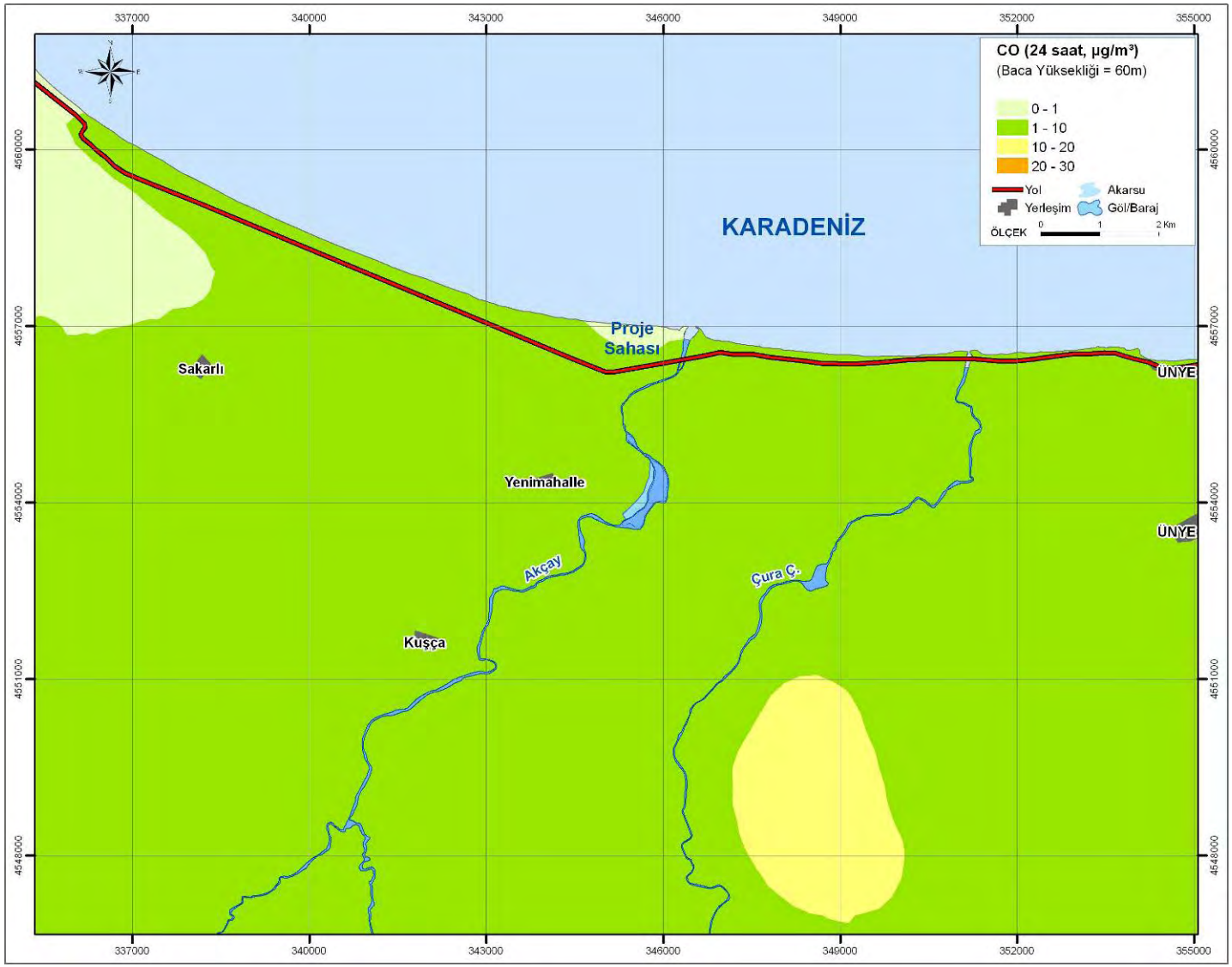


Figure V.8: Distribution of CO Emissions within the Working Area (Short Term Values)

Worst Case Scenario

NOx Emissions

As the worst case scenario for the modeling study on air quality, wind speed has been taken as 0.1 m/s for all hours. According to this assumption, concentration values, which are estimated to occur at ground level in line with the modeling activities performed on daily (24 hours) and annual basis, are under the limit values stipulated in Annex-IA of Air Quality Evaluation And Management Regulation (see Table V.17). As for the ground level concentration values, the limit values specified in Air Quality Evaluation And Management Regulation shall apply.

Table V.17: Results of Air Quality Modeling for NOx Emissions (Worst Case)

Period	Parameter	NO_x Concentration ($\mu g/m^3$)	Coordinate		Date
			x	y	
Annual	Short Term Value	43	339673	4553677	16.10.2003
	Long Term Value	1	339673	4553677	-
Winter	Short Term Value	15	353673	4555177	07.02.2003
	Long Term Value	1	353673	4555177	-
Spring	Short Term Value	37	339673	4553677	19.04.2003
	Long Term Value	1	351673	4552677	-
Summer	Short Term Value	27	346673	4552677	09.07.2003
	Long Term Value	1	346173	4552177	-
Autumn	Short Term Value	43	339673	4553677	16.10.2003
	Long Term Value	1	339673	4553677	-
January	Short Term Value	11	344673	4551177	08.01.2003
	Long Term Value	1	353673	4555177	-
February	Short Term Value	15	353673	4555177	07.02.2003
	Long Term Value	1	351673	4552677	-
March	Short Term Value	18	344173	4551677	23.03.2003
	Long Term Value	1	344173	4551677	-
April	Short Term Value	37	339673	4553677	19.04.2003
	Long Term Value	2	339673	4553677	-
May	Short Term Value	35	352173	4553177	18.05.2003
	Long Term Value	2	351673	4552677	-
June	Short Term Value	9	343673	4556177	16.06.2003
	Long Term Value	1	343673	4556177	-
July	Short Term Value	27	346673	4552677	09.07.2003
	Long Term Value	2	346173	4552177	-
August	Short Term Value	13	352173	4553177	12.08.2003
	Long Term Value	1	345173	4555177	-
September	Short Term Value	11	344673	4551177	21.09.2003
	Long Term Value	1	349173	4566177	-
October	Short Term Value	43	339673	4553677	16.10.2003
	Long Term Value	2	339673	4553677	-
November	Short Term Value	40	339673	4553677	28.11.2003
	Long Term Value	1	339673	4553677	-
December	Short Term Value	40	348673	4550677	25.12.2003
	Long Term Value	1	348673	4550677	-

CO Emissions

As the worst case scenario for the modeling study on air quality, wind speed has been taken as 0.1 m/s for all hours. According to this assumption, concentration values, which are estimated to occur at ground level in line with the modeling activities performed on daily (24 hours) and annual basis, are under the limit values stipulated in Annex-IA of Air Quality Evaluation And Management Regulation (see Table V.18).As for the ground level concentration values, the limit values specified in Air Quality Evaluation And Management Regulation shall apply.

Table V.18: Results of Air Quality Modeling for CO Emissions (Worst Case)

Period	Parameter	CO Concentration (µg/m³)	Coordinate		Date
			x	y	
Annual	Short Term Value	28	339673	4553677	16.10.2003
	Long Term Value	1	339673	4553677	-
Winter	Short Term Value	10	353673	4555177	07.02.2003
	Long Term Value	0.4	353673	4555177	-
Spring	Short Term Value	24	339673	4553677	19.04.2003
	Long Term Value	1	351673	4552677	-
Summer	Short Term Value	17	346673	4552677	09.07.2003
	Long Term Value	1	346173	4552177	-
Autumn	Short Term Value	27	339673	4553677	16.10.2003
	Long Term Value	1	339673	4553677	-
January	Short Term Value	7	344673	4551177	08.01.2003
	Long Term Value	0.3	353673	4555177	-
February	Short Term Value	10	353673	4555177	07.02.2003
	Long Term Value	1	351673	4552677	-
March	Short Term Value	12	344173	4551677	23.03.2003
	Long Term Value	1	344173	4551677	-
April	Short Term Value	24	339673	4553677	19.04.2003
	Long Term Value	1	339673	4553677	-
May	Short Term Value	23	352173	4553177	18.05.2003
	Long Term Value	1	351673	4552677	-
June	Short Term Value	6	343673	4556177	16.06.2003
	Long Term Value	1	343673	4556177	-
July	Short Term Value	17	346673	4552677	09.07.2003
	Long Term Value	1	346173	4552177	-
August	Short Term Value	8	352173	4553177	12.08.2003
	Long Term Value	1	345173	4555177	-
September	Short Term Value	7	344673	4551177	21.09.2003
	Long Term Value	1	349173	4566177	-
October	Short Term Value	27	339673	4553677	16.10.2003
	Long Term Value	1	339673	4553677	-
November	Short Term Value	26	339673	4553677	28.11.2003
	Long Term Value	1	339673	4553677	-
December	Short Term Value	25	348673	4550677	25.12.2003
	Long Term Value	1	348673	4550677	-

Calculation of Deposited Dust

As there will be no dust emission in the exhaust gas of the proposed power plant, no calculation has been made on the deposited dust.

V.2.8 Emissions that could be released through operation of Other Units except for the Power Plant, Systems to be used for Measurement, Mitigation Measures, Precautions to be taken against the Possible Dust Emission, Characteristics of the Filters to be Used, Maintenance of Filters, Precautions to be taken in case of Failure of Filters

There will be no emission other than the emissions released from the chimney during operation of the power plant. Evaluations with regard to the exhaust gas emissions are given in detail in the section V.2.7.

V.2.9 Quantities, Characteristics, Storage/Bulking and Disposal Processes of the Solid Wastes to be generated by All Units and the Employees during the operation of the facility; Areas and Methods for Transportation of These Wastes or the Types of Recycling; Possible Changes on the Receiving Environments; Possible and Current Impact; Precautions to be taken

As for the solid wastes that will occur as a result of the operational activities of the project, these wastes will include domestic solid wastes arising out of the daily requirements of the personnel, domestic solid wastes, waste oil and packaging wastes. If the amount of domestic wastes arising out of the personnel during the operational activities of the power plant is taken as 1,34 kg/person.day (source: www.cedgm.gov.tr), daily solid waste quantity to be formed by 80 personnel will be approximately 107 kg (80 people x 1,34 kg/person.day).

Solid wastes within the Project, which will be collected in accordance with the provisions of "Regulation on Control of Solid Wastes", which entered into force upon publication in Official Gazette dated 14.03.1991 (no 20814), will be disposed of in the storage area for solid wastes designated by Terme Municipality. Packaging wastes (paper, cardboard, metal, glass, rubber, textile, plastic etc.) that will be formed during the construction phase of the project will be collected separately from the other wastes, carried in special closed vehicles which will not pollute environment in terms of appearance, odor, leakage and similar factors, stored in separate locations and disposed of in the licensed institutions in accordance with the provisions of " Packaging Wastes Control Regulation ", which entered into force upon publication in Official Gazette dated 24.06.2007 (no 26562).

Domestic solid wastes that will occur during the operational phase of the Project will be collected, stored and disposed of in accordance with the related articles of " Solid Wastes Control Regulation", which entered into force upon publication in Official Gazette dated 14.03.1991 (no: 20814).

Packaging wastes (paper, cardboard, metal, glass, rubber, textile, plastic etc.) that will be formed during the operational phase of the project will be collected separately from the other wastes, carried in special closed vehicles which will not pollute environment in terms of appearance, odor, leakage and similar factors, stored in separate locations and disposed of in the licensed institutions in accordance with the provisions of " Packaging Wastes Control Regulation ", which entered into force upon publication in Official Gazette dated 24.06.2007 (no 26562).

Waste oil, vegetable waste oil and waste batteries and accumulators that will occur during operational phases will be disposed of in accordance with the provisions of "Waste Oil Control Regulation", which entered into force upon publication in Official Gazette dated 30.07.2008 (no 26952), " Vegetable Waste Oil Control Regulation", which entered into force upon publication in Official Gazette dated 19.04.2005 (no: 25791), and " Waste Batteries and Accumulators Control Regulation", which entered into force upon publication in Official Gazette dated 31.08.2004 (no 25569). Additionally, hazardous wastes arising out of maintenance and repair within the project such

as filter, oily tubes, gloves and contaminated materials will be disposed of in accordance with the provisions stipulated in " Hazardous Wastes Control Regulation", which entered into force upon publication in Official Gazette dated 14.03.2005 (no 25755).

Besides, possible medical wastes will be disposed of in accordance with the provisions stipulated in " Medical Wastes Control", which entered into force upon publication in Official Gazette dated 22.07.2005 (no 25883).

Maintenance, repair, oil and filter change operations of the vehicles used during the operational phase will be performed in the licensed gas stations.

Waste water that will be formed within the Project will be composed of domestic waste water and processed cooling water during the operational phase. After treatment of this waste water in waste water treatment facility, this water will be discharged into the sea with other process waste water. During this discharge process, provisions stipulated in " Water Pollution Control Regulation", which entered into force upon publication in Official Gazette dated 31.12.2004 (no: 25687), shall apply.

Medical wastes in the facility will be separately collected and these wastes will be disposed of in accordance with the provisions of " Medical Wastes Control Regulation", which entered into force upon publication in Official Gazette dated 22.07.2005 (no 25883).

V.2.10 Precautions to be taken against possible odor, dust and pest formation in the facility

There is no activity which will cause formation of odor, dust and pest during operation of the power plant. Besides, solid wastes in the facility will be regularly transported to the disposal facility and it will be ensured that these wastes be transferred to the storage area in time. Additionally, a cleaning unit will be formed in the facility for cleaning and sanitation activities and this unit will perform the necessary activities.

V.2.11 Effects of the Possible Vibration within the Project, Precautions to be taken, Preparation of the Acoustic Report in accordance with the Regulation on Assessment and Management of Environmental Noise (It will be separately prepared for each facility)

Noise, which will be formed within the project, will result from the power plant units during the operational phase. Estimated noise level has been calculated in accordance with the provisions stipulated in " Environmental Noise Assessment and Management Regulation (2002/49 - EC)", which entered into force upon publication in Official Gazette dated 07.03.2008 (no 26809) and "Acoustic Report" of the project is given in Appendix-11. The final values have been assessed in accordance with the limits (see Table V.19) set out in Annex-VIII - Table 4 of the Regulation.

The following methods will be applied in order to minimize the effects of noise that will be formed as a result of commissioning of the project.

- Installation of highly-efficient mufflers and filters on the gas turbine inlets,
- Minimization of the noise in the gas turbine exhausts with the waste heat boiler and if needed, installation of high-capacity mufflers,
- Designing the main transformer in a way that will minimize formation of noise,
- Ensuring that the fuel gas measurement and control systems emit noise at low levels,
- Installation of inlet and outlet mufflers on the cooler fans,
- Ensuring that the auxiliary motor, pump, compressor and valves emit noise at low levels,

- Limitation of truck transportation to day time.

Table V.19: Environmental Noise Limit Values for the Industrial Facilities

Areas	$L_{daytime}$ (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)
As for the uses, which are sensitive to noise, areas where education, culture and health facilities and holiday and camp facilities are situated	60	55	50
As for the areas where commercial structures and uses that are sensitive to noise are situated; areas where the houses are densely situated	65	60	55
As for the areas where commercial structures and uses that are sensitive to noise are situated; areas where the offices are densely situated	68	63	58
For each facility within an Organized Industrial Zone or a Specialized Industrial Zone	70	65	60

Besides, it is not envisaged that the vibration, which will be formed with commissioning of the project, will be felt in the settlement units outside the project site and in this context, this vibration will not create a negative effect.

V.2.12 Quantities and Characteristics of the Radioactive Wastes, Sources and Levels of Noise, Possible and Current Effects and the Proposed Measures

No radioactive waste will be formed within the Project. Detailed assessment on the noise sources and levels is given in Acoustic Report stipulated in Appendix-11.

V.2.13 Hazardous, Toxic, Inflammable and Explosive Substances to be Used during Generation in the Project Units; Transportation and Storage of these Substances; Types of Use for these Substances; Possible Hazards during Use and Precautions to be taken

During operation of the proposed power plant, there will be a series of different chemical substances within the power plant site. Chemical substances will be transported into the power plant site through trucks and used by the experienced personnel. BORASCO will ensure that these activities are performed in accordance with the related legislation provisions on occupational health and safety.

The most important explosive substance to be used in Samsun Natural Gas Combined Cycle Power Plant will be natural gas. Natural gas will be supplied to the power plant site through a branch duct from Samsun-Ankara Natural Gas Main Transmission Line, which is the outlet line of the station used in Blue Stream Project of Petroleum Pipeline Cooperation and there will be no storage operation in the power plant site.

In the facility, storage buildings for chemical substances shall be reinforced concrete in accordance with the use of Explosive And Hazardous Substances Regulation and it should be surrounded with a second concrete wall against any leakage. Besides, any leakage for the environment will be prevented through emergency valves in the unit. Channels, which drain the area, where chemical substances are stored, will be connected to an oil filter and drainage water will be discharged into natural environment by passing this unit. It is not expected that the chemicals to be used will transform into a secondary hazardous substance during and after the operational phase.

Activities concerning storage, transportation and use of dangerous and hazardous substances will be performed in accordance with the related articles in " Hazardous Chemical

Substances and Products Control Regulation", which entered into force upon publication in Official Gazette dated 11.07.1993 (no: 21634).

V.2.14 Determination of the Level and Dispersion Effect of the Project on Underground and Ground Cultural and Natural Entities (traditional civic appearance, archeological remains, natural values to be protected) in the Impact Area of the Project

There is no underground and ground cultural and natural entity in the project area and its immediate surroundings. Therefore, it is not envisaged that this project will have any effect on these entities.

V.2.15 Possible Effects on Continental Flora / Fauna and the Precautions to be taken (including the effects of water intake / discharge structures and transmission lines with regard to the cooling water system)

Within the Project, the possible effects on continental flora and fauna have been assessed under the headings of exhaust gas emissions, noise and vehicle traffic and waste water discharge. Environmental effects arising out of the Project will be monitored in line with the monitoring program, which has been created within the Project and given in the Chapter VIII.1.

Within the Project, the possible effects on continental flora and fauna have been assessed under the headings of exhaust gas emissions, noise and vehicle traffic. Environmental effects arising out of the Project will be monitored in line with the monitoring program, which has been created within the Project and given in the Chapter VIII.1.

Assessment of the Effect of Exhaust Gas Emissions

As for flora and fauna, the most important contaminants arising out of the proposed power plant are known to be NO_x (NO and NO_2). Concentration levels of NO_x emissions arising out of the power plant at ground level are found to be under the limit values specified in Air Quality Evaluation And Management Regulation, Annex-IA for both contaminant parameters (NO and NO_2) (see Section V.2.7). In that case, it is envisaged that there will be no negative effect of the emissions on flora and fauna. This assumption is explained in detail in the following paragraphs by taking into account the subsequent processes following release of NO_x into the atmosphere.

Some of NO_x emissions discharged from the chimney might combine with the hydroxyl radicals in the atmosphere and form nitric acid (HNO_3). However, as this reaction is relatively slow and the formed HNO_3 steams are carried onto the upper atmosphere layers and do not come down the ground level, it is generally accepted that NO_x emissions do not create any effect on the plant in this way.

On the other hand, some other part of NO_x emissions released into the atmosphere comes down the ground level through dry and wet deposition processes. In this way, NO_x, which comes down the ground level through dry and wet accumulation, might affect the plants in two different ways such as "direct effect" and "soil acidification". Unlike the particles, it is known that NOx emissions, which are directly deposited on leaves, will not create considerable effects for plants. During literature search, it has been determined that a maximum annual average NO_x Ground Level Concentration value in an amount of 30 µg/m³ is accepted as a general impact limit for sensitive flora species (WHO, 1994).

In this context, the maximum annual average NOx Ground Level Concentration value in an amount of 1 µg/m³ in the proposed power plant remains under the limit value of 30 µg/m³ specified by

WHO (1994). Therefore, it is accepted that NOx emissions arising out of the power plant will not create any negative effect on sensitive or insensitive flora species.

Cooling Water Intake / Discharge Structure

Cooling water of the power plant will be supplied from Black Sea and this cooling water will be discharged into Black Sea. In this context, the only receiving environment will be Black Sea and there will be no activity over Akçay Stream. During discharge of cooling water into Black Sea, discharge parameters and possible temperature increase in the sea environment will comply with the related limits of WPCR and Aquaculture Regulation. In this context, it is not expected that cooling water intake / discharge structures will not have any negative effect on the environment.

Assessment of the Impacts of Noise

Design values in the power plant units have been determined in such a way that the noise level will be kept at minimum level. In this way, possible noise levels in the operational phase of the power plant will be lower than the limit values stipulated in Environmental Noise Evaluation and Management Regulation (see Appendix-11). Therefore, it is not expected that the fauna in the impact area of the Project is badly affected by the noise arising out of the Project.

Assessment of the Impact of the Vehicle Traffic

As the natural gas to be used as the fuel of the power plant will be transferred to the facility through a pipeline, no vehicle will be used for transportation of the fuel and the vehicles will generally be used for transportation of the personnel to the power plant. Movements of the vehicles used for transportation of the personnel will be limited to the current access routes and the roads in the facility.

Besides, the vehicles will be forbidden to enter into the environmental land and it will be ensured that fauna species are not badly affected by the vehicles entering into facility through a wire fence. Within these measures, it is not expected that vehicle traffic arising out of the Project will create any negative effect on the fauna species.

V.2.16 Possible Effects on the Forest Areas and the Precautions to be taken, Precautions to be taken against Forest Fires

As a result of the modeling study, concentration values of the ambient air arising out of the exhaust gas emissions remain under the limit values stipulated in Annex-IA of Air Quality Evaluation And Management Regulation. As there is no forest area within the Project area, there will be no negative effect on the forest areas because of the Project.

V.2.17 Effects of the Project on Crops and Soil Acidification, Methods Used for Estimation of Soil Acidification and the Precautions to be taken

As a result of the exhaust gas emissions of the proposed Samsun Natural Gas Combined Cycle Power Plant, there is no soil acidification in the project area and its immediate surroundings. Impact assessment concerning soil acidification has been performed through a qualitative approach.

General

The most important contaminants, which cause formation of soil acidification, are gas contaminants, sulfur dioxide (SO_2), nitrogen oxides (NO_x) and ammonia (NH_3). After these acid forming substances are released from the contaminant source into the atmosphere, they are deposited in the soil through two different processes such as wet and dry. Addition of these acid forming substances into the soil results in an increase concerning H^+ ion concentration in the soil. Elements

that buffer the effects of the added H^+ ions are some basic cations in the soil (Ca^{+2}, Mg^{+2}, Na^+, K^+ and NH_4+);[1] With the increase of H^+ concentration in the soil, surfaces of clay and organic colloids in the soil are covered with H^+ ions instead of cations (Ca^{+2}, Mg^{+2}, Na^+, K^+ and NH_4+ ions). In this context, increased H^+ ions raise the acidity value of the soil. This soil acidification creates a series of the following effects:

- Addition of the cations in the soil into the ground water through washing,
- The fact that the soil becomes infertile because of cation loss and loss of crops depending on this phenomenon,
- Mobile washing of some metals (for example, Al and Cd) because of the decreasing pH.

Soil Acidification depending on Exhaust Gas Emissions

As for the exhaust gas emissions that will occur during the operational phase of the natural gas power plants, the most important contaminant which will cause acidification is NO_x emission. Besides, as the estimated ground level NOx emissions arising out of the power plant are very low, these emissions are lower than the limit values set out in Annex-IA of Air Quality Evaluation And Management Regulation and the possibility of nitric acid rain is very low in our country[2], it is not possible that NOx accumulation arising out of the power plant will cause any acidification in the soil of the region.

Similarly, as the estimated concentration values of the exhaust gas at ground level are lower than the limit values set out in Annex IA of Air Quality Evaluation And Management Regulation, it is not expected that these emissions will have any negative effect on agricultural areas.

V.2.18 Effects on Underground and Ground Water and the Precautions to be taken

The highest water consumption for these power plant projects is water consumption for cooling in the operational phase. Cooling water to be used in the operation phase of the power plant will be supplied from Black Sea. For this reason, there will be no negative effect on surface water during supply of cooling water. Water to be used as potable water in the facility is planned to be supplied from the current and possible wells in the region. It is not expected that the people in the region are badly affected because of this requirement, which is approximately 20.5 m^3/hour.

Waste water, which will occur because of potable water in the operational phase, will be discharged into Black Sea in line with the provisions of Aquaculture Regulation and WPCR after this water is treated in waste water treatment facility.

V.2.19 Possible Effects on the Sea Environment (especially because of discharge into the sea) and the Precautions to be taken

There will be no considerable negative effect on the flora and fauna species in the sea environment as the waste water of the power plant will be discharged into the sea environment in accordance with the standards(see SectionV.2.5 and SectionV.2.6) set out in WPCR(see Appendix 6).

[1] Total of the equivalent weights of the cations that could change in 100 grams of a soil type is called "Cation Change Capacity" value of this soil.

[2] As known, formation of acid rain is based on occurrence of some meteorological and environmental conditions. In other words, acid rain might occur as a result of rapid photochemical reactions that could be formed by strong ultraviolet rays coming into a very polluted atmosphere (especially hydrocarbon (HC) pollution). However, Mediterranean countries do not receive ultraviolet rays that could form these reactions because of the thick ozone layers over these countries. In that case, acid rains, which will result from NOx emissions, do not seem possible for our country.

V.2.20 Cumulative Assessment of the Possible Effects of the Power Plant (on the Receiving Environment such as Organisms, Air, Water and Soil) with the Current Pollution Load of the Region

There is no industrial facility in the project area and in the surrounding area. In other words, there is no industrial facility that could be taken into account in order to assess the cumulative effects of the proposed power plant.

V.2.21 Assessment of Traffic Load and Effects of All Transportation Activities (including Maritime Traffic) (inside and outside the Facility) within the Project

As the natural gas to be used as the fuel of the power plant will be transferred to the facility through a pipeline, no vehicle will be used for transportation of the fuel and the vehicles will generally be used for transportation of the personnel to the power plant. Movements of the vehicles used for transportation of the personnel will be limited to the current access routes and the roads in the facility.

Besides, the vehicles will be forbidden to enter into the environmental land and it will be ensured that fauna species are not badly affected by the vehicles entering into facility through a wire fence. Within these measures, it is not expected that vehicle traffic arising out of the project will create any negative effect.

There is no activity which could affect the Maritime Traffic within the Project.

V.2.22 Areas and Ways for Meeting the Housing and Other Technical / Social Infrastructure Requirements of the Personnel that will work during the Operation of the Facility and their Families

In the power plant, where approximately 80 people will be employed in the operational phase, most of the personnel will be employed from the settlement areas in the region. Therefore, no additional social facility has been planned for accommodation of the personnel in the power plant. A cafeteria building will be available for meeting lunch and rest requirements of the personnel during lunch break. Personel of the power plant will be transported through buses.

Under all these circumstances, given the fact that there are no workers from the remote settlement areas and most of these personnel will be provided from the people in the region, during the operational phase of the Project, it is not expected that the Project will have any serious negative effect on the social and technical infrastructure services of Akçay and Hocaoğlu Quarters, which are the closest settlement areas to the power plant.

V.2.23 Risky and Dangerous Activities for Human Health and Environment during the Operational Phase of the Project

There will be no dangerous and risky activity for human and environmental health during the operational phase of the power plant. However, all the precautions concerning occupational health and safety will be taken for the personnel that will be employed in the power plant.

In this context, all the related legislation in force, in particular, Occupational Health and Safety Regulation, which entered into force upon publication in Official Gazette dated 09.12.2003 (no: 25311), shall apply. However, the personnel to be employed in the power plant will be trained on the following topics by the senior employees of the facility and the related experts:

- Site Security
- Environmental Protection

- First Aid
- Fire-Fighting
- Occupational Health and Safety
- Use of Chemical Substances
- Risk Assessment

V.2.24 Site Arrangements to be performed for Creating Landscaping Elements in the Project Area and for other Purposes

After the construction and mounting operations of the power plant are completed, all the available areas of the site will be transformed into green area. To this end, grass and ornamental plants will be used for office and management buildings while ever-green saplings will be used for remote areas. Recreational activities to be performed after completion of the activities for the proposed power plant are given in the Chapter VI.1.

V.2.25 Distance Proposed for Health Protection Band

The entire site will be surrounded with a fence and the facilities of the power plant will be surrounded with an additional security fence. In addition to lighting of the access routes of the site, other necessary security and protection precautions will be taken within the site. Security personnel will be employed in the facility and they will work on three shifts. Fire-extinguishing network will be equipped with automatic control systems. As an additional precaution, fire-extinguishing systems with CO_2 and foam injection will be installed in some important parts of the power plant.

Within Samsun Natural Gas Combined Cycle Power Plant Project, an approval will be obtained from Turkish Republic, Ministry of Health by taking into account the effects and the contaminant elements of these enterprises on environmental and social health in line with the provisions stipulated in "Business Licenses and Work Permits Regulation"; distances of the health protection band will be determined in accordance with the procedures and reference distances to be specified by this Ministry; the health protection band approved by the authorized institution will be included in the development plan and these distances will be protected by the related Directorate of Development or the related institution.

V.2.26 Other Activities

There is no activity to be considered in this part.

V.3 Impacts of the Project on Socio-Economic Environment

In this part of the Project, impacts of the actions within the scope of proposed project on the socio-economic situation of working area are evaluated.

V.3.1 Revenue Growth to Occur with the Project, New Employment Opportunities, Population Movements, Immigrations, Education, Health, Culture, Other Social and Technical Infrastructure sevices and Changes in the Utilization of These Services etc.

Proposed Project is expected to create potential economic growth for local community and to dynamize the economy of the country and the region. Electrical energy to be generated in the proposed facility will meet an important amount of energy demand of the country and the region. Possible impacts of the proposed power plant on regional economy and service sector are explained in the following part in detail.

Probable Revenue Growth

Annual energy generation of the proposed project will be approximately 6.948.800.000 kW-hour and it is anticipated that the plant will provide stable and constant energy input to especially the industries in the Black Sea region. In Turkey, total energy loss during the transfer of energy from eastern and southeastern regions exceeds %10 and these losses cause increase in the cost of electric for consumers.

Area preparation of the project, an important amount of necessary materials and services during construction and operation phases are planned to be met from the region. Some of the total Project cost will be allocated to labor force, accommodation, equipment rent, fuel and to the charges for the services of regional enterprises, thus contribute to the economy of the region.

Also, it is anticipated that 900 people will be employed during the most intensive time of the construction phase of the power plant. Spending of this staff for daily needs will indirectly contribute to the regional economy.

It is anticipated that with the start of the service, 80 people will be employed in the power plant. An important number of these people are anticipated to be engineers, technicians, and employees of the region.

Temporary and stable employment opportunities will be created during the power plant construction phase covering 14-month construction installation and operation phase to last for 30 years. Increase in the employment in the region is regarded as a positive impact on the regional economy. Constructional and operational activities of the power plant will contribute to the development of regional economy by creating an extra demand for sales and services. Also, new working areas will be created parallel to domestic and general expenditure of the families of staff to work in the power plant, thus economy will be indirectly developed.

Social Services and Infrastructure

Regional Economy

Generally, needs occurred as a result of large scale projects increase the burden of current social services and infrastructure in the region. On the contrary, with the project in question new funds will be created to develop these services by means of the increase in the total tax amount.

Especially during the operation of the power plant, impacts on the current social and technical infrastructure will be unimportant since the number of staff to work will not be large. These impacts can be more evident during the intensive construction phases.

Education Services

On the condition of the realization of this project, it is probable that people from surrounding towns and villages will come to the region in order to be employed in the new working areas of the power plant. It is anticipated that regional schools and the current literacy profile will be effected since most of the staff to be employed will be consisted of the people stil living in the region.

Health Services

A health unit within the borders of the power plant will be established in order to respond to any small scale accident and health problem to occur in the power plant. Staff and doctor will be available with all the necessary equipment and tools in the health unit. In case of any severe accident it is anticipated that health institutions in Terme, Çarşamba towns and Samsun province will be used. Thus, it is possible that the work-load of the current hospitals and health units in the region will increase with the construction and operation of the proposed power plant. Since the health institutions outside of the facility will not be used for small accidents, it is not anticipated that there will be any negative impact on regional health services. Severe cases will be transferred to the health units in Terme and Çarşamba towns and Samsun Province. Impact on the regional health institutions will be minimized by complying with the regulations on the facility security and occupational health and safety during the construction phase.

Technical Infrastructure Services

Fire Fighting

As stated in the former parts of the report, necessary equipment will be available in the power plant for fire prevention and extinguishing. Therefore, there will not be any negative impact of the proposed power plant on the local fire brigade services.

Water Supply

It is planned that the water supply of the power plant construction will be met from the current water resources in the region. In the operational phase, water supply will be obtained from underground water resources and from Black Sea. It is not anticipated that utility water to be approximately 20,5 m^3/hour will have a negative impact on the resources.

Transportation

Construction activities will lead to a small-scale load on regional transportation network. Since Samsun-Trabzon road will be used during the transportation, it is not anticipated that there will be any important negative impact on Samsun-Trabzon road as this road is already heavily loaded and the construction activities are temporary.

Accordingly, there were activities before carried on the road heading to Samsun-Trabzon road as part of the Blue Stream Project during the construction of surface facilities. Fort his reason, there will not be any Project oriented, permanent negative impact on the road, since this 14-month construction mounting activities are temporary. Activities to be done on the roads will be carried out in coordination with the competent authority in the province.

During the operation activities, most of the traffic load will result from staff transportation.

Necessary parking lot space in the power plant will be provided for visitors, service vehicles and vehicles belonging to staff. Therefore, it is not envisaged that activities will have any long-term negative impact on regional transportation network.

Communication

Necessary telephone system will be provided for the proposed facility by Türk Telekom. During the operation of the power plant, it is expected that there will not be any important negative impact on the current telephone service infrastructure.

V.3.2 Environmental Cost-Benefit Analysis

In general terms, environmental cost-benefit analysis is composed of factors concerning people and defined by socio-economic and socio-environmental parameters. Quantification of these factors is accomplished through empirical and social research techniques. But the criteria of this quantification not only changes from country to country but also from person to person. For this reason, cost-benefit analysis of the evaluation of human health and environmental values is fairly hard. However, it is possible to explain the main cost-benefit analysis related to the power plant qualitatively. Cost-benefit analysis within the scope of the Project can be seen in Table V.20. In this context, it can be seen that the Project of Samsun Natural Gas Combined Cycle Plant will have a positive impact.

Table V.20 Environmental Cost-Benefit Analysis

Main Benefits	Main Costs
Annual electric generation of approximately 6.948.800.000 kW/hour	Partial excursion of fauna specie in the site during construction phase
Clean and productive energy generation	Acceptable increase in local NOx ambient air
Secure energy generation	Limited negative impacts on social services and infrastructure
During short term construction phase(14-month mounting activities) and operational phase of 30 years creation of new working fields and employment opportunities	Temporary increase in local truck and bus traffic during construction process
Free and constant energy provision to local industries	Visual impacts
Decline in the need for outside energy sources	Usage of natural resource (natural gas, water, land, etc.)

Impacts on Land Usage

A part of the land site that the power plant is to be constructed is dry agricultural land and hazelnut is bred in most of the region. But the expected economic benefit of the power plant will be far beyond than that of agricultural economic benefit. In addition, considering the magnitude of added-value, economic benefit of the power plant gains great importance.

Impacts on the Biophysical Environment

Possibility of the negative air, water and noise impacts of the power plant on animals and plants as well as humans will be minimized as stated in the related parts of the report (see Section V.2.). As explained in the aforesaid chapters, since there is no forestland in the power plant construction site, there is not an environmental cost to be normally occurred from forestland.

VI. PROBABLE AND ONGOING IMPACTS AFTER THE CLOSURE OF THE FACILITY AND PRECAUTIONARY MEASURES FOR THESE IMPACTS

In the end of the 30-year operational life of the Samsun Natural Gas Combined Cycle Plant Project operational activities will be ended and various land improvement and recreational activities will be carried out in the power plant site. Objective of the improvement activities is to prevent any environmental concern and limitation for future usage of the proposed power plant land. As stated in the related chapters of the report, it is envisaged that the design and operation of the proposed facility will be in compliance with this objective.

Details as examined in the chapter V.2. no dangerous substance will be produced or stored in the power plant site during the operation. For this reason, after the end of the activities there will not be any impact connected to dangerous substances. During this time impacts on water, air and land quality have been examined and precautionary measures have been offered in order to minimize the impacts to occur following the termination of the power plant activities.

VI.1 Rehabilitation and Reclamation Activities

Land activities in the Project site will start just after the termination of activities of the cycle plant equipment (such as gas and vapor tribunes switch equipment etc.) and after demolishing the buildings. Land improvement activities will generally include land grading and land scaping activities. Additionally, drainage channels ditches will be opened in the grounds and surface drainage will be constantly controlled in order to prevent the possible surface accumulation of rain water to the Project site during the land improvement activities. In the end of the land improvement activities, land surface will be stabilized to enable the preparation of the plant activities.

Rehabilitation and reclamation activities in the project site will commence within a proposed landscape programme after the land has been improved and stabilized. In this context, with the completion of the land improvement activities, the land of the power plant site is planned to be prepared for planting.

Within the project site, recreation and planting activities will be carried out in compliance with the region’s climatic and land characteristics. Land improvement will be counted as complete only after flora can be grown and therefore growing season has to be passed.

VI.2 Impacts on Current Water Resources

Following the completion of the activities regarding the Proposed Samsun Natural Gas Combined Cycle Plant Project, discharge of any process water is not possible without necessary increase is performed. In this context, concerning the termination of the activities and land improvement activities, it is expected that there will not be any important impact on quality of surface and underground waters.

VI.3 Probable Air Emissions

In the termination phase of the operation activities or following the termination no air emission will be released to the atmosphere. But, during the termination of the activities, there may be small amount of gas discharge relating to dissembling of some units. In case of such an event necessary air-conditioning and cleaning activities will be performed hypercorrectly. Additionally, re-plantation of the Project site will prevent wind erosion and dust erosions arising out of wind erosions. Under these circumstances, termination of the operation process will not have any negative impact on the quality of the air.

VII. ALTERNATIVES OF THE PROJECT

(In this section, location choice, comparison of the measures to be taken in technology will take place and choice ranking will be stated.)

In this chapter alternative plant sites within Samsun Natural Gas Combined Cycle Plant Project and details related to alternative manufacturing technologies are presented.

VII.1 Site Choice

A lot of criteria have been examined during the activities of site choice of the proposed Samsun Natural Gas Combined Cycle Plant. During the site choice following main criteria has been carefully examined:

- Environmental characteristics of the site (ambient air quality, etc.),
- Connection possibility of the water and power sources,
- Topographical, geological and seismicity characteristics of the site,
- Possible geological risks in the site,
- Accessibility to transportation roads (logistics),
- Land ownership status,
- Land usage status,
- Economical feasibility.

In accordance with these criteria, during the selection of the proposed Project site, following criteria were considered and the most appropriate location was determined as a site within the borders of Samsun Province, Terme Town as stated in Section II.1.2:

- Ambient air provides the best energy productivity and the least flue gas emission figures thus ambient gas is convenient considering these conditions,
- Natural gas to be used as fuel will be supplied from Blue Stream Project,
- Methane rate of the Blue Stream gas is comparably higher than that of Iran gas and other alternatives, thus flue gas emission figures are relatively lower,
- Considering the energy within Samsun and the nearby district and the energy resources offered to the needers, the region needs dependable and uninterrupted production,
- The site is close to a developed 380 kV communication network (transference of the energy produced in the plant is easier to west regions where the need is greater).

VII.2 Selection of Technology

Nowadays, developed and developing countries meet their needs of energy by adopting the principle “using the most appropriate combination of different energy resources in economic and safe ways”. In this context, it is accepted that depending on a one resource is risky on energy generation. For example, considering the dams that not only produce energy but also used in irrigation and can be affected from drought hydroelectric energy is risky in terms of stability and security. Additionally, planning and construction of this type of power plants take many years and need huge investments. For this reason, a lot of countries have agreed that the most secure electric energy countrywide should be composed approximately of %40 hydroelectric and %60 steam power energy (fossil and nuclear).

As an alternative to hydroelectric energy, we could count facilities based on nuclear energy production, facilities based on natural gas, thermal power plants based on fuel-oil and coal and newer technologies based on geothermal, wind and solar energy. In our country electric energy import is

another alternative carried out to meet the national energy need.

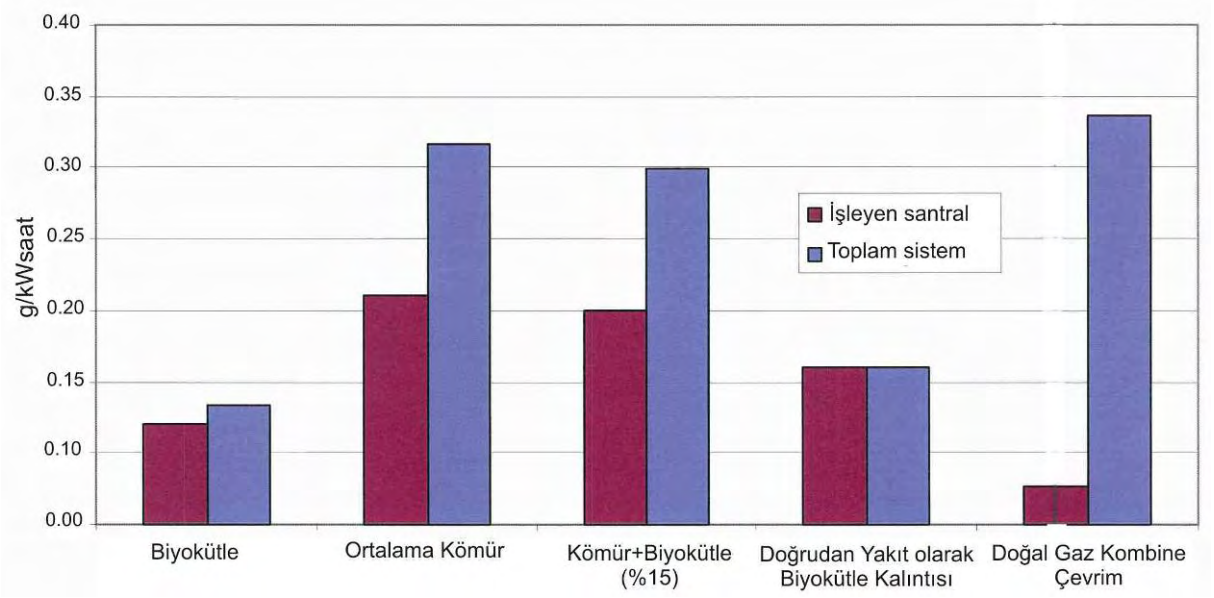
Related to nuclear energy, it is envisaged that this resource can only be used in the long-term if problems concerning investment to the resource, operation, radioactive waste and security are solved. Similarly, alternative energies such as geothermal, wind and solar technologies are now on trial phase, thus the utilization of these resources needs high costs. Consequently, in order to meet the increasing energy need in our country, it is inevitable to continue to establish power plants based on steam power in addition to hydroelectric resources.

Since dangerous emissions are much less than in conventional thermal power plants, natural gas cycle plants have more positive characteristics environmentally. Gas tribune technology which started to develop from 1940s and in late 1970s it found the practice possibility in combined cycle power plants. In 1980s, parallel with the developments in material technology, there was an increase in the productivity of gas tribune energy productions. Main advantages of the energy production facilities based on natural gas are stated as follow.

- While the highest productivity rate of conventional thermal power plants is approximately %40, this figure is above %52 in natural gas combined cycle power plants.
- By virtue of high productivity, CO_2 emission per electric energy unit produEIA in natural gas combined cycle plant is lower than that of conventional thermal power plants.
- Depending on the combination of natural gas used, particle substance emissions are zero and concentrations of SO_x emissions are ignorable enough.
- N_{Ox} emissions can be hold below emission standards by the help of special type burners used in gas tribunes.
- Construction phase of fossil fueled conventional stream plants is at least four years. For combined cycle plants this duration is approximately two years.
- Depending on the simple block structure design, space necessary for the power plant is small.
- Investment cost is comparatively lower than other energy production facilities.
- Operation and maintenance-repair cost is lower and easier than other energy production facilities and operational flexibility is high.
- Necessity for cooling water low.
- Depending on the low necessity of space and environmental impacts, it is possible to establish energy production facilities based on natural gas on regions near load centers (cities, etc.)
- While the necessary time for commission of a thermal power plant is at least 5 years, this duration for the power plant planned to be constructed by BORASCO (construction mounting) is envisaged to be 14 months.

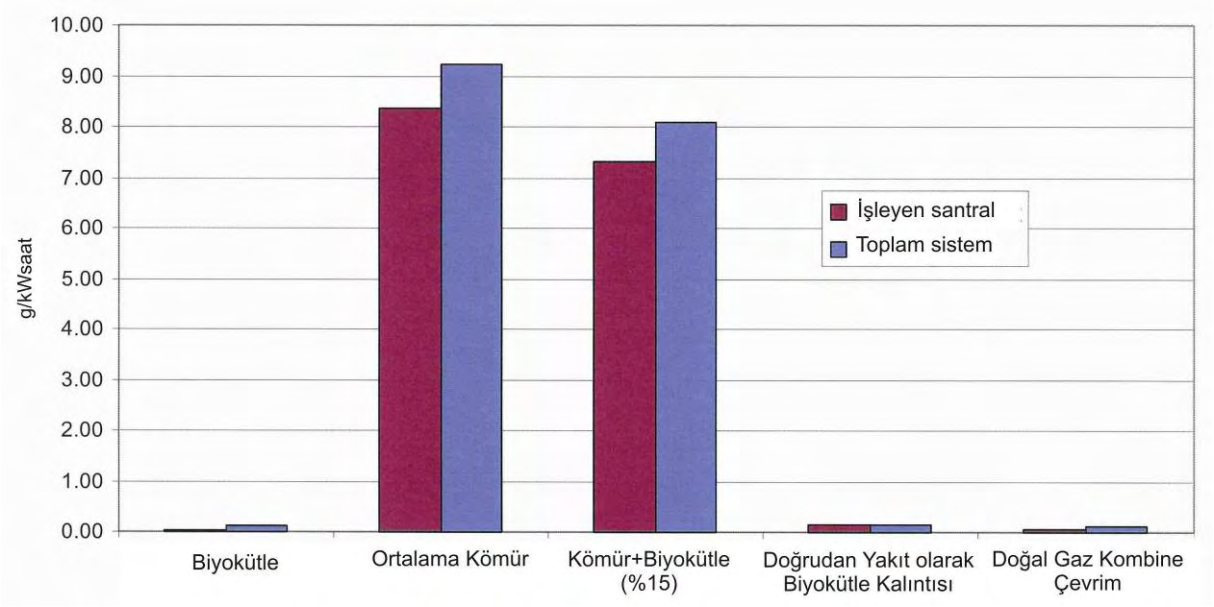
As result of all these evaluations, Samsun Natural Gas Combined Cycle Plant planned to be established on 886, 92 MWm / 868, 6 installed power and it is clear that the plant will take an important place in energy planning of our country.

Comparison of Natural Gas Combined Cycle Plant with other technologies is stated in Figure VII.1- Figure VII.7.



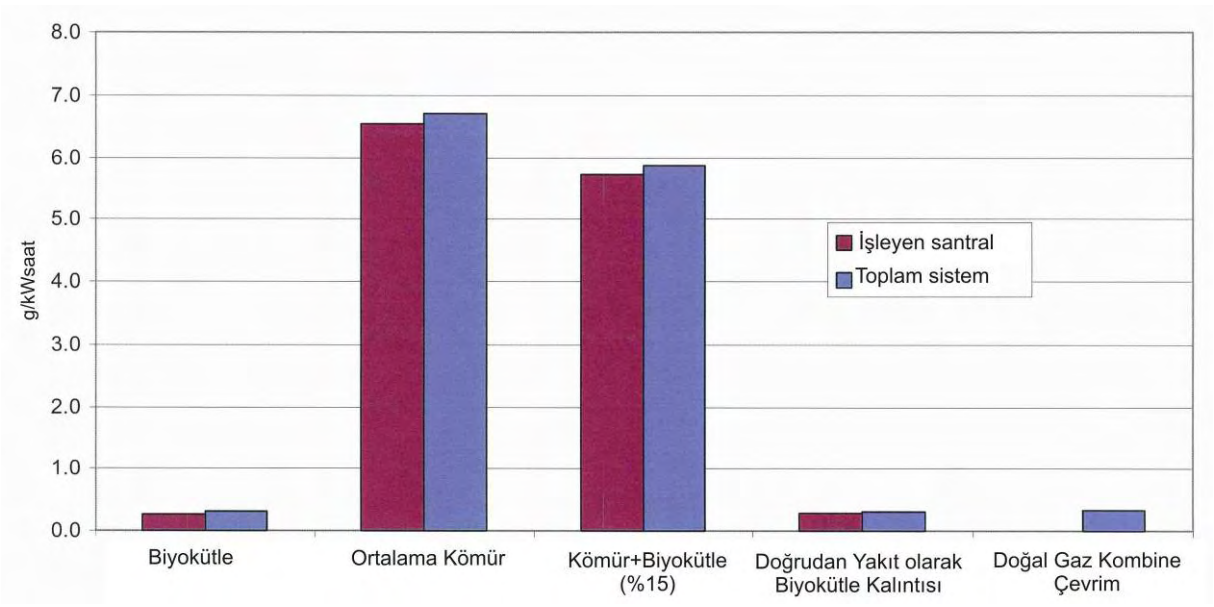
Source: National Renewable Energy Laboratory

Figure VII.1: Lifecycle and CO emissions of the plant



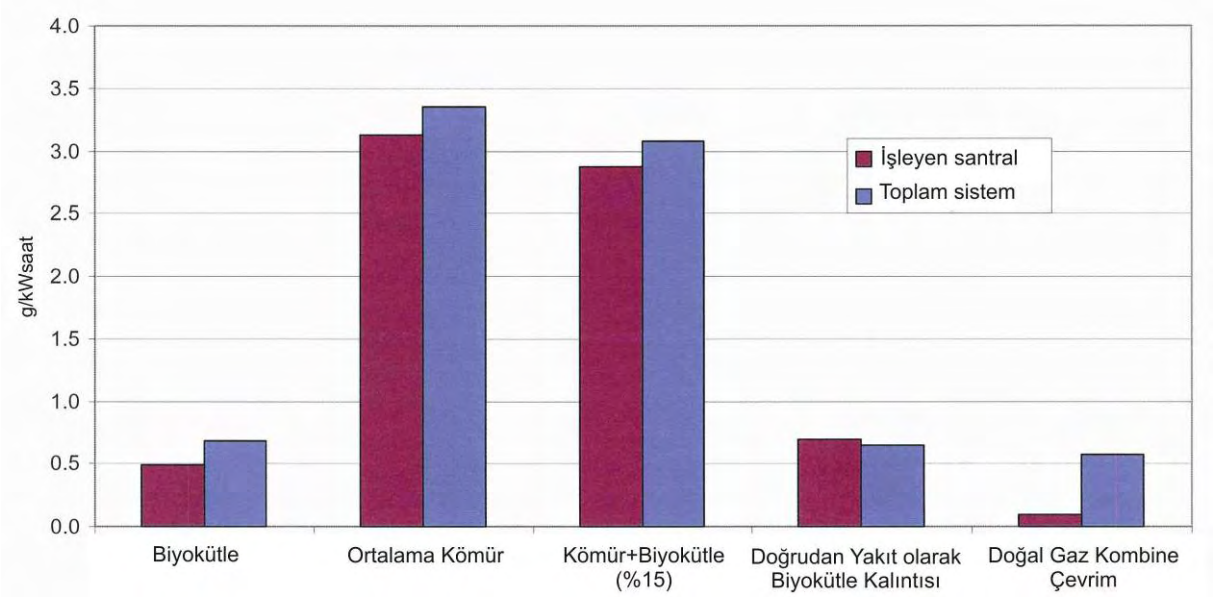
Source: National Renewable Energy Laboratory

Figure VII.2: Lifecycle and Particle Emissions of the Plant



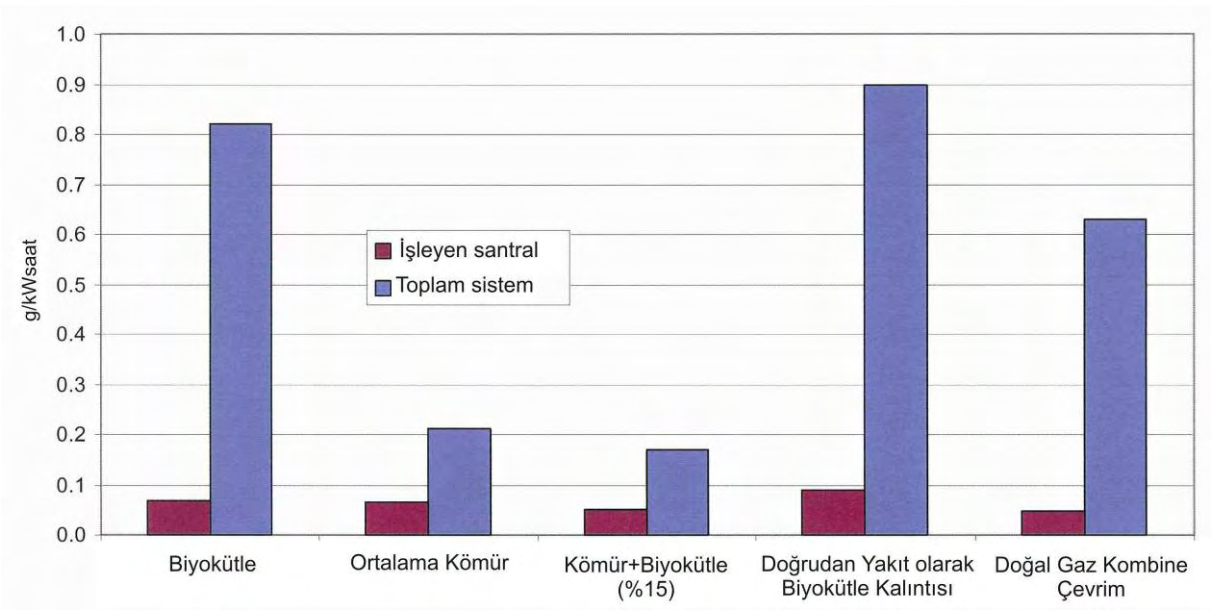
Source: National Renewable Energy Laboratory

Figure VII.3: Lifecycle and SO_2 Emissions of the Plant



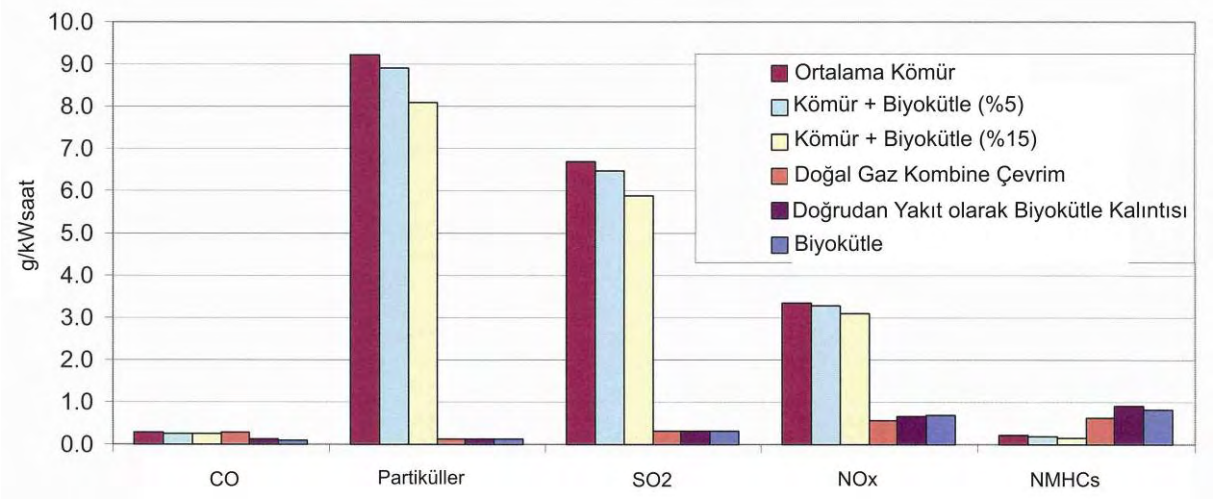
Source: (National Renewable Energy Laboratory)

Figure VII.4: Lifecycle and NO_x emissions of the plant



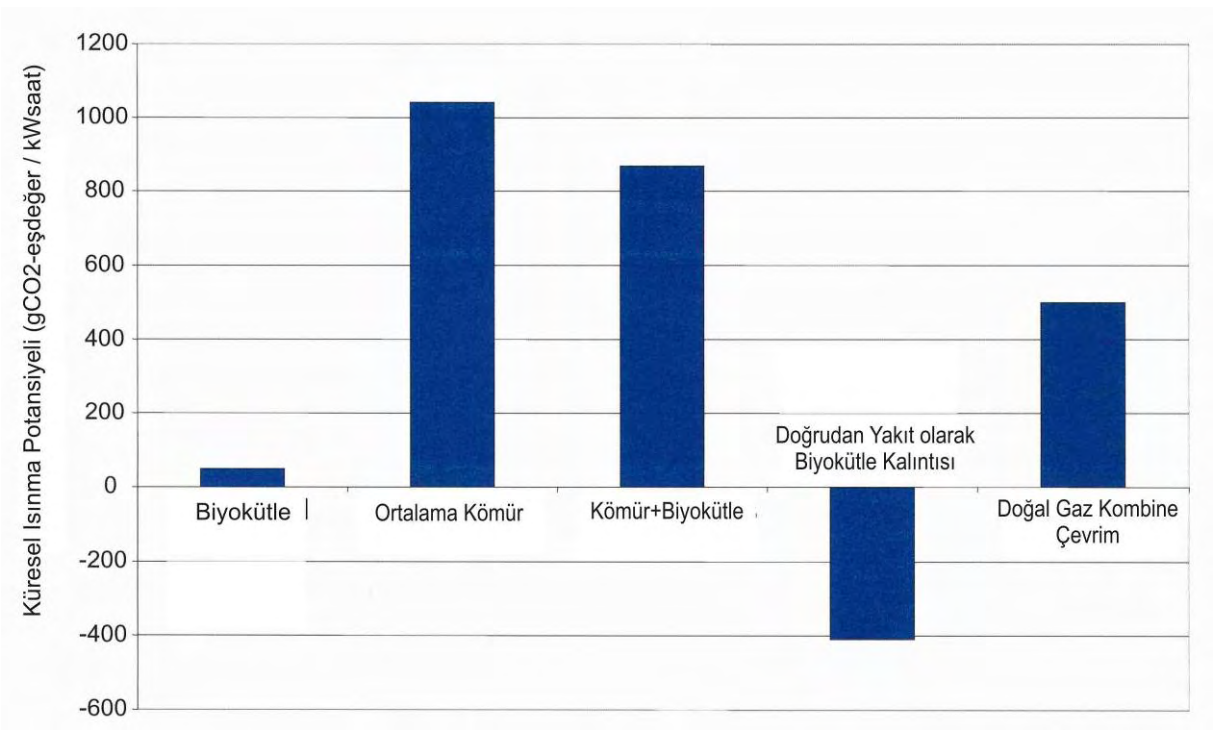
Source: National Renewable Energy Laboratory

Figure VII.5: Lifecycle and no methane hydrocarbon (NMHC) emissions of the plant



Source: National Renewable Energy Laboratory

Figure VII.6: Lifecycle Air Emissions



Source: National Renewable Energy Laboratory

Figure VII.7: Lifecycle Greenhouse Gases Emissions

VIII. MONITORING PROGRAMME AND EMERGENCY ACTION PLAN

VIII.1 Proposed Monitoring Programme for the Construction of Facility, Commission of the Facility and Proposed Monitoring Programme and Emergency Intervention Plan After Commissioning

Within the scope of Samsun Natural Gas Combined Cycle Plant, an environmental monitoring programme has been established in order to monitor environmental impacts possible to occur after the completion of land preparation-operation, commission and facility activities. This monitoring programme is depended on environmental sources and degree of negative interaction resulting from the proposed project.

In addition to these, information related to the project carried out until transitional phase (from constructional phase) will be delivered by T.R Ministry of Environment and Forestry in periodic times approved by the Ministry through Ministry's "Final Environmental Impact Assesment Report Monitoring Reports Forum" taking place in Certificate of Competency Notification Annex-4 coming into force by being published in Official Journal no: 26961 dated 08.08.2008.

Within the scope of the Project, information related to monitoring programme specified in three titles as land construction, commission and after commission is given above.

Monitoring Programme in Constructional Phase

In order to have the possible environmental impacts in minimum level, conveience of the implementation of land activities to related environmental rules and regulations during construction period from the first period of the construction activities of the project, should be supervised by a team of experts appointed by Provincial Department of Environment and Forestry.

Convenience of the environment monitoring after commission and storage of planting soil pulled out from the Power plant site to the project and future utility objections will be controlled and in case of a faulty necessary warnings will be given.

Equipments to be used in constructional phase will be controlled regularly and necessary maintenance will be carried out in order to minimize the noise. In addition to these, regular measures for the noise will be performed periodically (three days constantly every month) in order to detect the noise stemming from the project. Protective equipments will be used in case the noise exceeds the threshold limits specified in Environmental Noise Evaluation and Management Regulation. measurement results will be kept in work-site and by the project owner and will be presented upon demand of authorities.

Possible dust emissions to occur on constructional phase will be regularly measured. In this context, the time period should be chosen when the excavation works are intensive and the meteorological conditions are arid at most. The values obtained in one-week dust emission measurement activities will be compared with the limits specified in Air Quality Evaluation And Management Regulation Annex-IA.

In addition to this, quality of sea water will be monitored during cool water obtainment and construction of discharge structures. In this context every month, opacity of water will be monitored and sea ecology activities will be carried out.

Similarly, in order to ascertain the quality of Akçay Creek, seasonal water samples will be

taken before and during the constructional phase and necessary analysis will be carried out in compliance with WPCR Table-1.

Monitoring Programme on Constructional Phase

Monitoring programmes of flue-gas emissions, current air quality, domastic and industrial wastewater discharge, air quality and noise monitoring programmes will be carried out for Samsun Natural Gas Combined Cycle Plant in order to sustain environment security and not to lose the validity of acquired permissions. In this context, details of the ongoing monitoring programme are set in the paragraph below.

Flue-Gas Emissions and Current Air Quality

Flue-gas emissions and the current air quality monitored on the constructional phase are summarized in Table VIII.1. "Continuous Emission Monitoring-CEM" system will be established to measure the flue-gas emissions of the power plant. In this system, electronic analysis devices which could work separately will take place in order to measure NO_x, CO and O_2 concentrations and gas debit. Data taken from CEM system will be transmitted to central information system. In case the flue-gas emissions of the power plant exceed the limits, necessary precautions will be taken and the emission values will be tried to lower down below the limits. Online connection will be made from system to the Provincial Department of Environment and Forestry in order to monitor the emission values. Additionally, convenience approval of T.R Ministry of Environment and Forestry Department of Measurement and Evaluation will be taken on the installation phase of stable measurement devices.

Table VIII.1: Flue-Gas Emissions during the Commission and Monitoring the Current Air Quality

Subject	Parameter	Definition
Current Air Quality	NO_x	Constant monitoring of the ground level concentration values of air pollutants of the proposed site
Emission Parameters	NOx CO O_2	Constant monitoring in a symbolizing point in the flue

All the monitoring activities will be carried out in line with the standard techniques specified in Industrial Air Pollution Control Regulation. These activities will be carried out with the equipments of which the calibration, operation and maintenance procedures will be conducted in line with the instructions of the firm. Calibrations of the stable measurement devices will be presented to T.R Samsun Provincial Department of Environment and Forestry in compliance with the legislations and in periods specified in the operational manual books of the devices and calibration documents, in monthly reports with internationally monitor certified gases. Analysis that cannot be carried out with an installed device in the work-site and mobile equipments will be conducted in an authorized laboratory.

The location where the ground level concentrations are at the highest level in the project site will be detected coordinationally and by modeling, then an air pullotion measurement station will be established. In case this this detected point is moved out of Samsun Province, second air pullotion measurement station will be established to monitor the air quality in Samsun Province. This second station will be established within the Samsun Province where the ground level concentrations are at the highest level. Necessary infrastructure will be built up for the online connction of both of the stations to T.R Samsun Governorate Provincial Department of Environment and Forestry. Adiitionally, meteorological conditions (heat, preassure, wind, etc.) of the region will be monitored with station established in the work-site.

All the data obtained from emission monitoring activities and flue-gas emissions and the details related to current air quality will be reported to T.R Ministry of Environment and Forestry or Provincial Department of Environment and Forestry if necessary.

Domestic and Industrial Wastewater Discharges

Wastewater resulting from utility water on the construction phase will be purified in a purification plant. Discharge permission will be taken in accordance with the same regulation clauses for the purification process which will be carried out in compliance with the limitation values as specified in the WPCR Table 21.1. In this context, water analysis will be carried out four times in a year in the purification plant and control of the limitation values and parameters stated in WPCR Tablo 21.1 will be conducted.

Similarly, parameters will be followed stated in WPCR Table 23 and Aquaculture Regulations Annex-5 and Annex-6 in cooling water systems including process water. This discharge system is depended on discharge permission and will be subjected to monitoring activities four times in a year. In addition to this, temperature rating and clor concentrations will be measured in the end of the sea discharge line. Additionally, sea ecology activities will be carried out once in three years.

Also, seasonal water samples will be taken during the commissional phase in order to ascertain the water quality of Akçay Brook and analysis will be conducted in line with WPCR Table-1.

All the monitoring activities will be carried out in compliance with the technical standards approved by T.R Ministry of Environment and Forestry and which take place in technical notifications in the related environmental legislation. These activies will be carried out with the equipments of which the calibration, operation and maintenance procedures are conducted in line with the instructions of the firm. Analysis that cannot be carried out with an installed device in the work-site and mobile equipments will be conducted in an authorized laboratory.

All the data obtained from monitoring activities will be reported to T.R Ministry of Environment and Forstry or Provincial Department of Environment and Forestry if necessary. Analysis results will be kept by the project owner and will be presented upon demand of authorities.

Monitoring Land Quality

During the landscape and land arrangement activities which will gain momentum with the commission of the plant, the botanic soil that was digged and properly stored beforehand, will be used appropriately and necessary controls will be done during its application.

Noise Control

During the first periods of the commission phase and testing of the equipments elevated noise can occur time to time in short-terms. These activities will be carried out in dat times. For two years after the commission of the plant noise measurements will be conducted twice a year within the plant district and in Akçay and Hocaoğlu neighbourhood, then these measurements will be conducted once a year. Measurement results will be kept in the work-site and by the project owner and will be presented upon demand of authorities.

Monitoring Programme after Commission

After the termination of plant activities, water supply from sea and discharge to the sea will terminate. But the parameters in the monitoring programme of the proposed for the work-site on operational phase will be observed every season for a year. In case of any negative factor, necessary precautions will be taken immediately.

Emegency Intervention Plans

The most important objective of the emergency intervention plans (EIP) is to define the

necessary steps to take in case of an emergency. Natural disasters, accidents, faults stemming from the project or natural gas leak caused by faulty operation within the scope of this project is stated as “emergency”. Precautions taken to warn the population under threat before anything dangerous takes place is the most important part of EIP. In addition to this, conditions below will be taken into consideration by BORASCO during the preparation of EIP.

- In order to intervene in extraordinary conditions such as earthquake, explosion, sabotage, fire, accident and natural disaster, an emergency intervention team will be organized. A task definition will be made for the emergency intervention team. Key personel will be trained about this subject.
- Employees will be informed and trained for probable accidents during the operational phase of the project.
- In order to intervene immediately in case of an emergency, necessary equipment for the intervention will be kept in a seperate place. This equipment will include digging tools, face masks, protective glasses, gloves, and various pumps, electrical motors that do not lead to any explosion, radio-sets and similar equipments.
- Interventions of dippers, fronted loaders and other heavy duty vehicles such as dozers will be planned beforehand in an emergency and parking lots of these vehicles will be specified in consideration with these conditions.
- EIP’s should include lists of intervention teams, places of security equipments, emergency exits and proEIAures.
- EIP’s will be constantly controlled and periodical maintenance of all the related equipments will be conducted regularly.
- Necessary first-aid kits will be available in the temporary building for the personel in case employees get affected from probable accident. In the instant of an accident sufferer will be taken to the nearest health institution to the project site.
- Day and night watchmen will be employed for probable sabotage on constructional phase. Necessary trainings will be given in case of a probable earthquake in order to protect the life safety of employees. All the structures in the work-site will be constructed in compliance with Earthquake Regulations.
- Necessary warnings and information boards will be available in all the units of the facility. Additionally, emergency exit doors and fire fighting devices will be available in the buildings.

Additionally, before the operational phase of the project, necessary documants will be prepared and necessary permissions will be obtained from the related authorities in accordance with “Principles of Compensation of Damages and Intervention in Emergency for Pollution of Sea Environment with Petroleum and Other Hazardous Substances Law Implementation Regulation” which entered into force upon publication in Official Gazatte dated 21.10.2006 (no: 26326).

VIII.2 In case of the Approval Document of EIA, Programme Related to the Realization of Matters Placed in the Second Paragraph of “Liabilities of Institutions/Organizations with Competency Document” in Competency Notification

After obtaining the “EIA Approval” document within project, realization of the commitments in a specific period from investment to commission in Final EIA reports will be delivered to T.R Ministry of Environment and Forestry by filling the forms in 3-month periods of Final EIA Monitoring Reports taking place in T.R Ministry of Environment and Forestry Competency Notification Annex-4.

IX. NON-TECHNICAL SUMMARY OF THE INFORMATION GIVEN IN THE TITLES ABOVE

(Expression of all the activities planned to be conducted in the constructional and operational phases of the project and all the precautions to be taken for environmental impacts in a simple way with no technical terms)

An energy power plant of which the total capacity is 886,92 MWm / 868,6 MWe is planned to be established by BORASCO Electricity Generation Industry and Trade Inc. within Samsun province, Terme Town. It is envisaged that the plant where natural gas will be used as fuel, will generate 6.948.800.000 kW/hour electrical energy annually.

The aim of the project is to establish an electric generating facility with low cost and high profitability and to serve to energy demand by transmitting the electrical energy generated by the plant to the interconnected system. Natural gas to be used in the project will be supplied from Pipe Lines and Blue Stream Natural Gas Pipe Line run by Petroleum Transportation Corporation (BOTAŞ). Related to the subject, the best location for gas supply will be ascertained by applying to Petroleum Pipeline Cooperation.

The Facility is planned to start commissioning on December 2010 and it is envisaged that life of the project will be 30 years.

Temporary and stable employment opportunities will be created during the power plant construction phase covering 14-month construction installation and operation phase to last for 30 years. Increase in the employment opportunities is regarded as a positive impact on regional economy. Constructional and operational activities of the power plant will contribute to the development of regional economy by creating an extra demand for sales and services. Also, new working areas will be created parallel to domestic and general expenditure of the families of staff to work in the power plant, thus economy will be indirectly developed.

Assesments related to environmental and social impacts of the project are explained in detail in the former chapters.

X. RESULTS

(A summary of the explanations above, a general assessment of the environmental impacts of the project and probable success of the prevention of negative environmental impacts in case of the realization of project, choice of alternatives concerning the project and factors leading to this selection)

An energy power plant is planned to be established of which the total capacity is approximately 886,92 MWm / 868,6 MWe within the borders of Samsun province, Terme town by BORASCO Electricity Generation Industry and Trade Corporation. The plant where natural gas will be used as fuel is envisaged to produce 6.948.800.000 kW/hour energy annully.

The aim of the project is to establish an electric generating facility with low cost and high profitability and to serve to energy demand by transmitting the electrical energy generated by the plant to the interconnected system. Natural gas to be used in the project will be supplied from Pipe Lines and Blue Stream Natural Gas Pipe Line run by Petroleum Transportation Corporation (Petroleum Pipeline Cooperation). Related to the subject, the best location for gas supply will be ascertained by applying to Petroleum Pipeline Cooperation.

Following the 14-month construction phase including mounting activities, the facility is planned to start commissioning on December 2010 and 380 kV energy produced in the facility will be transferred to the national network by transmission lines. Life of the project is envisaged to be 30 years.

The aim of the proposed Samsun Natural Gas Bombined Cycle Plant is meet some of the electrical energy demand of the region using the natural gas supplied from Blue Stream Natural Gas Pipe Line. Main aims of the project are stated as follows:

- Meet some of the growing energy need,
- Provide the stability of electrical energy policy of our country,
- Bring new and latest energy technology to our country,
- Increase the variaty of energy resources,
- Provide resources for the increasing number of industry facilities in order to transmit stable and reliable energy,
- Provide employment fields for the people around the facility region and contribute to the local economy.

A lot of criteria have been examined during the activities of site choice of the proposed Samsun Natural Gas Combined Cycle Plant. During the site choice following main criteria has been carefully examined:

- Environmental characteristics of the site (ambient air quality, etc.),
- Connection possibility of the water and power sources,
- Topographical, geological and seismicity characteristics of the site,
- Possible geological risks in the site,
- Accessibility to transportation roads (logistics),
- Land ownership status,
- Land usage status,
- Economical feasibility.

In accordance with these criteria, during the selection of the proposed Project site, following criteria were considered and the most appropriate location was determined as a site within the borders

of Samsun Province, Terme Town as stated in Section II.1.2:

- Ambient air provides the best energy productivity and the least flue gas emission figures thus ambient gas is convenient considering these conditions,
- Natural gas to be used as fuel will be supplied from Blue Stream Project, closeness to the source,
- Methane rate of the Blue Stream gas is comparably higher than that of Iran gas and other alternatives, thus flue gas emission figures are relatively lower,
- Considering the energy within Samsun and the nearby district and the energy resources offered to the needers, the region needs dependable and uninterrupted production,
- The site is close to a developed 380 kV communication network (transference of the energy produced in the plant is easier to west regions where the need is greater).

Project site is located within the borders of Samsun province, Terme town. Additionally, site is placed in Samsun F38.d2 sheet, 1/25.000 scaled, size of the site is approximately 50 ha. Project site is located 76 km east of the Samsun province and 18 km east of Terme town center. Nearest settlements of the site are Akçay and Hocaoğlu neighbourhoods located west of the site.

In the construction phase of the project, 900 people will be employed and water need of the staff will be supplied from the water wells digged in the project site. Generated waste water will first be purified in the packet water purification facilities and then will be discharged to the nearest receiver in compliance with WPCR conditions. Solid waste generated by the staff will be collected by Terme Manucipality. Facility site, where the energy block will be located during the construction activities, will be rised 1 metre. Only the cooling water supplement place will be digged 6 m deep in the site and during the operational phase of the plant water supply will be provided from Black Sea. Soil generated after excavation activities will be stored for future use in the site and extra soil will be disposed in the place defined by Terme Manucipality in compliance with the provisions of “Excavation, Construction and Wreckage Soil Control Regulation”.

Utility water need of the plant will be met from underground water wells digged in the site during the operational phase. Cooling water will be supplied from Black Sea. After the collection and increase of waste water generated in the plant and other sites will be discharged to sea in compliance with the parameters of WPCR Table-23. There will not be any negative impact on the sea since, necessary dilution will be realized and the provisions of WPCR Aquacultue Regulations will be followed during discharge. Similarly, air quality modeling activities have been carried out in order to assess the concentration figures of the ground level flue-gas emissions to be discharged to the atmosphere during the operational phase of the plant. In accordance with the results of the modeling activities, since ground level concentration figures are lower than the limit figures specified in Air Quality Evaluation And Management Regulation Annex-IA, flue-gas will not have any negative impact on vegetation and human health in the region.

An important amount of necessary materials and services in the site preparation, constructional and operational phases of the project is planned to be met from the region. Part of the total project cost, labor force, accommodation, rent of equipment, charges for the services to be provided from fuel and local activities, will contribute to the regional economy. During the most intensive time of the plant on the construction phase 900 people are expected to be employed. Daily needs and expenditures of this staff will indirectly contribute to the local economy. With the commission of the proposed plant, 80 people is envisaged to be employed. An important number of this staff will be the engineers, technicians and employees from the region.

Temporary and permanent employment opportunities will be created during the power plant construction phase covering 14 months and constructional, installational and operational phase to last for 30 years. Increase in the employment in the region is regarded as a positive impact on the regional economy. Constructional and operational activities of the power plant will contribute to the development of regional economy by creating an extra demand for sales and services. Also, new working areas will be created parallel to domestic and general expenditure of the families of staff to work in the power plant, thus economy will be indirectly developed.

A part of the regulations and laws to be complied during the Constructional and operational phase of the Samsun Natural Gas Combined Cycle Plant is listed below:

Environmental Law dated 2872
(Entered into force by publication of Official Gazette dated 11.08.1983 no: 18132.)

Labor Law dated 4857
(Entered into force by publication of Official Gazette dated 10.06.2003 no: 4857.)
İlgili İş Sağlığı ve Güvenliği Mevzuatı

Law on Soil Protection and Land Improvement dated 5403
(Entered into force by publication of Official Gazette dated 19.07.2005 no: 25880.)

Disaster Areas Structures Regulation
(Entered into force by publication of Official Gazette dated 02.09.1997 no: 23098.)

Packing Waste Control Regulation
(Entered into force by publication of Official Gazette dated 24.06.2007 no: 26562.)

Waste Battary and Accumulator Control Regulation
(Entered into force by publication of Official Gazette dated 31.08.2004 no: 25569.)

Waste Oil Control Regulation
(Entered into force by publication of Official Gazette dated 30.07.2008 no: 26952.)

Environmental Impact Assessment Regulation
(Entered into force by publication of Official Gazette dated 17.07.2008 no: 26939.)

Environmental Noise Assessment and Management Regulation (2002/49/EC)
(Entered into force by publication of Official Gazette dated 07.03.2008 no: 26809.)

Implementing Regulation on the Law of Damage Compensation Principles and Emergency Intervention to the Pollution of Marine Environment by Petroleum and Other Hazadous Substances
(Entered into force by publication of Official Gazette dated 21.10.2006 no: 26326.)

Earthquake Regulation
(Entered into force by publication of Official Gazette dated 02.07.1998 no: 23390.)
Industrial Air Pollution Control Regulation,
(Entered into force by publication of Official Gazette dated 22.07.2006 no: 26236.)

Excavation, Construction and Wreckage Soil Control Regulation
(Entered into force by publication of Official Gazette dated 18.03.2004 no: 25406.)

Air Quality Assessment and Management Regulation
(Entered into force by publication of Official Gazette dated 06.06.2008 no: 26898.)

Business Commencement and Work Permit Regulation
(Entered into force by publication of Official Gazette dated 10.08.2005 no: 25902.)

Solid Waste Control Regulation
(Entered into force by publication of Official Gazette dated 14.03.1991 no: 20814.)

Using Flammable, Explosive, Dangerous and Hazardous Substances on Precautionary Measures Businesses Regulation
(Entered into force by publication of Official Gazette dated 24.12.1973 no: 14752.)

Protection of Employees from Dangers of Explosive Environments Regulation
(Entered into force by publication of Official Gazette dated 26.12.2003 no: 25328.)

Water Pollution Control Regulation
(Entered into force by publication of Official Gazette dated 31.12.2004 no: 25687.)

Aquaculture Law
(Entered into force by publication of Official Gazette dated 04.04.1971 no: 13799.)

Aquaculture Regulation
(Entered into force by publication of Official Gazette dated 10.03.1995 no: 22223.)

Hazardous Waste Control Regulation
(Entered into force by publication of Official Gazette dated 14.03.2005 no: 25755.)

Water Pollution of Hazardous Substances Control Regulation
(Entered into force by publication of Official Gazette dated 26.11.2005 no: 26005.)

Medical Waste Control Regulation
(Entered into force by publication of Official Gazette dated 22.07.2005 no: 25883.)

Soil Pollution Control Regulation
(Entered into force by publication of Official Gazette dated 31.05.2005 no: 25831.)

Soil Protection and Land Improvement Law Implementing Regulation
(Entered into force by publication of Official Gazette dated 15.12.2005 no: 26024.)

Exhaust Gas Emissions Released by Vehicles in Traffic Control Regulation
(Entered into force by publication of Official Gazette dated 08.07.2005 no: 25869.)

XI. PARTICIPATION OF PEOPLE

(Means of informing the people in the region who are probable to be effected by the Project and views of people about the Project and explanations related to subject)

XI.1 Generel Overview of Local People Probable to be Effected from the Project

Construction of the Project is envisaged by BORASCO Electricity Generation Industry and Trade Corporation. In this context, local people probable to be effected from the project are the citizens of Terme town of Samsun.

XI.2 Means Used for the Participation of People to EIA Process

In order to inform people of the Samsun Natural Gas Combined Cycle Plant activities constructed by BORASCO Electricity Generation Industry and Trade Inc. and to recieve their proposals and opinions;

A- In accordance with the 9. Article of the EIA Regulation Entered into force by publication of Official Gazette dated 7.07.2008 no: 26939, sayılı a place has been allocated where people can be informed about the investment and the opinions and proposals of the people can be received. Before the meeting, information boards have been prepared having the information of meeting place, time and subject and it was announced in a national newspaper at least 10 days before the meeting.

B- Before the Meeting of People's Participation, it was announced with loud speakers with the help of Manucipality, notification boards were placed where people could see.

C- Opinions and proposals of the members of Content Specification and Commission of Inspection and Evaluation for the Meeting of People's Participation were evaluated by the facility owner.

XI.3 Evaluations on Concerns, Proposalsand Opinions of People Related to the Project

Regarding the project, Meeteing for Enlightment of People was held in Special District Administration Building Public Training Center Meeting Hall in Terme town on 16.12.2008 to inform local people. Local people and representatives from public institutions and organizations delivered their opinions about the project in the meeting. (see. Figure XI.1- Figure XI.3).

Additionally leaflets were given to people before the meeting in order to give them related information beforehand. (see. Appendix-13).

Detailed information about site selection and technology was given to local people having concerns about project site and technology to be applied. Related to the subject, EIA report format was prepared in harmony with opinions and proposals of people. Additionally, during the Meeting of People's Participation, detailed information took place in the related parts of this report about concerns and evaluations of local people.

Figure XI.1: Meeting for Enlightment of People-1

Figure XI.2: Meeting for Enlightment of People -2

Figure XI.3: Meeting for Enlightment of People -3

XI.4 Evaluations of the Subject and Opinions of the Related Parties on Project

Informations related to the subject are stated in Chapter X.3 and there is no additional information to be stated in this chapter.

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NOTES AND SOURCES

PERSONNEL LIST SUBSCRIBED IN COMPLIANCE CERTIFICATE DECLARATION

Project Owners' Name : BORASCO Electricity Genaration Industry and Trade Inc.
Project Location : Samsun Province Terme District
Project Name : Samsun Natural Gas Combined Cycle Plant Project
Report Date : March 2009
Name of Institution Prepararing Report : ENVY Energy Generation Industry and Trade Inc.
Yeterlilik Belge No : 09

Personnel List Subscribed In Compliance Certificate Declaration	Name-Surname	Occupation	Responsibility	Signature
Environmental Engineer (5-a)	Hakan BEKAR	Environmental Engineer	Environmental Impacts and Precautions	
Engineering and Architecture Faculty Graduate Personnel (5-b)	Tahir ÇEBİ	Master of Science Geological Engineer	Geological,geotechnical and hydrogeological study	
	Zeynep KÖKSAL	Geological Engineer	Geological and geotechnical study	
	Kadir ÖZKAN	Electrical Engineer	Section V.2	
Report Coordinator (5-c)	Saadet KASAPGİL	Biologist	Report Coordinator	
	Ayşegül KORUR	Master of Science Environmental Engineer	Report Coordinator	
(5/1-ç) Personnel	Bülent KADIOĞLU	Environmental Engineer	Environmental Impacts and Precautions	

Personnel List Preparing EIA Report

Name of Staff:	Hakan Bekar
Profession:	Environmental Engineer
Date of Birth:	April 16, 1968
Place of Birth:	Ankara
Nationality:	Republic of Turkey
Membership in Professional Societies:	Chamber of Environmental Engineers of Turkey

Key Qualifications:

Mr. Bekar is presently working as the operating manager in Antalya Wastewater Treatment Facilities (Hurma Wastewater Treatment and Lara Wastewater Treatment), which are operated by ENVY Inc.

Mr. Bekar has experience in the design and management of wastewater systems, preparation of potable water, rainwater and sewerage projects. He was also responsible for the operation of İnegöl wastewater treatment facility.

He worked in the preparation of feasibility reports, lighting report and tender documents for the sludge drying system for the treatment facility.

In addition, Mr. Bekar has also worked as a Process Specialist in Bursa Wastewater Treatment Facilities Advanced Sludge Drying Consulting Services, in field studies and data collection, carrying out the analysis of sludge obtained from the existing facilities, determining the factors to have a role in design, carrying out studies on the composition of dry sludge that will be obtained as a result of the methods to be applied, writing the relevant sections of the report, preliminary environmental impact assessment, planning of local transportation/circulation/movement of sludge considering environmental impacts and public consent/order, determining the technical acceptance criteria of sludge that will come to the sludge treatment facility from other sources.

Education:

1985 – 1990	B.Sc. in Environmental Engineering Department, Middle East Technical University, Ankara

Employment Record:

Aug 2001 – ENVY Energy and Environmental Investments Inc., Ankara

- *Antalya Wastewater Treatment Facility (Hurma and Lara Wastewater Treatment Facilities), Operations Manager*
- *Trans Anatolian Pipeline Project (Samsun-Ceyhan Crude Oil Pipeline Project) FEED Study*
- *Bursa Wastewater Treatment Facilities, Advanced Sludge Drying Consulting Services, Process Specialist*
- *İnegöl Wastewater Treatment Facility, feasibility study for the sludge drying system for the treatment facility, lighting report and preparation of tender documents, Environmental Engineer*
- *İnegöl Wastewater Treatment Facility feasibility study and management, evaluation of the test results of inflowing and outflowing water, monitoring, evaluating and planning oxygen and chemical concentration, Process Specialist.*
- *Tuz Golu Underground Natural Gas Storage Project. Design of water supply and process water discharge lines and brine disposal lines prepared in the content of Project.*
- *Baku-Tbilisi-Ceyhan Crude Oil Pipeline Project Basic Engineering Studies, sampling of surface and underground water and soil, measuring of dust and noise at the project area.*
- *Corlu Water Supply and Sewerage Project. Water supply and sewerage network design and wastewater treatment plant design.*

June 1999 – Aug 2000 UBM United Consultants Inc., Ankara

- *Master Plan Feasibility Report and Preliminary Project Studies for Wastewater and Storm Water Systems of Ankara Metropolitan Area.*

May 1995 – June 1999 Step-De Construction Ltd. Co, Ankara

- *Miscellaneous infrastructure projects*
- *Preparing of detail drawings for nodes of water supply systems*
- *Cardak (Denizli) Industrial Area improvement, road, design of water supply, sewer and storm water systems*
- *Bursa (Barakfakili, Gursu, Kestel) Sewer Collector Design*

July 1994 – Dec 1995 Land Forces Headquarter, Army Computer Officer, Ankara

Feb 1992 – July 1994 BAKSU (Babtie Shaw, Kentkur, Su Yapi) Joint Venture, Ankara

- *Great Ankara Sewerage and Storm Water Project. Design of Maltepe Catchment Area Waste Water Network and Cebeci Catchment Area Storm Water Network.*

Nov 1990 – Feb 1992 ARSAN Treatment and Const. Ltd. Co, Ankara

- *Yalova (Central), Kusadasi (Aydin) Potable Water Supply Project*

Certificates:

- First Aid, Ankara, October 2001, Ankara

Computer Skills:

- Operating Systems: Windows 9x
- Other Software: Microsoft Office, AutoCAD (Release 14, Release 2000), Harvard Graphics, Miscellaneous Infrastructure Design Programs

Languages:

	Speaking	**Reading**	**Writing**
English	Very Good	Very Good	Very Good
Turkish	Native	Native	Native

Name of Staff:	Tahir Cebi
Profession:	Geological Engineer (MSc)
Date of Birth:	January 11, 1952
Place of Birth:	Trabzon
Nationality:	Republic of Turkey
Membership in Professional Societies:	Chamber of Geological Engineers; Member of the Committee of International Engineering Geology; Association of Turkish Drillers

Key Qualifications:

Mr. Cebi worked as Chief Engineer, Technical Committee Vice President, Division Chief and Assistant Department Head in the Potable Water Department in Bank of Provinces between 1974-2000. During this period he worked on several potable water projects for municipalities as an engineer, controller and project manager. He was responsible of the preliminary studies, investigations and the identification of potable water resources in projects. Moreover, he worked on groundwater investigations, boring and designing drilling wells (Hydrogeology), potable water infrastructure facilities and the analysis of the ground stability problems of water treatment plants and the organization of EIA studies and tender phases of ongoing projects.

Between 1997-2000 he worked as the director of the Department Mechanics and Drilling in the Bank of Provinces. During this period, he was in charge of the selection and purchasing of the necessary equipment and machinery of potable water drilling wells, ground investigation wells. As an addition to this, he coordinated the studies on contracts, regulations, and preparations of the technical equipments and provided financial assurance required by the Bank to execute the geothermal energy projects of municipalities.

He was retired as of April 23, 2000 and worked at SIAL Ltd. Co. for 5 months in various potable, irrigation and engineering projects and joined ENVY Inc. group on September 2000. He is currently the Environmental and Geology Coordinator of ENVY.

Education:

1969 – 1974	B.Sc., M.Sc. in Geological Engineering Department, Karadeniz Technical University
1966 – 1969	Surmene High School, Trabzon

Employment Record:

2000 -- ENVY Energy and Environmental Investments Inc. Soil Investigations, Geological, Geophysical and Hydrogeological Studies Coordinator

- *Cankırı-Orta Thermal Power Plant Environmental Impact Assesment Study, 2006*
- *Duzce Solid Waste Disposal Project Environmental Impact Assesment Study,2006*
- *Manisa Solid Waste Disposal Project Environmental Impact Assesment Study,2006*
- *Samsun-Ceyhan Crude Oil Pipeline Project Feasibility Study, 2005, Geological and routing expert*
- *Turkey - Greece Natural Gas Pipeline Project, 2003, Geological & Geotechnical coordinator*
- *Tuz Golu Underground Natural Gas Storage Project*
- *Baku-Tbilisi-Ceyhan Crude Oil Pipeline Project, 2002, Basic & Detailed Engineering Phase*
- *Zorlu Energy Yalova Ipek Paper Autoproducer Plant; EIA Preliminary Study,*
- *Tuzla Transformer Station EIA Preliminary Study,*
- *Manisa Transformer Station EIA Preliminary Study,*
- *(Keban-Elazig) Branching Line - Hankendi Transformer Station Electricity Transmission Line EIA Preliminary Study,*
- *Alpaslan Hydroelectricity Plant - Adilcevaz Electricity Transmission Line EIA Study,*
- *Alpaslan Hydroelectricity Plant - Hinis Transformer Station Electricity Transmission Line EIA Study,*
- *Tepeoren - Sile Electricity Transmission Line EIA Study,*
- *AKSA Energy Hadimkoy 120 MW Autoproducer Plant EIA Study,*
- *Kayseri Zorlu Energy 164 MW Autoproducer Plant EIA Study,*
- *Hatay Airport Project EIA Study,*
- *Adiyaman – Golbasi Thermal Plant Pre-field Studies.*

1997 – 2000 General Directorate of Bank of Provinces, Head of the Mechanics and Well Drilling Department

- *Well drilling studies for exploration of potable water*
- *Geotechnical drilling studies for determination of resettlement areas*

- *Tendering and Specification preparation studies for procurement of equipment and machinery*
- *Research, project and pre-feasibility studies related to geothermal energy investments*

1994 – 1997 General Directorate of Bank of Provinces, Deputy Head of the Potable Water Department

- *Project Manager in hydrogeological research studies*
- *Geotechnical Project Coordinator in infrastructure investments of potable water projects; especially dealt with solution of soil related problems of these projects.*
- *Coordinator of tendering works of the Environmental Impact Assessments, Research and Feasibility Studies*

1987 – 1994 General Directorate of Bank of Provinces, Section Head of the Potable Water Department

- *Coordinator of the hydrological and hydrogeological research studies of potable water projects for municipalities*
- *Geotechnical Project Coordinator, specifically dealt with the solution of soil related problems, encountered in the application of potable water and sewerage infrastructure projects*

1981 -- 1987 General Directorate of Bank of Provinces, Deputy Section Head of the Potable Water Department

- *Project Manager of hydrogeological research studies and related applications*

1976 – 1981 General Directorate of Bank of Provinces, Potable Water Department, Chief Engineer

- *Hydrological and hydrogeological research studies of potable water projects for municipalities*

1975 -- 1976 General Directorate of Bank of Provinces, Potable Water Department, Engineer

- *Hydrological and hydrogeological research studies of potable water projects for municipalities*

1974 -- 1975 General Directorate of Bank of Provinces, Mechanics and Well Drilling Department, Chief Site Engineer

- *Hydrological and hydrogeological research studies of potable water projects for municipalities*

Certificates:

- Geotextile and Geomembrane Seminar, METU, Ankara, 1995
- TBA English Language Courses, Ankara, 1988-1991
- Groundwater Courses, METU, Ankara, 1977

Computer Skills:

- Operating Systems: Windows
- Other Software: Microsoft Office

Languages:

	Speaking	Reading	Writing
English	Good	Good	Good
Turkish (Native Language)	Excellent	Excellent	Excellent

Publications:

- Plain Lands of Turkey of which State Hydraulic Works Commenced Agricultural Operations by 1982 Bank of Provinces Publications
- A Methodological Approach for Development of Water Resources for Integrated Environmental Evaluation, translation, 1993 Bank of Provinces Publications
- Problems and solutions related to underground water applications, 1993 Publication of Chamber of Geological Engineers
- Research papers and articles related to hydrology, hydrogeology and well drilling studies, published in many magazines and technical publications

Conferences:

- Symposium of International Large Water Projects; Paris; 1986
- Symposium on International Environment and Geology; Istanbul, 1997
- Symposium on International Geology Engineering, Istanbul, 1983
- Geotechnical Symposium of International Geology Engineering National Committee, Istanbul, 1985

Honors and Awards:

- Outstanding Achievement Award, Chamber of Geological Engineers, 1992

Name of Staff:	Saadet Kasapgil
Profession:	Science Expert Biologist
Date of Birth:	May 2, 1962
Place of Birth:	Nevşehir
Nationality:	Republic of Turkey

Key Qualifications:

Saadet Kasapgil worked as an EIA Branch Manager at Infrastructure and Industrial Investments EIA Department of Ministry of Environment and Forestry between years 1996-2006.

21 years in government service, she worked as a Commission Manager at different Investigation and Evaluation Commissions of projects given below.

Fuel Storage and Filling Facilities, Fuel and gas pipeline, recycling facilities, domestic and industrial solid waste deposition facilities, integrated chemical facilities, different industrial investments (textile, medicine, biodiesel, food, fertilizer), hazardous waste recycling facilities, transportation and shore investments (harbor, airport, road projects), petroleum and minning and High Cost Environmental Investments.

Education:

1996	M.Sc., Gazi University, Health Sciences Institute
1984	B.Sc., Hacettepe University, Science Faculty, Biology Department
1979	Ankara Bahçelievler Deneme High School

Employment Record:

2006 – Energy and Environmental Investments Inc.

- *Bolunmez Petroleum Inc. Tekirdag Fuel Storage Tank Farm Environmental Impact Assessment Report (2006)*
- *Likit Chemistry Inc. Tekirdag Chemical Storage Facility Environmental Impact Assessment Report (2006)*
- *Cankiri-Orta Thermal Power Plant Environmental Impact Assessment Report (2006)*

1996 – 2006 Ministry of Environment and Forestry General Directorate of EIA and Planning

Industrial Investments EIA Department

- *Branch Manager of Waste and Chemical Facilities*

- *Branch Manager of Industrial Investments*

Infrastructure Investments and EIA Department

- *Transportation and Shore Investments Branch Manager*

Examination and evaluation of EIA reports and Chairmanship of the Commission

- *Revision of the EIA report dated 07.02.1993, numbered 21489*
- *Revision of the EIA report dated 23.06.1997, numbered 23028*
- *Revision of the EIA report dated 06.06.2002, numbered 24777*

Environmental Investments with High Cost (5 Projects)

- *Domestic and Industrial Wastewater Treatment Plant of Dilovası*
- *Wastewater Treatment Plant of Nevsehir*
- *Wastewater Treatment Plant of Tokat*
- *Solid Waste Disposal Sites of Canakkale*
- *Solid Waste Disposal Sites of Kusadasi*

MATRA Project

- *Foundation of Ministry of Environment and Forestry EIA Training Center*
- *Preparation of Sectoral Guidelines*

METAP Project (Environmental Technical Aid Program of Mediterranean)

- *Harmonization of EIA systems with EU*

1994 – 1996 Ministry of Environment and Forestry General Directorate of Environmental Protection

- *Department of Standards an Strategies*

  Strategy Department Expert Biologist
- *Prime Minister State Planning – Ministry of Environment and Forestry NEAP (National Environmental Action Plan)- Expert*
- *Environment-Health- Tourism Subcommittee- Expert*

1985 – 1994 Ministry of Health

- *Ankara Numune Hospital Biyologist*

Certificates:

- Quality Management Systems ISO 9001:2000 Head Auditor/Auditor Training Achievement Certificate" AUGUST - 2006
- Management of the Project Proposal Preparation and Project Translation of EU Donation Programs JUNE-2006
- Health Impact Assessment in New Member States and Accession Countries (HIA-NMAC) MARCH – 2006
- Training of Trainers to Implementation of Environmental Guidelines, Training Instructor Certificate NOVEMBER -2005
- The University of Manchester "EIA Training Programme'' Participation Certificate MARCH – 2005
- Harmonization and Implementation of EU EIA Directive and Ministry of Environment and Forestry Project Participation Certificate MARCH-2003
- FORGEA INTERNATIONAL-ITALY Management of Construction and Demolition Waste OCTOBER -2001
- Turkish and Middle East Public Administration Institute Training Program of Modern Management Certificate FEBRUARY – 2001
- Ministry of Environment and Forestry IV. Environment Council Participation Certificate NOVEMBER -2000
- The University of Manchester METAP (Mediterranean Environmental Technical Assistance Programme) Project Training Improvement of Environmental Impact Assessment Workshop Achievement Certificate JULY-1999
- Ministry of Transport (DLH) – Overseas Coastal Area Development Institute of Japan (OCDI) Port Modernization and Environmental Preservation NOVEMBER – 1997
- Turkish Standards Institution TS-ISO 9000 Quality Assurance and Management Training Program Participation Certificate NOVEMBER – 1995

Languages:

	Speaking	**Reading**	**Writing**
English	Average	Good	Good
Turkish (Native Language)	Excellent	Excellent	Excellent

Name of Staff:	Zeynep Köksal Çubukçu
Profession:	Geological Engineer
Date of Birth:	March 7, 1975
Place of Birth:	Ankara
Nationality:	Republic of Turkey
Membership in Professional Societies:	Chamber of Geological Engineers of Turkey

Key Qualifications:

Ms. Koksal currently works as a project engineer in ENVY Inc. She participated in EIA studies of Tuz Golu Basin Underground Natural Gas Storage Project, EIA and design studies of Ankara Combined Cycle Natural Gas Power Plant. Also, she worked in Baku-Tbilisi-Ceyhan Crude Oil Pipeline and Turkey – Greece natural gas pipeline Project as geological engineer.

Education:

1994 – 1999	Geological Engineering Department, Hacettepe University, Ankara
1991 – 1992	Stamford High School, Texas, USA
1983 – 1991	TED Ankara College

Employment Record:

Oct 2005 – ENVY Energy and Environmental Investments Inc., Project Engineer, Ankara

- *Trans Anatolian Pipeline Project (Samsun-Ceyhan Crude Oil Pipeline Project) FEED Study, 2006-*
- *Samsun-Ceyhan Crude Oil Pipeline Project Feasibility Study, 2005*
- *Duzce Solid Waste Disposal Project Environmental Impact Assesment Study,2005*
- *Manisa Solid Waste Disposal Project Environmental Impact Assesment Study,2005*
- *Genel Energy Taq-Taq Oil Reserve Existing Environmental Condition Assestment and Monitoring Studies,2005*

Apr. 2005 – Oct 2005 Consulate Department, American Embassy, Ankara

Oct 2001 – Oct 2004	ENVY Energy and Environmental Investments Inc., Project Engineer, Ankara

- *Urban natural gas distribution detailed and feasibility engineering studies*
- *Four Seasons Hotel EIA Preliminary Study*
- *Turkey - Greece Natural Gas Pipeline Project, Basic & detailed engineering phases, 2003, Geological Engineer*
- *Gumusova-Gerede Motorway Bolu Mountain Crossing EIA Studies, 2002*
- *Tupras Inc. Izmir Refinery Improvement of Oil Specifications Project, EIA Preliminary Study, 2002*
- *Baku-Tbilisi-Ceyhan Crude Oil Pipeline Project Detailed Engineering Studies*
- *Tuz Golu (Salt Lake) Underground Natural Gas Storage Project EIA Studies, 2001*

Jun 1996 – Aug 1996	Turkish Petroleum Cooperation (TPAO), Trainee, Ankara

Certificates:

- Project Management (using MS Project) Certificate from Hacettepe University, Financial Research Center
- ISO 14001 Environmental Management System, ENVY Energy and Environmental Investments Inc., July, 2002

Computer Skills:

- Operating Systems: Windows
- Other Software: Microsoft Office applications (MS Word, MS Excel, MS Access, MS PowerPoint)

Languages:

	Speaking	**Reading**	**Writing**
English	Excellent	Excellent	Excellent
Russian	Poor	Poor	Poor
Turkish (Native Language)	Excellent	Excellent	Excellent

Name of Staff:	Kadir Özkan
Profession:	Electrical Engineer
Date of Birth:	April 20, 1956
Place of Birth:	Ankara
Nationality:	Republic of Turkey
Membership in Professional Societies:	Chamber of Electrical Engineers
Key Qualifications:	Mr. Özkan is currently working as electrical engineer in Antalya Wastewater Treatment Facilities (Hurma Wastewater Treatment and Lara Wastewater Treatment) operated by ENVY Inc. Mr. Özkan has 26 years of professional experience and he has worked in managerial positions in numerous departments in Başkent and İç Anadolu Electricity Distribution Companies.

Education:

1978 – 1980	M.Sc. in Management, Production Management, Ankara University, Faculty of Economics and Administrative Sciences
1973 – 1977	B.Sc. in Electrical Engineering, Gazi University, Ankara

Employment Record:

2006 –	ENVY Energy and Environmental Investments Inc., Ankara • *Trans Anatolian Pipeline Project (Samsun-Ceyhan Crude Oil Pipeline Project) FEED Study, Electrical Engineer* • *Antalya Wastewater Treatment Facilities (Hurma and Lara Wastewater Treatment Facilities), Electrical Engineer* • *Turkish Electricity Transmission Company (TEİAŞ), 154 kV Yumurtalık – South Adana Transmission Lines, Environmental Consulting Services, Electrical Engineer* • *Consultancy on Privatization of Electricity Projects*
2004 – 2006	Manager in the Elevator Control Coordinatorship, which is a joint unit of the Chambers of Electrical and Mechanical Engineers and Çankaya Municipality.
2004	Retirement from Başkent EDAŞ General Directorate.
2002 – 2003	Başkent EDAŞ Keçiören Operations Manager
2002	Başkent EDAŞ General Directorate, Maintenance and Repair Supply Manager
2001	Başkent EDAŞ General Directorate, Facilities Manager

1991 - 2001	Başkent EDAŞ General Directorate, Facilities Directorate, Regional Control Chief and Facilities Vice Manager
1985 - 1990	İç Anadolu Electricity Distribution Company, Provincial Operating Unit, Machinery supply and acquisition manager
1983 - 1985	İç Anadolu Electricity Distribution Company, Supplies Directorate Responsible
1980 - 1982	Completed military service as Control Engineer, Commandership of Construction and Property, Turkish Naval Force, İstanbul.
1979 - 1980	EGO General Directorate, Project Manager

Computer Skills:

- Operating Systems: Windows
- Other Software: MS Office (Word, Excel, Powerpoint)

Languages:

	Speaking	**Reading**	**Writing**
English	Good	Good	Good
Turkish (Native Language)	Excellent	Excellent	Excellent

Name of Staff:	Aysegul Korur (Hamzaoglu)
Profession:	Environmental Engineer (M.Sc.)
Date of Birth:	May 9, 1973
Place of Birth:	Mugla
Nationality:	Republic of Turkey
Membership in Professional Societies:	Chamber of Turkish Environmental Engineers

Key Qualifications:

Mrs. Korur is experienced in the fields of air quality and air pollutants. During her masters in Middle East Technical University, she studied fugitive dust emissions in ash disposal areas in thermal power plants. During this period, she also attended courses on air quality. After completing her masters degree, she has worked on many Environmental Impact Assessment (EIA) studies involving air quality modeling.

Mrs. Korur has also worked on other EIA reports on hydroelectric, thermal and natural gas combined cycle power plants, pipelines, ash disposal sites, clay and stone pits, energy transmission lines and underground natural gas storage. She has also studied fugitive dust emission and air quality modeling, and basic and detailed engineering in pipeline projects. Mrs. Korur is currently working as a Project Manager in Energy and Environmental Investments Inc.

Education:

1995 – 1998 M.Sc., Middle East Technical University, Environmental Engineering Department, Ankara

- *M. Sc. Thesis: "Assessment of the Potential Impacts of Fugitive Dust from Seyitomer (Kutahya) Coal-Fired Power Plant Fly Ash Disposal Area", September 1998, Supervisor: Prof. Dr. Gurdal Tuncel, Co-supervisor: Prof. Dr. Coskun Yurteri*

1991 – 1995 B.Sc., Middle East Technical University, Environmental Engineering Department, Ankara

Employment Record:

2006 ENVY Energy and Environmental Investments Inc., Ankara

- *Snamprogetti S.p.A., Trans Anatolian Pipeline Project (Samsun-Ceyhan Crude Oil Pipeline Project) FEED Study, 2006 – ongoing*
- *Çalık Energy Inc., Çankırı Orta Thermal Power Plant and Mining Areas, Environmental Consulting Services, 2006 – ongoing*
- *Turkish Electricity Transmission Company (TEİAŞ), 154 kV Yumurtalık – South Adana Transmission Lines, Environmental*

Consulting Services, 2006 - ongoing

2005 – 2006 DOKAY Engineering and Consulting Ltd. Co., Ankara

- *ENVY Inc. Samsun – Ceyhan Crude Oil Pipeline Project, Environmental Consulting Services (Consultant)*
- *Iğdır Municipality, Iğdır Solid Waste Environmental Impact Assessment studies, 2005 – 2006 (Project Engineer)*
- *Yüksel Project International Inc., Ankara – İstanbul High-speed Train, Environmental Impact Assessment consulting services, 2005 – 2006 (Project Manager)*
- *Goodyear, Environmental Baseline Survey, Phase I, 2006 (Project Engineer)*
- *Ankara Technology Development Area founder and operator Inc.(CYBERPARK), Environmental Impact Assessment Consulting Services, 2005 – 2006 (Project Manager)*
- *Ciner Group, Tufanbeyli Electricity Generation Ind. and Trade Inc., Tufanbeyli Thermal Power Plant, mines and limestone fields providing the fuel for the power plant, Environmental Impact Analysis studies, 2005 – 2006 (Project Manager)*
- *1210 MW Sugözü Thermal Power Plant and Water Structures Environmental Consulting Services, 2005 – ongoing (Project Engineer)*
- *İmece Engineering Ind. and Trade Ltd. Co., Karaman Integrated Cement Plant, Air Quality Modeling Studies, 2006*
- *İmece Engineering Ind. and Trade Ltd. Co., Tokat Integrated Cement Plant, Air Quality Modeling Studies, 2006*
- *İmece Engineering Ind. and Trade Ltd. Co., Muğla Integrated Cement Plant, Air Quality Modeling Studies, 2006*
- *Yüksel Project International Inc., Ankara – Konya High-speed Train Project, Environmental Impact Assessment (EIA) Consulting Services, 2005 – 2006 (Project Manager)*
- *Parteks Textile and Paper Ind. and Trade Ltd. Co., Environmental Impact Assessment (EIA) studies, 2005 – 2006 (Project Engineer)*
- *Lafarge Aslan Cement Inc. Environmental Studies, 2005 (Air Quality Modeling Studies)*
- *Bursa Metropolitan Machinery Supplies Maintenance and Repair Bureau, Bursaray Section, Bursaray Light-rail system 2nd Phase, Environmental Impact Assessment Consulting Services, 2005 (Project Engineer)*
- *Enerjisa Energy Generation Inc. Adana Power Plant, Environmental Measurement Studies, 2005 (Air Quality Modeling Studies)*
- *Kars Municipality, Environmental Impact Assessment studies in the scope of Kars Solid Waste Project Consulting Services, 2005 (Project Engineer)*
- *Fako Pharmaceuticals Inc. Environmental Responsibility Cost Analysis Studies, 2005 (Project Engineer)*

- *Worldbank funded GEF II Biological Diversity and Natural Resources Management Project, studies for providing technical support for social assessments in the project area, 2004 – 2005 (Project Engineer)*
- *KfW and Samsun Metropolitan Municipality, Samsun Solid Waste Management – Training consultancy; 2003 – 2005 (Project Engineer – Public Relations)*
- *Ener Energy Inc. 50 MW Van Diesel Electricity Power Plant, 2003 – 2005 (Air Quality Modeling Studies)*

1999 – 2005 ENVY Energy and Environmental Investments Inc., Ankara

- *Air quality monitoring studies for 620 MW Çayırhan Thermal Power Plant, 2004 – 2005 (Project Engineer)*
- *İnegöl area air quality measurement studies, 2003 – 2004 (Project Engineer)*
- *Tepeören – Şile Energy Transmission Lines, EIA Studies, 2004 – 2005 (Project Engineer)*
- *Vilsan Veterinary Drugs Inc., EIA Studies for Ankara Facilities, ENVY Energy and Environmental Investments Inc.,2003 (Project Manager – Responsible for public consultation and disclosure program)*
- *Inegol Municipality Sanitary Landfill Project, ENVY Energy and Environmental Investments Inc.,2003 (Public consultation and disclosure program leader)*
- *EIA studies for Samsun Power Plants (includes performing public consultation and disclosure program, preparation of posters, handouts, attendance to TV programs), ENVY Energy and Environmental Investments Inc., 2002 (Project Manager – Responsible for public consultation and disclosure program)*
- *Tuz Golu Underground Natural Gas Storage Project EIA Studies (includes performing public consultation and disclosure program), ENVY Energy and Environmental Investments Inc., 2001(Project Manager – Responsible for public consultation and disclosure program)*
- *Baku – Tbilisi – Ceyhan Crude Oil Pipeline Project Detail Engineering Phase, ENVY Energy and Environmental Investments Inc., 2001 (Project Engineer for public consultation and disclosure works)*
- *Blue Stream Pipeline Project EIA Studies (includes performing public consultation and disclosure program), ENVY Energy and Environmental Investments Inc., 2001 (Project Manager – Responsible for public consultation and disclosure program)*
- *Sugozu Power Plant EIA Studies (includes performing public consultation and disclosure program, preparation of Public Consultation and Disclosure Plan, video clips, posters, handouts and Painting Competition Book), ENVY Energy and Environmental Investments Inc., 2000 (Project Manager – Responsible for public consultation and disclosure program and the environmental section of Quarterly Bulletin of the investor company)*

- *Izmir Combined Cycle Gas Turbine Power Plant Project EIA Studies, ENVY Energy and Environmental Investments Inc., 2000 (Project Engineer – Responsible for public consultation and disclosure program, including preparation of Public Consultation and Disclosure Plan, video clips, posters, handouts and Painting Competition Book)*
- *Seyitomer Thermal Power Plant Ash Disposal Area, Clay and Stone Quarries Integrated Project EIA Studies, ENVY Energy and Environmental Investments Inc., 2000 (Project Manager)*
- *Ankara Combined Cycle Gas Turbine Power Plant Project EIA Studies, ENVY Energy and Environmental Investments Inc., 1999 (Project Engineer – Task Leader for public consultation and disclosure program, including preparation of Public Consultation and Disclosure Plan, video clips, posters, handouts and Painting Competition Book)*

Nov 1998 – Nov 1999 PARMAS Industrial Research and Engineering Inc., Environmental Engineer, Ankara

- *Adapazari Combined Cycle Gas Turbine Power Plant Project EIA Studies, PARMAS Industrial Research and Engineering Inc., 1999. (Project Engineer, participated in public consultation and disclosure program)*
- *Gebze Combined Cycle Gas Turbine Power Plant Project EIA Studies, PARMAS Industrial Research and Engineering Inc., 1999. (Project Engineer, participated in public consultation and disclosure program)*
- *Air Quality Modelling for 1400 MW Afşin-Elbistan C Thermal Power Plant during the planning phase 1998 (Project Engineer)*
- *EIA Report for 1400 MW Afşin-Elbistan B Thermal Power Plant 1998 (Project Engineer)*
- *Air Quality Modelling for 1400 MW Afşin-Elbistan B Thermal Power Plant 1998 (Project Engineer)*

August 1995 – Nov 1998 Middle East Technical University, Environmental Engineering Department, Teaching Assistant, Ankara

Certificates:

- Post-Certificate Environmental Compliance, “Environmental Compliance of Pipeline Construction”, US Federal Energy Regulatory Commission. (March 2003)
- ENVY Energy and Environmental Investments Inc. ISO 9000 Introduction to Quality System Program Attendance Certificate (July 2000)
- ENVY Energy and Environmental Investments Inc. ISO 9000 Quality System Documentation Program Attendance Certificate (August 2000)
- Internal Training Courses on Public Relations.
- Turkish Kizilay Association, Emergency Training

Certificate (July 2001)

- Hacettepe University; Financial Research Center; Financial and Business Administration Management Training Certificate
- Hacettepe University; Financial Research Center; Project Management Training Certificate

Computer Skills:

- Operating Systems: Windows
- Other Software: Microsoft Office, ISCTS, QUAL2E

Languages:

	Speaking	**Reading**	**Writing**
English	Excellent	Excellent	Excellent
German	Poor	Poor	Poor
Turkish	Native	Native	Native

Name of Staff:	H. Bülent Kadıoğlu
Profession:	Environmental Engineer
Date of Birth:	June 19, 1982
Nationality:	Republic of Turkey
Membership in Professional Societies:	Chamber of Environmental Engineers of Turkey

Key Qualifications:

Mr. Kadıoğlu has expertise in Geographical Information System (GIS) and worked in modeling of environmental measurement studies by GIS applications.

He participated in FEED studies of Trans Anatolian Pipeline Project (Samsun-Ceyhan Crude Oil Pipeline Project).

Education:

2000 – 2006	B.Sc. in Environmental Engineering Department, Middle East Technical University, Ankara
1997 – 2000	Kocaeli Korfez Science High School

Employment Record:

2006 – Today — ENVY Energy and Environmental Investments Inc., Ankara

Project Engineer

- *Snamprogetti S.p.A., Trans Anatolian Pipeline Project (Samsun-Ceyhan Crude Oil Pipeline Project) FEED Study (2006, Project Engineer)*
- *TEIAS Yumurtalık- Guney Adana 154 kV ETL Environmental Impact Assessment Report (2006, Project Engineer)*
- *Bolunmez Petroleum Inc. Tekirdag Fuel Storage Tank Farm Environmental Impact Assessment Report (2006, Project Engineer)*
- *Likit Chemistry Inc. Tekirdag Chemical Storage Facility Environmental Impact Assessment Report (2006, Project Engineer)*
- *Cankiri-Orta Thermal Power Plant Environmental Impact Assessment Report (2006, Project Engineer)*

Computer Skills:

- Operating Systems: Windows
- Other Software: Microsoft Office, ArcView 3.2, ArcInfo 8.2, Surfer, Corel DRAW 9, Corel PHOTO-PAINT9

Languages:

	Speaking	**Reading**	**Writing**
English	Excellent	Excellent	Excellent
German	Poor	Poor	Poor
Turkish (Native Language)	Excellent	Excellent	Excellent