TEMMUZ ELECTRICITY GENERATION INC.

ENVIRONMENTAL
IMPACT ASSESSMENT REPORT
for
ONUR REGULATOR AND ONUR HEPP PROJECT

TOKAT PROVINCE, REŞADİYE DISTRICT,
TOKLAR VILLAGE

DOĞA - EIA Environmental Projects
Planning, Consultancy, Construction,
and Tourism Ltd.

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The Subject and Description of the Project

Onur Regulator and Onur HEPP (Hydroelectric Power Plant) having 19,568 MWe (20.82 Mwm) of installed power and an annual total capacity of 42,848 GWh is planned to be established on Zinav Stream (located on H-38 map sheet), which is a branch of Kelkit Stream situated in 15 km northwest of Reşadiye District of Tokat Province, by Temmuz Electricity Generation Inc.

Hydroelectric power plants are systems that produce electricity by making use of water energy. Hydroelectric power plants convert potential energy of water to mechanical energy, and then mechanical energy is converted to electrical energy. Hydroelectric power plants are divided into two according to their storage property;

a) Power plant without reservoir: These are directly established on rivers or canals. As they do not have water reservoir (lakes), they convert the power of flowing water to electricity. River power plants and canal power plants are examples of these types of power plants.

b) Power plants with natural or artificial water reservoir (lake): At such type of power plants, it is essential to store water. Storage of water generally becomes an obligation on rivers where water regime is irregular, so that electrical energy can be produced regularly throughout the year. Dam power plants and power plants with pumped reservoir are among these types of power plants.

Onur HEPP and Onur Regulator take place among the power plants without water reservoir that is mentioned above. Therefore, any kind of water reservoir will not be built within the scope of the project.

In this facility, water taken to regulator will alter according to the change in daily flow. To sustain continuous flow on Zinav Stream and to protectthe ecological balance, the system will constantly release 0.450 m^3/s of environmental flowduring June-July-August months and 0.350 m^3/s during the other months to the stream without taking it into regulator system. Water taken into the regulator will be given to transmission tunnel that is 3133.43 m in length. Penstock begins at the 2824.85 m of the transmission tunnel. The total length of penstock is 324.06 m; 308.58 m of which will be built inside the transmission tunnel and 15.48 m will be built outside the tunnel to pass underground. Water sent to the power plant system by penstock will produce totally 42,848 GWh of annual energy by means of turbines. Tailwater to be obtained at the end of the system will be given to the stream flow without any change in the initial amount. Hence, the flowrate of Zinav Stream will not be altered.

Life-span of the Investment

Construction works of the project is considered to be completed totally in 32 months. In the last six months of this duration, test studiesis planned to be performed. Besides, life-span of the project is foreseen as 50 years and it is planned to extend this economical life-span by doing the necessary revision works during this period of time.

Purpose of Service

In Turkey, electrical energy consumption per capita has reached to 1903 kWh on gross basis by the beginning of 2003. If it is considered that this number is about 6500 kWh/person for Europe and2350 kWh/person according to the world's average; it can be seen that electrical energy consumption per capita in our country is rather low. For that reason, it is essential to increase the electrical energy supply, mainly the hydroelectric energy.

At the moment, 60% of Turkey's electrical energy is produced by use of natural gas resources. Examining the HEPP potential of Turkey, inadequacy ofresources was measured as 10 million KW/hour in the 1930s.However, our HEPP potential has reached to 450 billion KW/hour since 1970. This amounttechnologically decreases to 250 billion KW/hour. Turkey's HEPP potential is economically 155 billion KW/hour. Even though 30-35% of this amount is considered as producible,20-25% of this potential can be produced because the level of HEPP are low due to the construction sites. The main aim of this project is to supply continuous energy demand of the increasing population and the developing economy with least possible cost.

Onur Regulator and HEPP project is situated in Black Sea Region, Tokat Province, in the borders of Reşadiye District, in Yeşilırmak River Basin. In the downstream of the project site on the Zinav Stream, Zinav Lake exists. At the regulator site, the precipitation area of the stream is 196.50 km^2.

Onur Regulator and HEPP is planned to situate at 1/25.000 scaled Tokat H-38-b1 map sheet, between 4483000 north, 352000 east coordinates and 4488000 north, 354000 east coordinates.

Within the scope of Onur Regulator and HEPP Project; the regulator, energy tunnel, penstock, powerhouse and outhouses take place. By this project, it is planned to establish Onur Regulator on Zinav Stream at 1165.50 m thalweg elevation, and stream flows converted from this regulator is planned to be discharged back to the river basin after being passed through energy tunnel with a caliber of 4.00 m to be built at the left bank of Zinav Stream and being used for energy production by lowering the energy at Onur HEPP to be established on Zinav Stream at 955.00 m tailwater elevation. At the power plant,which is planned to have 19,568 MWe (20.82 MWm of installed power), 2 units of Francis vertical axis turbine is planned to be established.

Zinav Lake is located at the river mouth of Onur Regulator and HEPP facilities. It is necessary to release environmental flow to stream so as to protect natural life. Within this scope, in the revised Feasibility Report, environmental flow for Onur Regulator and HEPP project is determined as an amount which corresponds to 10% of the last 10 years' (2000-2009) annual average flow rate (AAF). In this case, the environmental flow is determined as 0.277 m^3/s, which corresponds to 10% of 2,769 m^3/s that is AAF of the last 10 years. As for the site of Onur Regulator, considering the annual average flow rate (1966-2009) of 3,218 m^3/s, environmental flow is determined as 0.450 m^3/s for June-July-August and

0.350 m^3/s for the other months, and any adverse condition is not expected at the lake with constant release of this amount of water to the stream.

As a result of the optimization studies performed, the penstock caliber is planned to be 2.0 m and the project flow is 10.00 m^3/s. The possibility for realization of the planned project flow is expected to be 6.67% within a year. Considering the possibility of realization of the project flow, the flow is planned to become 10.00 m^3/s. For 10.00 m^3/s of project flow, 225 m gross head and 19,568 MWe (20.82 MWm) of established power are planned.

Regarding the topographical conditions of the project site, it is planned to build the transmission system as tunnels.

Characteristics of the Facilities to be established in the Project

Regulator: Regulator is full-bodied and free flowing. Water level is chosen as 1180 m. The thalweg elevation at the regulator axle is 1165.50 m. The grading elevation of the regulator surrounding is determined as 1182.6 m at full weirs to confront 100 years flood flow of 146.4 m^3/s securely and without share of air. The crest length of the regulator is 34 m and the height from thalweg is 14.50 m. Plans and cross-sections of the regulator location are given in **Appendix:6.**

Onur Regulator

Aim	:Energy Production
Type	:Cross Flow, Full-Bodied
Drainage Area	:196.50 km^2
Flow of the Project	:10 m^3/s
Crest Elevation	:1180 m
Crest Length	:34 m
Thalweg Elevation	:1165.50 m
Landscaping Elevation	:1182.6 m
Normal Water Elevation	:1180 m
Base Elevation of Water Stilling	:1163 m

Gravel Pass

Threshold Elevation	:1166.6 m
Foundation Elevation	:1164
Number of Gates	:2
Width of Gate	:3 m
Size of Gate	:3 m x 4 m

Water Acquisition Structure and Sedimentation Pool; It is required to build a sedimentation pool so as the sediments coming from the river basin of Onur Regulator do not affect the benefits of the project. Therefore, the flow converted in the regulator is planned to be conveyed to the pool to be built at the left bank. It is intended to convey water, which is planned to be taken with a screened and closed structure, to the sedimentation pool and from there to the transmission tunnel. The minimum particle diameter is considered to be 0.3 mm. At the end of the sediment pool, a discharge pipe is planned to be built which will provide discharge of sediments to the streambed.

Water Acquisition System and Sedimentation Pool

Water Acquisition Threshold Elevation: 1171 m
Water Acquisition System Width : 2 m x 3 m
Sedimentation Pool Length : 46 m
Sedimentation Pool Width : 2 m x 3 m
Number of Sedimentation Pool Gates: 2
Slope of the Sedimentation Pool : 0.01
Diameter of the Sediment Particles : 0.30 mm

Energy Tunnel: Inside of the energy tunnel, which will take place subsequent to the sedimentation pool, is planned to be built in circular shape and the outside in horseshoe shape, with concrete cover. The inside caliber of the tunnel is planned as 4 m, coating thickness as 0.3 m, the entrance axis elevation as 1173.9 m, exit axis elevation as 953.5 m, tunnel length as 3133.43 m, and the slope as 0.00 - 0.08. Plans and cross-sections of the transmission tunnel are given in **Appendix:7**

Inner caliber of tunnel	: 4 m
Coating thickness	: 0.3 m
Entrance axis elevation	: 1173.9 m
Exit axis elevation	: 953.5 m
Tunnel length	: 3133.43 m

Penstock and Cleats : Subsequent to the transmission tunnel, it is planned to start penstock. The pipe caliber is planned to be 2 m for the proposed project flow. Average wall thickness of penstock is planned to be 14.5 mm and total length of penstock is planned to be 324.06 m.

Caliber of Penstock	:2 m
Average Wall Thickness of Penstock	:14.5 mm
Total Length of Penstock	:324.06 m

Powerhouseand Tailwater Channel: Onur HEPP is planned to be at 955.00 m tailwater elevation, and the length of powerhouse is planned as 29.4 m, and the width as 18.7 m. Outlet water of the power plant is planned to be released to the streambed. The location map of the powerhouse is presented in **Appendix: 8**.

Tailwater Elevation	:955.00 m
Length of Powerhouse	:29.4 m
Width of Powerhouse	:18.7 m
Height of Powerhouse	:27.10 m

Turbine Type, Power of the Unit and Quantity: For Onur HEPP, which is planned to have 225.00 m gross head and 10 m^3/s project flow, two vertical axis Francis turbines with 19,568 MW total installed power (2 x 9,784 MW) are thought to be required.

Total Installed Power	:19,568 MWe (20.82 Mwm)
Number of Units	:2
Turbine Type	:Francis Vertical Axis
Gross Head	:225.00 m
Net Head (for project flow)	:428.96 m
Installed Power of Units	:2 x 9,784 MW
Synchronous Speed	:750 rev/min
Specific Speed	:99.46 m-Kw
Turbine Output	:0.92

Generator Type and Capacity: Generators will be vertical axis, salient-pole, three phased.

Type	:3 Phased SynchronousGenerator
Quantity	:2
Power	:2 x 10,900 kVA
Power factor	:0.90
Frequency	:50 Hz
Number of Poles	:6 pair (12 item)
Numberof Revolutions	:750 rev/min
Generator Output	:0.98

Transformer Type and Quantity:

Transformers

Unit Transformers:	
Quantity	:2
Type	:External, 3 Phased, Grease Insulated
Constant Power	:2 x 11,000 kVA
Nominal Voltage	:6.3 / 34.5 kV (+/- 2 x 2.5 %)
Frequency	:50 Hz
Linkage Group	:YNd 11
Cooling Form	:Onan
Output	:0.99

Internal Transformers:	
Quantity	:2
Type	:Internal, 3 Phased, Dry or Silicon Grease
Constant Power	:400 kVA
Nominal Voltage	:6.30 (+/- 2 x 2.5 %) / 0.4 kV
Frequency	:50 Hz
Linkage Group	:Dyn 5

Energy Transmission Line and Switchyard: Electricity produced at the power plant is planned to be connected to Tuna HEPP River Basin Transformer Center's medium voltage busbar. Within this scope, energy transmission line will be 9 km.

Table 1.1 Characteristic Information of the Project

No	DESCRIPTIONS		
1	Project Name		Onur Regulator and HEPP Project
2	Company Name		TEMMUZ Electricity Generation Inc.
3	Company Address		Çınar Mah. Cihat Saran Sok. No: 17 Küçükyalı / İSTANBUL
4	Company Phone / Fax No.		0 216 518 03 06
5	E-mail Address of the Company		-
6	1/25,000 scaled map		TOKAT H 38 -b1
	ONUR Regulator		
7	Regulator 6° UTM Coordinates		4 483 000 N, 352 000 E
8	Province		Tokat
9	District		Reşadiye
10	River Basin Name		Western Black Sea Region
11	Region of State Hydraulic Works (SHW)		7th Region (SAMSUN)
12	Stream Name / Main Branch Name		Zinav Stream / KELKİT
13	# of Stream Observation Station		SHW 14-122, 14-121 and 14-117 (14-32)
14	Drainage Area	(km^2)	196.50
15	Average Flow	(m^3/s)	3,218 (Including Environmental flow Requirement)
16	Annual Average Total Flow	(hm^3)	101,472 (Including Environmental flow Requirement)
17	Q_{100} Flood Flow	(m^3/s)	146.40
18	Q_{500} Flood Flow		193.50
19	Q Full Weir Dam Design Flow		
20	Dam / Regulator Type		Cross Flow, Full-bodied
21	Crest Elevation (Threshold Elevation)	(m)	1180.00
22	Maximum Water Elevation (Q_{100})		1181.69
23	Minimum Water Elevation		1180.00
24	Thalweg Elevation		1165.50
25	Type of Transmission Structure		Inside circular, outside horseshoe, concrete coated tunnel
26	Length of Transmission Structure	(m)	3133.43 m
27	Tailwater Elevation of Plant	(m)	955,00
28	Plant Coordinates		4 488 000 North, 354 000 East
29	Caliber of Penstock	(m)	2.00
30	Length of Penstock		324.06
31	Thickness of Penstock	(mm)	15.00
32	Type of Turbine		Francis vertical axis
33	Quantity of Units		2
34	Bar Tension	(kV)	34.5
35	Cross Section of Energy Transmission Line		2X477 MCM
36	Length of Energy Transmission Line	(km)	9
37	Gross Fall	(m)	225.00
38	Net Fall (in project flow)		223.38
39	Flow of the Project	(m^3/s)	10.00
40	Installed Power	(MW)	20.82 MWm / 19,568 MWe
41	Reliable Power	(MW)	0.398
42	Reliable Energy	(GWh)	3,485
43	Secondary Energy		39,364
44	Total Energy		42,848

Country in Terms of Economic and Social Aspects

Our country shows a rapid social and economical development. In parallel with the required electrical energy, new projects and investments have to be developed, primarily by using local energy resources. Adverse environmental effects of the projects, prepared to obtain continuous, good-quality, reliable and economical energy, should be least.

Developing countries need large amounts of energy. The provision of energy from national resources is of vital importance in terms of national economy. While it varies according to the place of use, the most essential energy type is electricity. The cheapest energy type, which our country has, is water. What resources are used in the generation of electricity is important in terms of the planning of investments, and realization of generation. The realization of new projects and their switch to service are of vital importance for the most productive use of national energy resources and provision of country energy needs.

In the generation of electrical energy; besides fossil and nuclear fuelled thermal power plants and natural gas power plants, hydroelectric power plants have two essential characteristics such as renewable and peak working. The consumption of electricity energy is an important indicator of economical and social prosperity. In a country, electrical energy generation and/or consumption per capita become more of an issue in terms of reflecting life standards in that country.

Among various energy resources, hydroelectric energy power plants would be preferred as they are environment-friendly and carry low potential risks. These types of power plants can satisfy sudden demand alterations. For that reason, they are used peak power plants in our country. Hydroelectric power plants are environment-friendly, clean, renewable, able to satisfy peak demands, highly productive (over 90%), without any fuel expenditure, playing insurance role in energy prices, long-lasting (200 years), low repayment term (5-10 years), rather low cost of operation (approximately 0.2 cent/kWh), independent national resources.

The development of even the half of the hydroelectric generation potential, which can be carried out economically worldwide, will enable 13% decrease of greenhouse gas emissions. Hydroelectric power plants, compared to other generation types, possess the lowest operation cost and the longest operation life, and the highest efficiency.

There are plenty of economic, environmental, strategic reasons why Turkey should give priority and encourage hydroelectric power plants against other energy alternatives.

In a country, the hydroelectric potential assessed based on the assumption that country's all natural flows within the borders and seas can be used at 100% is the country's gross theoretical hydroelectric potential. However, as the use of all this potential is not possible, the maximum potential to be used with the available technology is called technically practical hydroelectric potential. On the other side, each facility that has a technical practicality does not mean economically practical facility. The part of technical potential that can be developed in the available and expected local conditions is called economically practical hydroelectric potential. As can be seen from **Table 1.2**, Turkey's theoretical hydroelectric potential is 1% of the world's theoretical potential, and economic potential is 16% of the economic potential of Europe's.

Table 1.2. Hydroelectric (HEPP) Potential of the World and Turkey

HYDROELECTRIC (HEPP) POTENTIAL OF THE WORLD AND TURKEY			
	Gross HEPP potential (GWh/year)	Technical HEPP Potential (GWh/year)	Economical HEPP Potential (GWh/year)
WORLD	40 150 000	14 060 000	8 905 000
EUROPE	3 150 000	1 225 000	800 000
TURKEY	433 000	216 000	130 000

Source: www.dsi.gov.tr

Theoretical hydroelectric potential of Turkey is figured as 433 billion kWh, technically regarded potential as 216 billion kWh, and technically and economically regarded potential as approximately 130 billion kWh.

As of today, 150 hydroelectric power plants operate in Turkey. These power plants have 13,395 MW of installed power and 48,100 GWh of annual total production capacity, which makes 37% of the total potential.

40 hydroelectric power plants that possess 3,497 MW of installed power and 11,270 GWh of annual production capacity, which makes 9% of the total potential, are still being built. In order to use the rest 70,563 GWh of annual potential, 526 hydroelectric power plants will be built in Turkey in the future and with a total 36,697 MW of installed power, the total number of hydroelectric power plants will reach to 716.

The USA has developed 86% of its technical hydroelectric potential, Japan 78%, Norway 68%, Canada 56%, and Turkey 21% of its own. The fact that the ratio of hydroelectric and other renewable energy resources as regards to current ratio will increase by 53% (in the world's consumption in 2020) has been foreseen by the International Energy Agency (IEA) and this is interpreted as the utilization of hydroelectric power at all potentials. European Union (EU) has put an action plan into force to double its renewable energy share of internal energy consumption (from 6% to 12%) and to increase electricity generation to 21% within EU till 2010.

If economical recessions are not considered, electricity consumption in Turkey increases 6-8% every year. So as to satisfy this demand, our country has to save about 2-3 billion US Dollars for new energy projects every year. Since energy is a vital subject in our country as well as all around the world, all alternatives primarily local hydroelectric energy, which is the self sufficient, continuous, reliable and affordable and independent should be considered. In the table below, our country's hydroelectric power plant potential and their energy production are displayed.

Table 1.3. Hydroelectric Power Plants in Turkey and Their Capacity

The Status of HEPP Projects	**Quantity of HEPP**	**Total Installed Capacity**	**Average Annual Production (GWh/year)**	**Rate (%)**
In the facility	150	13,395	48,100	37
Under Construction	40	3,497	11,270	9
Construction has not begun yet	526	19,805	70,563	54

Source: www.dsi.gov.tr

Though annual electricity consumption per capita estimate is 1,906 kWh, the world's average is 2,500 kWh, 8,900 kWh in developed countries, 827 kWh in China, and about 12,322 kWh in the USA. As industrialization is a target in order to insure the economical and social development of our country, the energy need of the industry and the other user groups should be provided relevantly, on time and safely.

Although electrical energy consumption per capita in Turkey has reached to 1,903 kWh on gross basis by the beginning of 2003, if it is considered that this number is about 6,500 kWh/person in Europe and the world's average is 2,350 kWh/person; it can be seen that electrical energy consumption per capita in our country is rather low. For that reason, the requirement for increasing the electrical energy supply, particularly to hydroelectric energy, is apparent.

At the moment, 60% of Turkey's electrical energy is produced by natural gas resources. If we have a look at the HEPP potential, the lack of adequate data was measured as 10 million KW/hour in the 1930s. Since 1970, our HEPP potential has reached to 450 billion KW/hour. This rate decreases to 250 billion KW/hour technologically. Turkey's HEPP potential is economically 155 billion KW/hour. However, even though we seem to be able to produce only 30-35% of this rate, our country can only produce 20-25% of its potential as the elevation of HEPP are low due to the construction areas.

The Importance and Necessity of the Project

Developing countries need large amounts of energy. The provision of energy from the national resources is of vital importance in terms of national economy. Regardless of the fact that it varies according to place of use, the most essential energy type is electricity. The cheapest energy source, our country possess, is water. What resources are used in electricity production is of vital in terms of planning of investments and realization of generation. In order to use the national energy resources effectively and to meet national energy needs, it is important to carry out new projects and put them into service.

Our country shows a quick social and economical development. In parallel with the required electrical energy, some new projects and investments, primarily obtained from some local energy resources, have to be developed. The adverse effects of projects, prepared to obtain continuous, good-quality, reliable and affordable energy, are paid attention to be the least.

In the generation of electrical energy; besides fossil and nuclear fueled thermal power plants and natural gas power plants, hydroelectric power plants have two essential characteristics such as being renewable and peak working. The consumption of electricity energy is an important indicator of economical and social prosperity. In a country, electrical energy generation and/or consumption per capita become more of an issue in terms of reflecting life standards in that country.

The sketch showing the water resources at the project site and its near surrounding is given in **Appendix:14.** The feasibility report of the project has been approved by SHW (State Hydraulic Works), and the approved water right report is given in **Appendix:18.**

CHAPTER II: THE LOCATION OF THE SITE CHOSEN FOR THE PROJECT

II.1. Project location (display of the project site, whose accuracy is approved by related governorship and municipality, on 1/100.000 scaled Environmental Plan and Development Plan (project site labeled) including the legend and plan notes, if these plans are not available display on Land Use Map)

Tokat is situated between 39°52' - 40°55' north latitude and 35°27' - 37°39' east longitude; in the central part of Black Sea Region and surrounded by Samsun in the north, Ordu in the northeast, Sivas in the south-southeast, Yozgat in the southwest, and Amasya in the east. Project site is at a distance of 399 km to Ankara, 232 km to Samsun, 233 km to Ordu, 108 km to Sivas, 206 km to Yozgat, 114 km to Amasya, and 785 km to Istanbul.

Land transport is made by E80 Highway. The settlements close to the project site are Toklar Village, about 1 km away from the regulator (water acquisition system) and Bereketli Town, at an approximate distance of 3 km. The map that displays the location of the project site in the region is given in **Appendix: 1;** photos belonging to the project site are given in **Appendix: 21**, and 1/25.000 scaled topographical map of the project site is given in **Appendix: 2.**

The facility subject to the project is situated in Tokat Province, on Zinav Stream ,which is a branch of Kelkit Stream, in the 15 km northwest of Reşadiye District.

1/100.000 scaled Environmental Plan, on which project site is labeled, is given in **Appendix:22**, as to 1/25.000 scaled Layout Plan in **Appendix:3.** Subsequent to the completion of EIA process, Local Development Plan will be prepared and approved.

As the required workplaces, offices, social and administrative buildings are planned to be prefab, any kind of digging or construction work will not take place for these buildings. However, in case these buildings are planned to be permanent, with 19.08.2008 dated and 10337 numbered Ministerial Approval, a report will be prepared for these areas according to the criterion of General Directorate of Natural Disasters and will be approved to the related authority.

II.2. The locations of units within the scope of the project (if available borrow pit, concrete plant and crushing-screening facility included), location of units, technical infrastructure units, administrative and social units, if available other units, the size of open and closed areas determined for them, location map of these units in the project site, the display of units and temporary-permanent storage areas on 1/25.000, 1/5.000 and/or 1/1.000 scaled maps, settlement plan of the construction site, excavation storage site, regulator, channel/tunnel route, forebay pool, penstocks, powerhouse, etc. (indication of the distances to each other), plans and cross-sections belonging to the constructions, sketch of the catchment area and gauging stations, pursuant to technical drawing standards. Introduction file including locations (coordinates) of the project units in a digital CD (in ED 50 format).

Onur Regulator and HEPP project are composed of regulator, transmission tunnel, penstock and power plant. The regulator planned to be made within the scope of activity, has a full-bodied and free-flowing. Water elevation has been chosen as 1180 m. The thalweg elevation is 1165.50 m. The regulator environmental grading elevation is determined as 1182.6 m to compensate 146.4 m^3/s that is 100-flood flow securely in the regulator spillway and without any freeboard. Regulator's crest length is 34 m and height

from thalweg is 14.50 m. The location plan and cross-sections of the regulator are given in **Appendix: 6.**

As the water taken into the regulator reaches to a sufficient level, it will be transmitted to the transmission tunnel. Penstocks begin after 2824.85 m of the transmission tunnel. The total length of penstock is 324.06 m, 308.58 m of which will be built inside the tunnel, and 15.48 m will be built outside the tunnel.

Within the scope of the activity, borrow pit and crushing-screening facilities will not be built. Proper size of the material that is obtained from the tunnel excavation will be used as the foundation material for road construction (regulator access road and power plant access road). Nevertheless, proper materials will be used for the concrete plant which is planned to be built in order to provide the concrete needed during the construction period of tunnel inner coverage, power plant etc. intended within the scope of activity (The location map of the concrete plant is given in **Appendix:9**). As can be seen in the map given in **Figure 5.1.1.1**, the excess material will be stored at two different sites. The approval of SHW (State Hydraulic Works) on this issueand 1/25.000 scaled map that shows the storage sites are given in **Appendix: 16-b.**

Catchment area and Gauging Stations

Onur Regulator and HEPP Project are situated in Black Sea Region, Tokat Province, in the borders of Reşadiye District, on Zinav Stream that flows into Kelkit Stream in Yeşilırmak River Basin. Zinav Lake exists in the project river mouth on the Zinav Stream.

The drainage area of the river at regulator area is 196.50 km^2. Onur Regulator and HEPP are situated between 4 483 000 north and 352 000 east coordinates, between 4 488 000 north and 354 000 coordinates in 1/25.000 scaled Tokat H38 – b1 numbered map.

The stations used for project water supply calculations are 14–122, 14–121 and 14–117 (14–32) numbered gauging stations. There doesn't exist any gauging stations on Zinav Stream. As it is seen in the Hydrometeorological Location Map in **Figure 2.2.1.**, Karakuş River lies in the back river basin of Zinav Stream. By considering the facts that these are neighbor river basins and they are nourished from the same height, 14–122 and 14–121 numbered gauging stations on Karakuş River are used in the regulator calculations. 14–121 and 14–117 (14–32) numbered gauging stations are used in the completion of the missing years of 14-122 numbered gauging station.

The characteristics of gauging stations, which is situated at the project site and its near surrounding, and their observation periods are given in **Table 2.2.1**; and Hydrometeorological Location Map in **Figure 2.2.1**

Table 2.2.1. The Characteristics of Gauging Stations and Observation Periods

No	GAUGING STATIONS Name	Rainfall Area (km²)	Elev (m)	YEARS
14-122	KARAKUŞ ÇAYI - GÖKÇEBAYIR	363.00	925	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2002 2003 2004 2005 2006 2007 2008 2009
14-121	KARAKUŞ IRMAĞI - KEVGİR KALESİ	679.00	571	1990 1991 1992 1993 1994 1997 1998 2001 2002 2003 2004 2005
14-32	ÇİLKORU DERESİ -GÖKDERE	90.0-94.1	734	1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979
14-117	ÇİLKORU DERESİ-GÖKDERE	78.00	734	1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
1401	KELKİT NEHRİ -FATLI	10048.80	375	1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
1418	YEŞİLIRMAK NEHRİ -GÖMELÖNÜ	1608.00	820	1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
1427	KELKİT ÇAYI YEMİŞLİ-KÖPRÜSÜ	8572.80	690	1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
14-123	TANOBA DERESİ - DEĞİRMENLİ	64.50	255	1992 1993 1994 1995 1996 1997 1998
14-144	BEĞERGEN DERESİ-AKARÇAY	16.40	928	2001 2002
14-124	GÜLÜT DERESİ - YENİSU	104.30	938	1990 1991 1992 1993 1994 1995 1996
22-067	SAP DERESİ - DURAKKÖYÜ	332.00	150	1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
22-091	BOLAMAN ÇAYI - ÇATALPINAR	784.00	110	1987 1988 1989 1990 1991 1992 1993 1994 1996 1997 1998 1999
1428	KELKİT ÇAYI DERBENT ÇİFTLİĞİ	784.00	110	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
1424	ÇEKEREK ÇAYI-ÇIRDAK KÖPRÜSÜ	1032.80	1040	1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

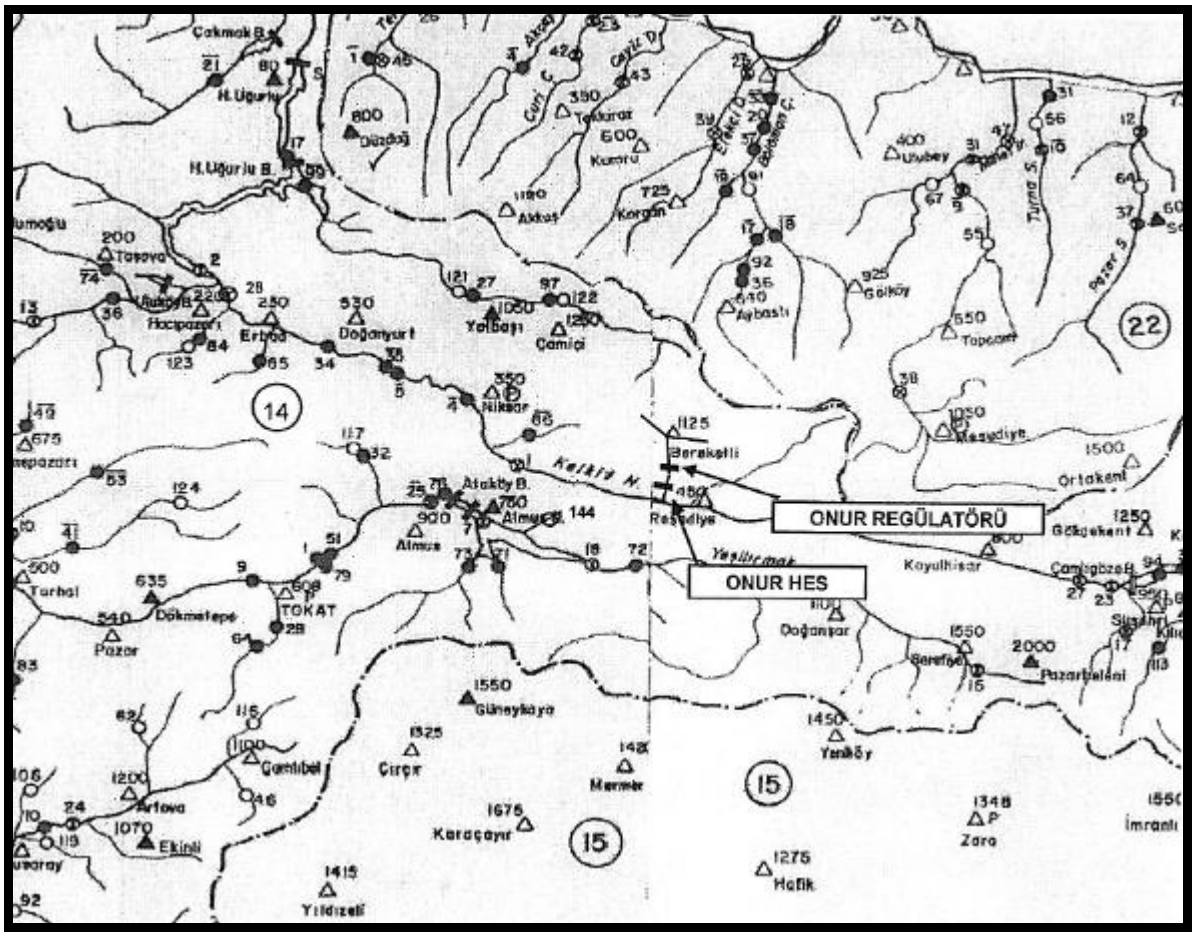

Figure 2.2.1. Hydrometeorological Location Map

CHAPTER III: THE ECONOMICAL AND SOCIAL ASPECTS OF THE PROJECT

III.1. Investment program and financial resources regarding the realization of the project, where these resources will be provided

For Onur Regulator and HEPP facilities, quantity take off has been performed for the cost of the facilities and exploration summaries has been prepared. The cost of the facilities, such as regulator, gravel pass, sedimentation pool, energy tunnel, penstocks, construction of powerhouse, construction of service and access roads to the site are calculated by using "Unit Price Schedule for 2010 of the SHW, Dams and HEPP Department", and the costs of electromechanical equipment are calculated by consulting to the concerning manufacturer firms. 1 USA dollar was considered as 1.6043 TL, issued as 2010 annual average rate by SPO (State Planning Organization) Under Secretariat.

The costs of iron and concrete transportation have been calculated regarding the transport distance between the closest concerned facilities to the project site. It has been assumed that concrete will be provided from Samsun-Ladik and rebar from Karabük and transported to the project site.

The total cost of the construction work is 20,955,540 US Dollars (33,618,972 TL). By adding electromechanical equipment costs to this amount, exploration cost has been calculated as 28,293,540 US Dollars (45,391,326 TL). With the uncertain costs and the cost of energy transmission line, total facility cost becomes 31,505,994 US Dollars (50,545,066 TL). With the aim of determining total project cost; total facility cost, exploration, design, inspection and expropriation costs have been added and 34,111,103 US Dollars (54,724,443 TL) has been determined as the project cost.

The investment cost calculation is made by assuming an interest rate of 9.5% for the energy projects according to SHW (State Hydraulic Works)criteria. The amount of interest for this cost and for the duration of construction has been calculated as 4,929,153 US Dollars (7,907,840 TL). The Total Investment Cost, which includes total project cost and the interest amount during the construction, has been calculated as 39,040,256 US Dollars (62,632,282 TL).

The financial resources concerning the realization of the planned activity are the equity capitals of the investor Temmuz Electricity Generation Inc. and foreign based loans that it will be provided. The total estimated cost of the construction works of Onur Regulator and Onur HEPP has been determined as 33,618,972 TL (**Table 3.1**).

Table 3.1. The Construction Costs of the Facility

NO	CONSTRUCTION COSTS OF THE FACILITY	EXPLORATION COST	
		TL	US $
1	Diversion and Cofferdam	240,645	150,000
2	Onur Regulator	5,851,413	3,647,331
3	Energy Tunnel	21,627,503	13,480,960
4	Filling Concrete and Penstock	2,534,760	1,573,745
5	Powerhouse	2,349,117	1,464,263
6	Construction Facilities	367,690	229,190
7	Roads	441,344	275,101
7.1	Regulator Access Road	51,877	32,336
7.2	Powerhouse Access Road	389,467	242,764
8	Powerhouse Interception Channel	20,532	12,798
9	Regulator Bridge	195,968	122,152
SUM OF CONSTRUCTION WORKS		33,618,972	20,955,540

III.2. The Flowchart and Timetable Concerning the Realization of the Project

The process flowchart of the project is given in **Figure 3.2.1,** and the construction phase of the activity is planned to be completed in 32 months. Test operations are planned to be performed in the last 6 months of this period. The timetable that displays working schedule is given in **Appendix: 11.**

Process Flowchart

Process flowchart for the facility is given below.

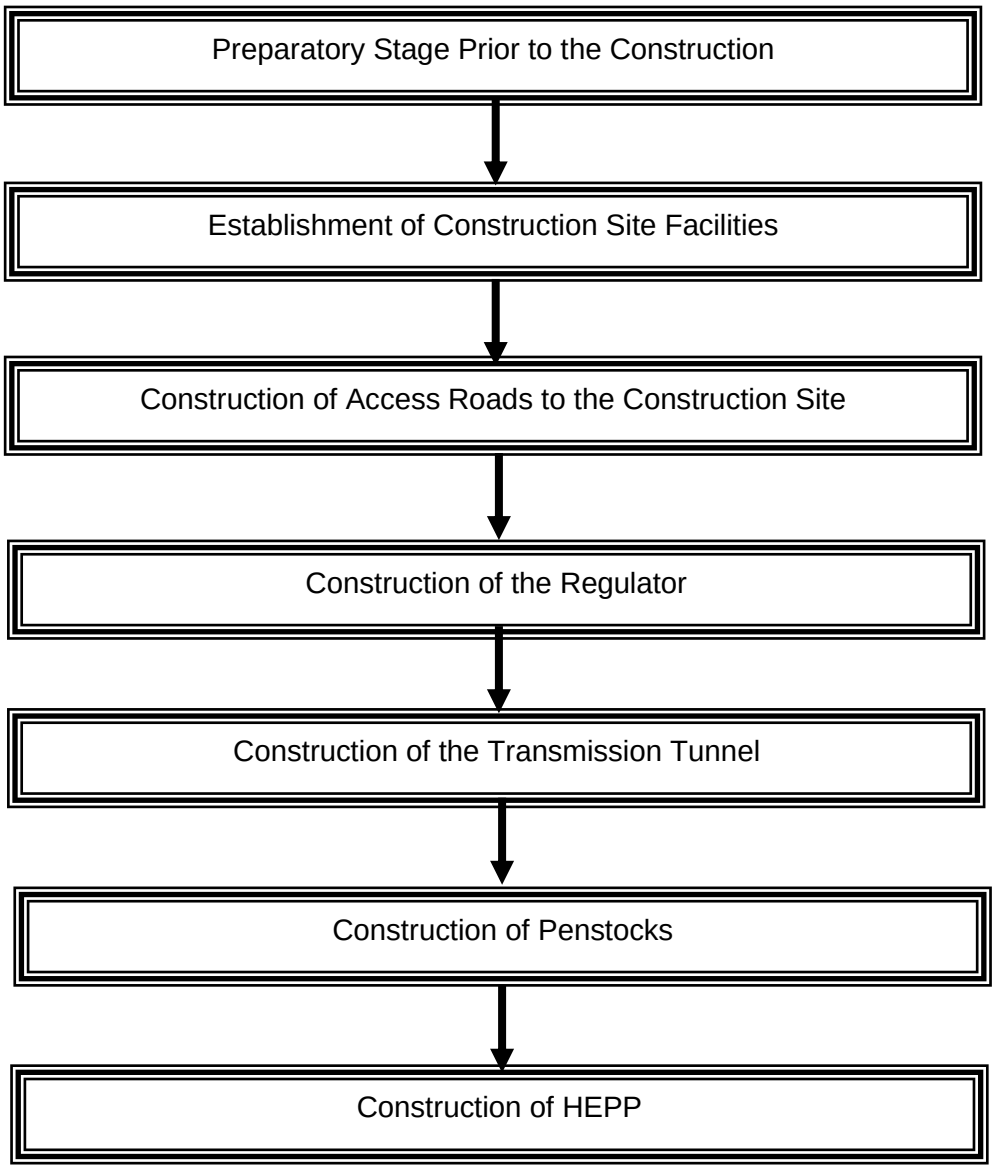

Figure 3.2.1. Process Flowchart

III.3. Cost-Benefit Analysis of the Project

The assessment of Onur Regulator and HEPP facilities with regards to the national economy has been made. With this aim, 50-year period has been determined as the economical lifespan of the project. Within the framework of the following criteria, an annual interest rate of 9.5% has been used for reliable and secondary energy profits, investment and 50-years of operation period and for calculation of the project incomes. As economical analysis is examined with regards to the national economy, Insurance, Independent Consultant, Capitalization, and Value-Added-Tax are not included in the sum of the investment cost account. The investment cost of the project and its distribution by years are given in **Table 3.3.1.**

Table 3.3.1. The Investment Cost of Onur Regulator and HEPP Project and Its Distribution by Years According to SHW Costs

		Total	1."6 Months"	2."6 Months"	3."6 Months"	4."6 Months"	5."8 Months"
Diversion and Cofferdam	(1)	150.000	150.000				
Onur Regulator	(2)	3.647.331	486.311	1.458.932	1.458.932	243.155	
Energy Tunnel	(3)	13.480.960		4.044.288	4.044.288	4.044.288	1.348.098
Filling Concrete and Penstock	(4)	1.573.745				1.049.184	524.582
Powerhouse	(5)	1.464.283			292.853	585.705	585.705
Construction Facilities	(6)	229.190	229.190				
Roads	(7)	275.101	275.101				
Powerhouse Intercep. Chan.	(8)	12.798		12.798			
Regulator Bridge	(9)	122.152	122.152				
Construction Works	(10)=(1)+..+(9)	20.955.540	1.262.753	5.516.018	5.796.073	5.592.312	2.458.383
Electromechanical Equipment	(11)	7.338.000			1.467.600	2.935.200	2.935.200
Exploration Cost	(12)=(10)+(11)	28.293.540	1.262.753	5.516.018	7.263.673	8.857.512	5.393.583
Uncertain Expenses	(13)= (10)*0,10+ (11)*0,005	2.485.454	126.275	551.802	652.987	735.991	392.599
Energy Transmission Line	(14)	750.000				250.00	500.00
Total Cost of Facility	(15)= (12)+(13)+(14)	31.505.994	1.389.029	5.067.620	7.916.680	9.846.503	6.286.181
Survey Design Inspection	(16)= (10)*1,10*0,10	2.305.109	138.903	606.762	637.668	651.454	270.422
Expropriation	(17)	300.000	300.000				
Project Cost	(18)= (15)+(16)+(17)	34.111.103	1.827.931	6.674.382	8.554.228	10.497.958	6.556.603
Interest During the Project	(19)(*)	4.929.163	500.504	1.450.336	1.398.870	1.172.502	408.940
Cumulative Loan of the Period	(20)		2.326.436	10.453.154	20.404.263	32.074.712	39.040.255
Total Investment Cost	(21)=(18)+(19)	39.040.250	2.328.436	8.124.719	9.951.099	11.670.460	6.965.543

*Interest rate is taken as 9.5%.

ANNUAL PROFITS

The unit profit values of the General Directorate of State Hydraulic Works that has foreseen to be used for economical analysis are given below:

Reliable Energy : 6.0 cent/kWh
Secondary Energy : 3.3 cent/kWh

Unit profit values to be used for the economical analysis that is made according to the market prices are taken as 8.0 Dollar-Cent:

Reliable Energy : 8.0 cent/kWh
Secondary Energy : 8.0 cent/kWh

The amount of energy that can be acquired within the scope of Onur Regulator and HEPP project are given below. The energy profits to be acquired by energy generation of Onur HEPP have been calculated in two different ways; according to State Hydraulic Works (SHW) prices and market prices, and given below.

Reliable Energy : 3,485 GWh/year
Secondary Energy : 39,364 GWh/year
Total Energy : 42,848 GWh/year

Total Annual Energy Profit

According to SHW Prices
Reliable Energy Profit : 209,100 US Dollars
Secondary Energy Profit : 1,299,012 US Dollars
Total Energy Profit : 1,508,112 US Dollars
According to the Market Prices
Reliable Energy Profit : 278,800 US Dollars
Secondary Energy Profit : 3,149,120 US Dollars
Total Energy Profit : 3,427,920 US Dollars

ANNUAL EXPENSES

The annual expenses, to be calculated here, will be used for doing cost-benefit analysis of the facility in terms of national economy. Therefore, annual expenses will be calculated according to the general principles accepted for the energy investments.

Annual expenses are composed of the sum of “Interest **+** Amortization **+** Renovation Expenses” and “Operation **+** Maintenance Expenses”.

As cost items that are used for the economic assessment of the facility are calculated using SHW Unit Prices; in the following sections mentioned as “Market Prices”, it is accepted that the investment can be materialized based with a discount of 25% on the basis of SHW Unit Prices.

For Onur Regulator and HEPP project, annual total expense calculated according to the SHW prices is 4,107,116 US Dollars, and annual total expense with regards to the market prices is 3,352,812 US Dollars.

INCOME/EXPENSE RATE

As it is possible to calculate the income/expense rates of the projects by dividing annual income into annual expenses, it is also possible to calculate it by moving the 50-years' cash flow of income and expenses to the first year by considering a certain discount rate (9.5% for this project), and by taking the ratio of these rates. The income/expense rate of Onur Regulator and HEPP Project is calculated by both of the methods in consideration with 50-years period of time.

Table 3.3.2. The Income/Expense Rate for Onur Regulator and HEPP Project (According to SHW Prices)

Year	Expenses			Incomes (US $)	Present Value		Reliable Energy (GWh)	Secondary Energy (GWh)	Total Energy (GWh)
	Project Cost (US $)	Operation and Maintenance (US $)	Total (US $)		Expenses (US $)	Incomes (US $)			
	(1)	(2)	(3) = (1)+(2)	(4)	(3) / 1.095^n	(4) / 1.095^n			
1	8,502,314		8,502,314		7,764,670				
2	19,052,186		19,052,186		15,889,732				
3	6,556,603	106,498	6,663,101	502,704	5,074,977	382,886	1.162	13.121	14.283
4	0	319,494	319,494	1,508,112	222,232	1,049,004	3.485	39.364	42.849
5	0	319,494	319,494	1,508,112	202,951	957,994	3.485	39.364	42.849
6	0	319,494	319,494	1,508,112	185,344	874,881	3.485	39.364	42.849
7	0	319,494	319,494	1,508,112	169,264	798,978	3.485	39.364	42.849
8	0	319,494	319,494	1,508,112	154,579	729,660	3.485	39.364	42.849
9	0	319,494	319,494	1,508,112	141,168	666,356	3.485	39.364	42.849
10	0	319,494	319,494	1,508,112	128,920	608,545	3.485	39.364	42.849
11	0	319,494	319,494	1,508,112	117,735	555,748	3.485	39.364	42.849
12	0	319,494	319,494	1,508,112	107,521	507,533	3.485	39.364	42.849
13	0	319,494	319,494	1,508,112	98,193	463,500	3.485	39.364	42.849
14	0	319,494	319,494	1,508,112	89,674	423,288	3.485	39.364	42.849
15	0	319,494	319,494	1,508,112	81,894	386,564	3.485	39.364	42.849
16	0	319,494	319,494	1,508,112	74,789	353,027	3.485	39.364	42.849
17	0	319,494	319,494	1,508,112	68,300	322,399	3.485	39.364	42.849
18	0	319,494	319,494	1,508,112	62,375	294,428	3.485	39.364	42.849
19	0	319,494	319,494	1,508,112	56,963	268,884	3.485	39.364	42.849
20	0	319,494	319,494	1,508,112	52,021	245,556	3.485	39.364	42.849
21	0	319,494	319,494	1,508,112	47,508	224,252	3.485	39.364	42.849
22	0	319,494	319,494	1,508,112	43,386	204,797	3.485	39.364	42.849
23	0	319,494	319,494	1,508,112	39,622	187,029	3.485	39.364	42.849
24	0	319,494	319,494	1,508,112	36,185	170,803	3.485	39.364	42.849
25	0	319,494	319,494	1,508,112	33,045	155,984	3.485	39.364	42.849
26	0	319,494	319,494	1,508,112	30,178	142,451	3.485	39.364	42.849
27	0	319,494	319,494	1,508,112	27,560	130,093	3.485	39.364	42.849
28	0	319,494	319,494	1,508,112	25,169	118,806	3.485	39.364	42.849
29	0	319,494	319,494	1,508,112	22,985	108,499	3.485	39.364	42.849
30	0	319,494	319,494	1,508,112	20,991	99,085	3.485	39.364	42.849
31	0	319,494	319,494	1,508,112	19,170	90,489	3.485	39.364	42.849
32	0	319,494	319,494	1,508,112	17,507	82,638	3.485	39.364	42.849
33	0	319,494	319,494	1,508,112	15,988	75,469	3.485	39.364	42.849
34	0	319,494	319,494	1,508,112	14,601	68,921	3.485	39.364	42.849
35	0	319,494	319,494	1,508,112	13,334	62,942	3.485	39.364	42.849
36	0	319,494	319,494	1,508,112	12,177	57,481	3.485	39.364	42.849
37	0	319,494	319,494	1,508,112	11,121	52,494	3.485	39.364	42.849
38	7,704,900	319,494	8,024,394	1,508,112	255,080	47,940	3.485	39.364	42.849
39	0	319,494	319,494	1,508,112	9,275	43,781	3.485	39.364	42.849

40	0	319,494	319,494	1,508,112	8,470	39,982	3.485	39.364	42.849
41	0	319,494	319,494	1,508,112	7,735	36,514	3.485	39.364	42.849
42	0	319,494	319,494	1,508,112	7,064	33,346	3.485	39.364	42.849
43	0	319,494	319,494	1,508,112	6,451	30,453	3.485	39.364	42.849
44	0	319,494	319,494	1,508,112	5,892	27,811	3.485	39.364	42.849
45	0	319,494	319,494	1,508,112	5,381	25,398	3.485	39.364	42.849
46	0	319,494	319,494	1,508,112	4,914	23,194	3.485	39.364	42.849
47	0	319,494	319,494	1,508,112	4,487	21,182	3.485	39.364	42.849
48	0	319,494	319,494	1,508,112	4,098	19,344	3.485	39.364	42.849
49	0	319,494	319,494	1,508,112	3,743	17,666	3.485	39.364	42.849
50	0	319,494	319,494	1,508,112	3,418	16,133	3.485	39.364	42.849
51	0	319,494	319,494	1,508,112	3,121	14,734	3.485	39.364	42.849
52	0	319,494	319,494	1,508,112	2,851	13,455	3.485	39.364	42.849
53	0	212,996	212,996	1,005,408	1,735	8,192	2.323	26.243	28.566
								Average	
					31,507,550	12,340,592	3.417	38.592	42.009
Total Income/ Total Expense = 0.392									

INTERNAL PROFITABILITY RATE

The calculation of internal profitability rate, which is the discount rate that equals the sum of operation **and** maintenance costs with the annual energy income that is moved to the first year, is given in **Table 3.3.1.**

As it is also seen in **Table 3.3.2,** the internal profitability rate cannot be calculated by SHW Energy Prices and SHW Construction Department Prices. The internal profitability rate of the project becomes 10.45% with Market Energy Prices and Market Construction Unit Prices as can also be seen in **Table 3.3.3.**

Table 3.3.3 Internal Profitability Rate of Onur Regulator and HEPP Project (According to SHW Prices)

Year	Expenses			Incomes (US $)	Difference (US $)	Present Value IRR = 1.84%
	Project Cost (US $)	Operation and Maintenance (US$)	Total (US $)			
	(1)	(2)	(3) = (1)+(2)	(4)	(5) = (4)–(3)	(6)
1	8,502,314		8,502,314		(8,502,314)	-8,348,375
2	19,052,186		19,052,186		(19,052,186)	-18,368,534
3	6,556,603	106,498	6,663,101	502,704	(6,160,397)	-5,831,809
4	0	319,494	319,494	1,508,112	1,188,618	1,104,845
5	0	319,494	319,494	1,508,112	1,188,618	1,084,842
6	0	319,494	319,494	1,508,112	1,188,618	1,065,200
7	0	319,494	319,494	1,508,112	1,188,618	1,045,914
8	0	319,494	319,494	1,508,112	1,188,618	1,026,977
9	0	319,494	319,494	1,508,112	1,188,618	1,008,383
10	0	319,494	319,494	1,508,112	1,188,618	990,126
11	0	319,494	319,494	1,508,112	1,188,618	972,200
12	0	319,494	319,494	1,508,112	1,188,618	954,597
13	0	319,494	319,494	1,508,112	1,188,618	937,314
14	0	319,494	319,494	1,508,112	1,188,618	920,343
15	0	319,494	319,494	1,508,112	1,188,618	903,680
16	0	319,494	319,494	1,508,112	1,188,618	887,319
17	0	319,494	319,494	1,508,112	1,188,618	871,253
18	0	319,494	319,494	1,508,112	1,188,618	855,479
19	0	319,494	319,494	1,508,112	1,188,618	839,990
20	0	319,494	319,494	1,508,112	1,188,618	824,782
21	0	319,494	319,494	1,508,112	1,188,618	809,849

22	0	319,494	319,494	1,508,112	1,188,618	795,186
23	0	319,494	319,494	1,508,112	1,188,618	780,789
24	0	319,494	319,494	1,508,112	1,188,618	766,652
25	0	319,494	319,494	1,508,112	1,188,618	752,772
26	0	319,494	319,494	1,508,112	1,188,618	739,142
27	0	319,494	319,494	1,508,112	1,188,618	725,760
28	0	319,494	319,494	1,508,112	1,188,618	712,620
29	0	319,494	319,494	1,508,112	1,188,618	699,717
30	0	319,494	319,494	1,508,112	1,188,618	687,048
31	0	319,494	319,494	1,508,112	1,188,618	674,609
32	0	319,494	319,494	1,508,112	1,188,618	682,395
33	0	319,494	319,494	1,508,112	1,188,618	650,402
34	0	319,494	319,494	1,508,112	1,188,618	638,626
35	0	319,494	319,494	1,508,112	1,188,618	627,064
36	0	319,494	319,494	1,508,112	1,188,618	615,710
37	0	319,494	319,494	1,508,112	1,188,618	604,583
38	7,704,900	319,494	8,024,394	1,508,112	(6,516,282)	-3,254,347
39	0	319,494	319,494	1,508,112	1,188,618	582,869
40	0	319,494	319,494	1,508,112	1,188,618	572,316
41	0	319,494	319,494	1,508,112	1,188,618	561,954
42	0	319,494	319,494	1,508,112	1,188,618	551,779
43	0	319,494	319,494	1,508,112	1,188,618	541,789
44	0	319,494	319,494	1,508,112	1,188,618	531,980
45	0	319,494	319,494	1,508,112	1,188,618	522,348
46	0	319,494	319,494	1,508,112	1,188,618	512,891
47	0	319,494	319,494	1,508,112	1,188,618	503,605
48	0	319,494	319,494	1,508,112	1,188,618	494,487
49	0	319,494	319,494	1,508,112	1,188,618	485,534
50	0	319,494	319,494	1,508,112	1,188,618	476,743
51	0	319,494	319,494	1,508,112	1,188,618	468,111
52	0	319,494	319,494	1,508,112	1,188,618	459,636
53	0	212,996	212,996	1,005,408	792,412	300,876
TOTAL						0

ASSESSMENT

Considering the construction unit price together with the reliable energy price of 6.00 cent/kWh and secondary energy price of 3.3 cent/kWh that is foreseen by the General Directorate of SHW, the project cannot be regarded as economical.

However, if discounted construction unit prices are considered together with the market prices that the reliable energy price is 8.00 cent/kWh and secondary energy price is 8.00 cent/kWh, the project economy becomes 1.091 cent/kWh.

III.4. Other Economical, Social and Infrastructure Projects that are not within the scope of the project but planned to be conducted by the project owner and other investors depending on the realization of the project

The project will create working opportunities for the locals especially during the construction phase. Moreover, a large part of the social needs of the workers will be provided in the settlements nearby and these activities will create a source of additional income for the locals. During the operation phase of the activity, the workers apart from the qualified staff will also be supplied from the local people.

Some arrangements will be made on the regulator bridge to not pose adverse effects on the residents dealing with animal husbandry at Toklar Village that is situated nearby of the regulator area to be installed within the scope of the project. Moreover, in order to prevent the villagers dealing with animal husbandryto be aggrieved, it will be supported to create new pasture areas. Within this scope, some kind of forage seeds like clover will be supplied to the villagers.

III.5. Other Economical, Social and Infrastructure Projects that are not within the scope of the project but it is indispensible for realization of the project and planned to be conducted by the project owner and other investors

A fish passage will be built so as the fish living in Zinav Stream, on which the project facilities will be built, not to be affected adversely and not to prevent the transition within the river system. Also, to provide access to the regulator to be built within the project, a road of 880 m and to provide access to the power plant area a road of 2,003 m are planned to be constructed.

As another matter is to transmit the generated energy to the distribution and consumption centers pursuant to the suggestions determined by TEİAŞ (Turkish Electricity Transmission Company) and EMRA (Energy Market Regulatory Authority). Within this scope, the energy to be generated at the facility will be connected to the medium voltage busbar of Tuna HEPP basin transformer station. The length of the energy transmission line in question is planned as 9 km.

No other economic, social and infrastructure projects which are indispensable to be materialized by the investor company and the other investors exist within the scope of the activity.

III.6. Information on the property status of the places chosen for the project (Regulator area, HEPP area, storage areas), expropriation, how to make resettlement, enlightenment of public within the scope of expropriation

The structures to be built within the project are Onur Regulator, energy tunnel, penstock and powerhouse. 10.06 ha of Onur Regulator and Onur HEPP project site is located at state's forest site, and the rest 14.51 ha is the area that is not considered as forest area **(Appendix: 16-a).** Expropriation of the forest areas is out of question, but permission will be taken for these areas in accordance with the 17th Article of 6831 numbered Forest Law. Prior to the beginning of the construction, the Regional Directorate of Forestry will be applied and permissions will be taken by carrying out the essential due process.

Moreover, whether the area, where the regulator will be constructed, coincides with an agriculture area or not is going to become apparent as a result of the works on Local Development Plan. In case the area coincides with agricultural land, necessary permissions

will be taken from Tokat Provincial Directorate of Food, Agriculture and Livestock breeding for using the land for non-agricultural purposes in accordance with the provisions of 5403 numbered “Soil Conservation and Land Use Law” that came into force by being published in 19.07.2005 dated and 25880 numbered Official Gazette. As to the expropriation studies, a mutual agreement will be initiated with the owners of the private property. In case of disagreements, expropriation will take place pursuant to the Expropriation Law numbered 4650, which came into force by being published in the Official Gazette dated 05.05.2001 and numbered 24393; and by force of c and d items of the 15th Article of Electricity Market Law No. 4628, changed by law no. 5496.

In accordance with the c and d items of 15th Article of Electricity Market Law No. 4628, changed by law no. 5496, expropriation procedures will be conducted by EMRA (Energy Market Regulatory Authority), and the decision of expropriation will replace the public profit and the real estates, which will have been expropriated, is going to be registered in the register of title on behalf of the treasury.

None of the settlements situated in the project site and near surrounding will stay under water as a result of any of the project activities. Therefore, resettlement within the scope of the project will not be concerned. However, in case the grassland areas that are being used by local residents of Toklar Village dealing with animal husbandry, stay under water; it will be supported to create new pasture areasby the project owner company.

III.7. Other Issues

There exist no issues to be assessed under this section.

CHAPTER IV: DETERMINATION OF THE AREA TO BE AFFECTED BY THE PROJECT OF REGULATOR, HEPP (IF AVAILABLE MATERIAL QUARRIES, CONCRETE PLANT AND CRUSHING-SCREENING FACILITIES) THAT TAKES PLACE WITHIN THE SCOPE OF THE PROJECT AND THE EXPLANATION OF BACKGROUND ENVIRONMENTAL CHARACTERISTICS

IV.1. Determination of the area to be affected by the Project (explanation for how and according to what the influence area is determined and the display of the influence area on the map)

The influence area of the project has been determined considering the potential impacts on air, water and soil pollution. Accordingly, there will be a temporary effect on environment due to the dust and noise to be generated during construction phase of the activity (construction of the regulator, transmission tunnel, HEPP, and construction site facilities) and during the use of excess excavation materials storage area. The precautions indicated in **Chapter IV** will be taken concerning these activities. These impacts will come to an end upon the completion of the construction phase.

According to the calculations given in Chapter IV; the maximum influence area of the project has been determined as; 200 m around the regulator and the transmission tunnel, and 300 m around the HEPP site regarding the dust to be generated; 100 m around the project site regarding the noise; and the area with a radius of 50 m at the tunnel entrance and exit regarding the impacts of blasting vibrations. 300 m, which is the maximum value among these influence distances, has been determined as the project influence area and displayed in 1/25.000 scaled topographic map given in **Appendix: 13.**

IV.2. The characteristics of the physical and biological environment within the influence area and the use of natural resources

IV.2.1. Meteorological and Climatic Characteristics (Indicated on the basis of Province-District)

Tokat Province is situated in the interior parts of Central Black Sea Region. Therefore, it is under the influence of both Black Sea Climatic characteristics and continental climate in Central Anatolia. With this characteristic, its climate has a climatic feature of transition between Black Sea climate and Steppe climate in Central Anatolia. The summer is generally hot and dry in low areas and warm, rainy in patches in uplands, as to winter cold and snowy is the general characteristic of the climate dominant in the province.

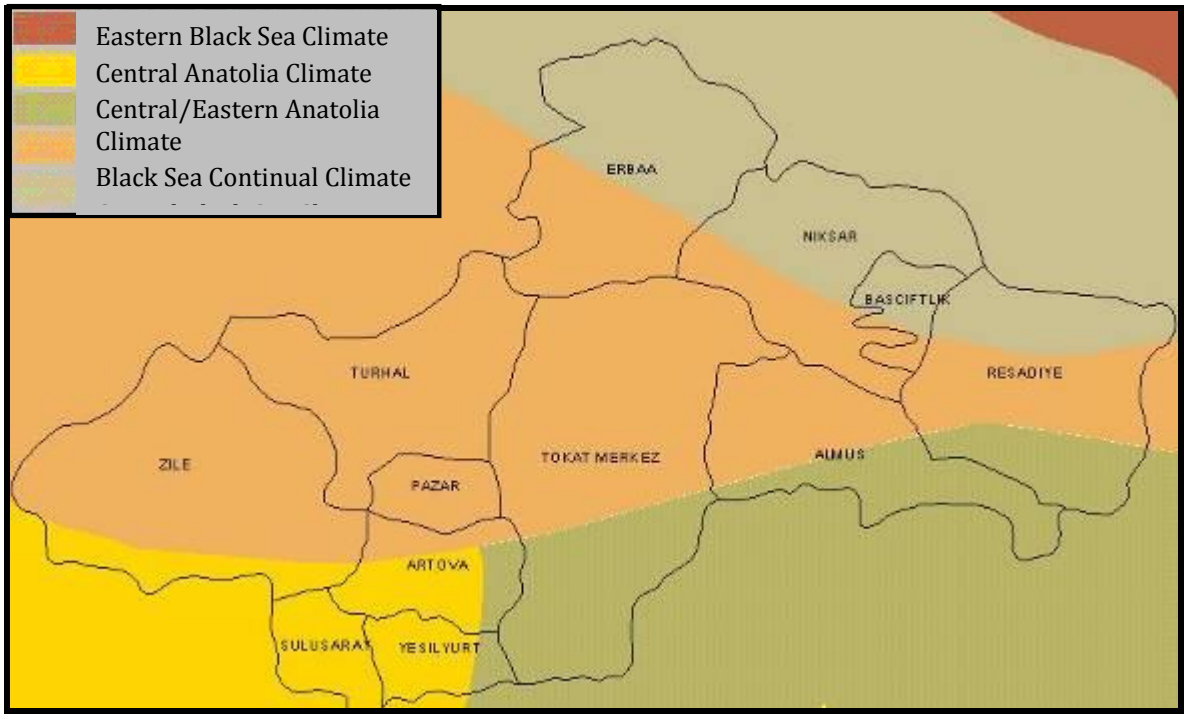

Figure 4.2.1.1. Climate of Tokat Province

The impacts of the distance to the sea and altitude are important in the climatic characteristics of Tokat. Therefore, crucial climatic differences are observed from north to the south. In winter tougher characteristics are observed towards to south.

Temperature: In the region, annual average temperature is 12.38 ^{0}C, and the months in which average temperature is the highest are June and July and the lowest are January and February.

Average of annual maximum temperature is 18.5 ^{0}C, and average of annual minimum temperature is 6.98 ^{0}C. Average highest temperature happened in August as 29.6^{0}C, and average lowest temperature in January as -1.7 ^{0}C.

Precipitation: Themaximum amount of precipitation happened in May and the minimum amount of precipitation in August. The total annual amount of precipitation took place as 448.2 m.

Average Evaporation: It is known that average evaporation took place in May. However, this value was not observed in the meteorological bulletin.

Relative Humidity: : The mean of annual average of relative humidity is 62.2%, and the lowest relative humidity took place is 57.1%.

Average Cloudiness: The average of annual cloudiness is 5.0, and the most cloudiness happened in January as 6.7 whilst the least cloudiness in August as 3.0.

Wind: The mean of annual average wind speed is 2.26 m/s in the region.

Since data of Reşadiye and Bereketli Meteorological stations are inadequate, the long-term meteorological data of Tokat Center Station (1975-2009) have been taken into consideration **(Appendix: 16-h).**

Table 4.2.1.1. Data of Tokat Meteorological Station

METEOROLOGICAL COMPONENTS	Observation Duration (# of years)	MONTHS												
		1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average Pressure (Bar)	35	948.8	947.0	944.9	942.7	943.1	942.1	940.8	941.5	944.7	947.9	949.1	949.0	945.1
Average Temperature (^{0}C)	35	1.8	3.1	7.3	12.5	16.3	19.8	22.2	22.3	18.7	13.6	7.5	3.5	12.4
Average High Temperature (^{0}C)	35	6.0	7.9	13.1	19.0	23.2	26.7	29.0	29.6	26.4	20.5	13.1	7.5	18.5
Average Low Temperature (^{0}C)	35	-1.7	-1.0	2.3	6.7	9.8	12.9	15.5	15.6	12.2	8.2	3.2	0.1	7.0
The Highest Temperature (^{0}C)	35	19.2	22.8	31.1	33.5	36.1	38.5	45.0	40.0	37.3	35.3	27.6	21.8	32.3
The Lowest Temperature (^{0}C)	35	-19.8	-22.1	-21.2	-4.5	0.0	3.2	6.1	7.8	2.4	-2.8	-8.0	-21.0	-6.7
Average Relative Humidity (%)	35	67.8	63.6	59.2	58.9	60.3	58.3	57.1	57.7	59.3	65.0	69.4	70.2	62.2
Average Cloudiness (0-10)	35	6.7	6.4	6	5.8	5.0	3.9	3.5	3.0	3.2	4.5	5.5	6.6	5.0
Total Average Precipitation (mm)	35	41.6	34.7	40.3	59.6	62.1	36.4	12.4	7.2	18.1	44.5	49.3	42.0	37.5
Maximum Daily Precipitation (mm)	35	44.6	27.5	34.7	40.8	49.2	31.5	33.6	23.1	32.9	33.9	36.6	32.1	35.0
Maximum Wind Speed (m/s)	35	48.9	39.3	37.0	33.2	34.2	33.6	22.0	23.3	26.7	28.5	28.8	40.0	33.0
Average Wind Speed (m/s)	35	2.2	2.5	2.8	2.5	2.2	2.2	2.4	2.4	2.1	1.9	1.9	2.1	2.3
Average 5 cm Earth Temperature (^{0}C)	35	2.4	3.8	8.3	14.2	19.6	24.5	28.1	28.1	22.9	15.5	7.7	3.7	14.9

Table 4.2.1.2. Number of Wind Blows with respect to the Directions

Number of blows	DIRECTIONS															
Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	340	801	2378	5477	1830	1129	706	1551	701	821	692	2067	2600	3325	1055	481
February	266	724	2305	5979	2167	1024	692	1279	635	787	555	1839	1912	2432	757	375
March	214	746	2809	7411	2390	1222	880	1377	880	975	605	2099	1849	1757	1757	359
April	240	774	2970	6936	2502	1217	598	2970	606	655	583	2091	2179	2004	519	361
May	355	1095	3445	7934	3184	1296	370	879	467	343	268	1454	1658	2242	578	463
June	480	1238	3859	7533	3642	1279	352	670	407	268	164	969	1521	1703	609	434
July	416	1739	3701	8381	4281	1753	470	757	374	333	111	421	1021	1274	560	370
August	402	1502	3891	6538	2262	952	683	1044	421	668	552	1861	2293	2853	914	298
September	253	973	2688	7577	4121	1659	683	713	411	330	142	822	1473	2290	629	342
October	288	952	2766	7203	3560	1501	801	841	350	327	358	1292	1940	2772	778	300
November	324	909	2552	6538	2262	952	547	1044	421	668	552	1861	2293	2853	914	508

December	2240	889	2240	5045	1957	883	644	1294	634	770	796	2191	3012	3523	1278	508
TOTAL	5478	11541	33226	77075	32328	13738	6720	12868	5606	6124	4686	16900	21151	25703	9293	4318

Table 4.2.1.3. Average Wind Speed with respect to the Directions (m/s)

SPEED	**DIRECTIONS**															
MONTHS	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
January	1.1	1.4	1.5	1.9	1.9	2.4	2.3	2.8	2.8	2.7	2.4	2.3	1.8	1.6	1.2	1.3
February	1.3	1.7	1.7	2.1	2.2	2.4	2.8	3.0	2.9	3.0	2.5	2.5	2.0	1.7	1.3	1.6
March	1.4	1.8	1.9	2.3	2.4	2.6	3.0	2.9	2.9	2.9	2.7	2.6	2.3	1.9	1.5	1.6
April	1.4	1.8	1.7	2.2	2.2	2.3	2.4	2.7	2.6	3.0	2.7	2.9	2.3	2.0	1.5	1.7
May	1.3	1.7	1.6	2.0	2.1	1.9	1.7	2.0	2.1	2.3	2.3	2.5	2.1	1.8	1.3	1.6
June	1.6	1.8	1.6	2.1	2.2	1.8	1.5	1.9	1.7	1.8	1.7	2.3	1.9	1.7	1.3	1.6
July	1.8	2.1	1.8	2.3	2.5	2.1	1.6	1.8	1.5	1.7	1.4	1.7	1.7	1.6	1.3	1.7
August	1.8	2.1	1.9	2.2	2.4	2.0	1.5	1.6	1.3	1.6	1.4	1.8	1.6	1.6	1.3	1.7
September	1.5	1.7	1.6	2.0	2.0	1.6	1.4	1.5	1.5	1.6	1.5	1.9	1.8	1.7	0	1.5
October	1.1	1.5	1.4	1.8	1.8	1.5	1.3	1.5	1.4	1.7	1.7	1.8	1.7	1.5	1.1	1.2
November	1.0	1.4	1.4	1.8	1.7	1.7	1.5	2.0	2.0	2.1	1.8	2.0	1.7	1.6	1.1	1.3
December	1.0	1.4	1.5	1.8	1.8	2.0	2.0	0	2.4	2.4	2.2	2.1	1.6	1.5	1.2	1.3
Average	**1.4**	**1.7**	**1.6**	**2.0**	**2.1**	**2.0**	**1.9**	**2.0**	**2.1**	**2.2**	**2.0**	**2.2**	**1.9**	**1.7**	**1.2**	**1.5**
TOTAL	**16**	**20**	**20**	**25**	**25**	**24**	**23**	**24**	**25**	**27**	**24**	**26**	**23**	**20**	**14**	**18**

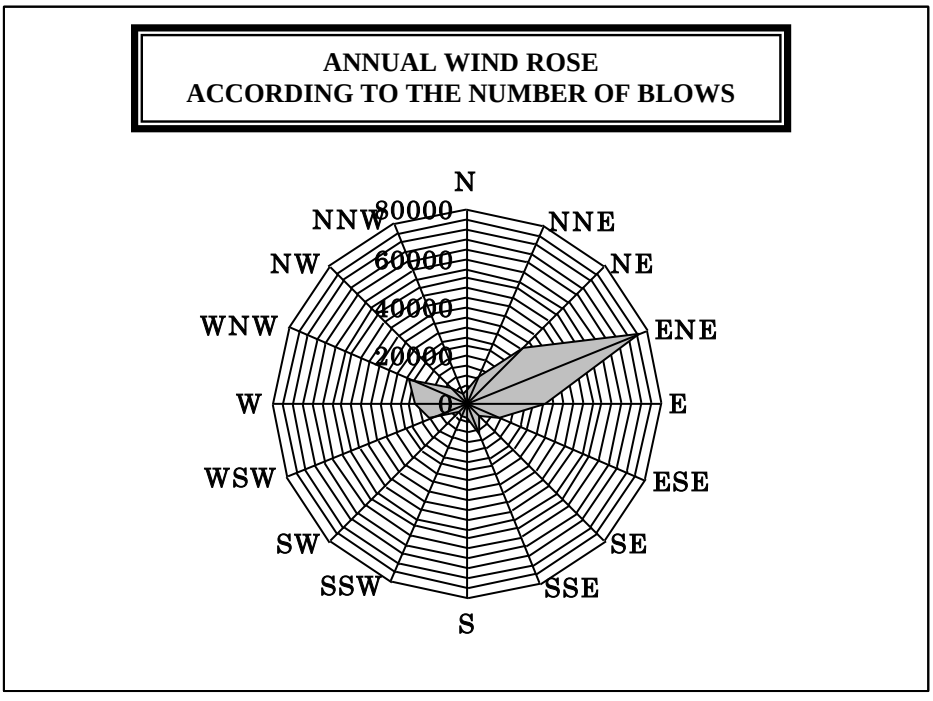

Figure 4.2.1.2 The Annual Wind Rose according to the Number of Blows for Tokat Meteorology Station Long-Term Records

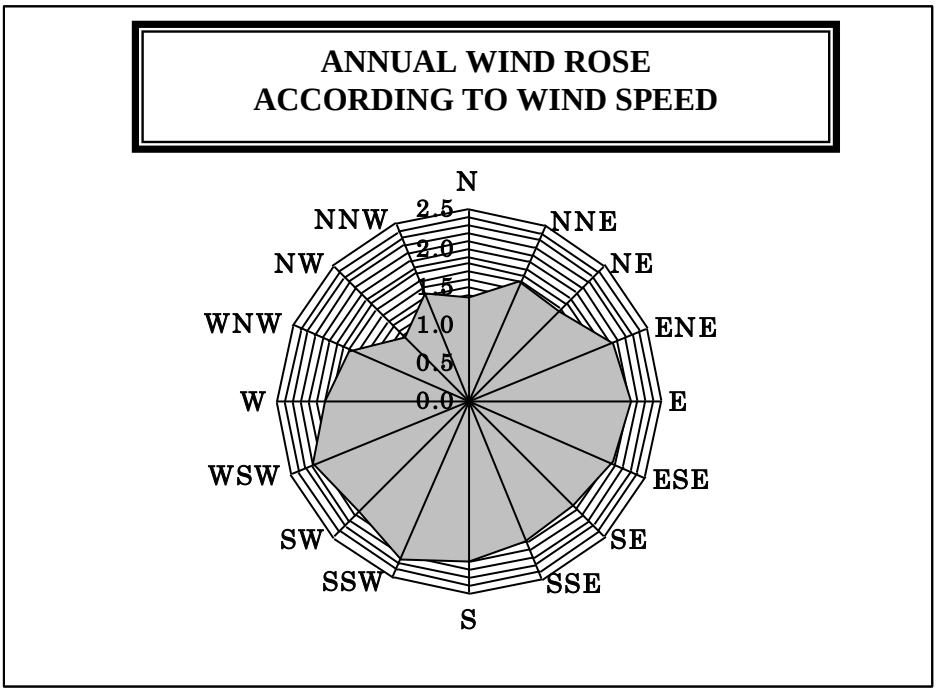

Figure 4.2.1.3. The Annual Wind Rose according to Tokat Meteorology Station Long-Term Records

IV.2.2. Geological Characteristics: The geological characteristics of the project site under two headings; as Regional Geology and Inspection (Activity) Area Geology (the 1/25,000 scaled general geology map in the regional geology chapter and large-scaled geology map of the inspection area (1/5000 or 1/1000 scaled if available) and the stratigraphic column sections (indicating vertical scales), regulator, transmission system (suggested as a tunnel or pipe system) route, forebay, penstock, and the preparation of detailed geological and geotechnical survey report of the power plant area and submission in the appendix (hydrogeological and geomorphological features). The potential for seismicity and natural disasters (the risk of earthquakes, Turkey Seismic Zone Map, etc.). Whether dislocation areas due to fault and fractures on the slopes exist, such as the risks of landsliding, rockfall, avalanche, flood etc., the preparation of 1/25,000 scaled geological map and sections in accordance with map-making techniques, detailing the geological information in accordance with the format, the display of activity area in all figures given pursuant to the scale, in order to assess the geological and geotechnical data, information on the log, hydraulic pressure test, permeability, pressiometer data.

GENERAL GEOLOGY

The locations and lithological features of the geological formations formed at Onur Regulator and HEPP project site and its vicinity are given.

This study has been compiled within the scope of “the Project of Geology and Geothermal Energy Opportunities of Reşadiye (Tokat) Suburbs” prepared by the General Directorate of Mineral Research and Exploration Institute (MTA), Department of Survey and Exploration of Energy Raw Materials.

In the geological and geotechnical studies of the project, the locations and lithological features of the formations have been investigated on the basis of older studies, primarily the study called “The Stratigraphy of the Region between Ünye-Ordu-Koyulhisar-Reşadiye” that was prepared by MTA and published in Journal of Turkey Geology Institution, and “The Project of Geology and Geothermal Energy Opportunities of Reşadiye (Tokat) Suburbs” prepared by MTA, Department of Survey and Exploration of Energy Raw Materials. In order to simplify the explanation and to distinguish lithostratigraphic units in geological mapping, rock units have been investigated by dividing into sub-headings by using informal geographical and lithological names that are compatible with the Stratigraphy Naming Rules together with the unit names used in the previous studies.

STRATIGRAPHY

In the site, Mesozoic and Cenozoic age units exist. Two rock groups, one in the north and the other in the south, exist according to the North Anatolia Fault Zone. On the base of North group, Middle, Upper Jurassic-Lower Cretaceous age Zinav limestone exist. Nebişeyh limestone, a member of Upper Cretaceous age Mesudiye formation, covers the unit inharmoniously. Whilst it is compatible with Nebişeyh limestone member, the boundary of Mesudiye hoard of volcano formation, it is gradational in some places. Mesudiye formation is covered harmoniously by the Bereketli member of Upper Cretaceous age Reşadiye formation. Paleocene age Sarıkayalar limestone, Eocene age Hasanşeyh and Quaternary age Yolüstü basalts cover all these units harmoniously.

Zinav Limestone (JKz)

The unit which outcrops in the north of activity site, around Zinav Lake and along Zinav Stream, around Büyük elmaçalı T., Hankırı T., Betişıh T., was named as Zinav limestone by the previous researchers (Terlemez and Yılmaz, 1980). Zinav limestone has best been observed along the stream.

The unit is generally whitish, grey or dark grey limestone. Low and Upper strata are unbedded in patches or rather thick-bedded, and middle strata are thick-bedded. As the unit is very fractured, calcite-filled, fine-grained, uniform patterned, some parts are oolitic patterned. This limestone with a recrystallized feature is Belemuites, Gastropod and Terebratula macrofossiliferous.

The lower boundary of Zinav limestone, the oldest unit of the activity site, cannot be seen. This limestone, which is generally with a faulted boundary, is covered by Lower Cretaceous Nebişeyh limestone with angular unconformity in the neighborhood of Zinav Stream.

The thickness of unit does not show a significant alteration in the survey site. It is about 300 m at the measured section at Zinav channel (Terlemez and Yılmaz, 1980) Zinav limestone has a thickness of 250-300 m in average.

These fossils have been found in the samples taken from various strata of Zinav limestone:

Cuneolina sp.
Paalzovvella sp.
Sprillina sp.
Globigerina sp.
Textulariidae Solenoporaceae (algae).

According to these fossils, the age of the unit is given as Medium-Upper Jura-Lower Cretaceous. Seymen studying around Reşadiye (1975) gave the age of Upper Jura-Upper Cretaceous to this unit and accepted the rock types in the region from Jura to Paleocene as compatible. The fact that it was deposited in a shallow marine environment can be said according to the fossils, which the formation includes, and rock type features.

The unit is equivalent to the formation defined as “Hankın Hill Limestone” by Seymen (1975).

Mesudiye Formation

Mesudiye formation is a non-segregated formation. The most typical outcrops of the intercalation composed of agglomerate, basic flow, limestone, tuffite and sandstone are seen around Mesudiye. Two members being as Tolluk tuff-sandstone and Nebişeyh limestone member are segregated in some places within this formation. However, it has not been possible to segregate these members in most places. Therefore, the obligation of adding Mesudiye nonsegregated formation term has arisen. It is likely to come across this formation in the region from Gölköy-Aybastı line to the Black Sea, in and around Mesudiye, on the north slope of Kelkit Valley between Reşadiye and Koyulhisar, in the north of Reşadiye, and around Zinav Lake.

Let's address to the features of the rock types composing this formation. They are agglomerate, dark greyish-brownish in color, unstratified, thick-stratified in patches, gravels are small, large, and block size and mostly andesite and basalt. Its concrete is loose or tight and composed of tuff and andesite. The gravels are sharp and unsorted, contact to each other is rather much in firm cemented ones, and doesn't exist in very loose-cemented ones.

Basic flow is usually andesite, basalt in patches, and in syphilitic character. Dark grey, brownish, greenish and purple; medium-thick stratified, coatless in patches, quite nonapparent patterned, displaying fine grained flow structure, fractured in different directions and the fractures are calcite-filled in patches. Sometimes, it makes up asperities which are agglomerated featured and in the form of lump in patches due to weathering. These basic flows are more dominant in the north (the north of Gölköy-Aybastı line). At a porphyria pattern that is apparent microscopically, sericitized, partly altered and albitized plagioclase crystals, pseudo-shapes filled with a bit of clinopyroxene remains, chlorite, full of chlorite, and uralite and quartz aggregates that surrounds pseudo-shapes in circles have been observed which is a chloric material and composed of opaque minerals.

Limestone is composed of Nebişeyh Limestone member in Mesudiye Town, but limestone strata that cannot be distinguished as a map unit, and tuffaceous clayey and sandy limestone strata with different features are seen. It is grey, green and claret red, generally thin to medium bedded. The ratio of sand and clay in it, and tuff and clay ratio in the north increases around Mesudiye. It is fractured in various directions, and fractures are calcite and silica-filled, without fine crystalline patterns, and touching is rough. It includes basic flow and agglomerate granules in patches and a gradual transition is observed.

The granules of the sandstone which is the least observed rock type in Mesudiye formation are totally of volcanic origin; greenish, grey reddish, and dirty yellow colored, thin to medium bedded. Generally, the granules are medium-rounded, poorly sorted, and sometimes medium sorted. Most of the fine-grained elements are volcanic. It shows global decomposition in patches.

It is possible to see terrestrial pebble stone strata in Mesudiye formation. The pepples of the pebble stones are in various sizes, medium sized, rounded; and contact to each other is rather rare. Besides, they are seen in limestone and volcanite. Loose tuff and limestone contains concrete. Moreover, variable dykes that cut this formation are observed.

Tuff-Sandstone Member of Tolluk (Kmt)

Tuff-sandstone intercalation, which is segregated at each strata of Mesudiye formation and creates the lowest strata of the formation, has only been encountered at Tolluk Hill, in the near north of Zinav Lake. This member is generally tuff and sandstone intercalated and with medium-stratum, little calcareous sandstone, greenish grey limestone inter-extrinsic in patches, and involves abundant pelecypod.

Nebişeyh Limestone Member (Kmn)

Nebişeyh limestone member belonging to Mesudiye formation, is outcropped around Reşadiye, Zinav Stream, Kaşpınar, Nebişeyh, Kapalı, Kırık T. in the survey site. "Nebişeyh Limestone Member" title was given by Terlemez and Yılmaz (1980). The unit has best been observed around Nebişeyh Village.

The unit, red colored, regular, thin to medium bedded, sandy in patches, brittle structured, clastic and composed of limestone that is interbedded with marn in patches.

Under this unit, Zinav limestone is situated inharmoniously. Nebişeyh limestone has filled the grabens that were formed due to the erode of Zinav limestone and perfused their surface. Terlemez and Yılmaz (1980) supported the opinion that the nature of contact between two units is incompatible, as to Seymen (1975), he asserts that this contact is compatible.

The upper contact of the unit is compatible or gradient with Upper-cretaceous Mesudiye formation.

The thickness of Nebişeyh limestone member is between 50 - 100 m.

Terlemez and Yılmaz (1980), found the following fossils in the samples they took from the unit.

Globotruncana linnei ana (d' orb.)
G. Cf. coronata Balli
G. Tricarinata (Que)
G. Ventricosa or G. Concavata inter types
G. Cf. globigerinoides plum.

According to these fossils, its age is Coniacian-Campanian.

In the studies performed by Kalyoncuoğlu et al. (1975), they found fossils that were at the same age. It can be said that the unit precipitated at a shallow depth, in a still medium. This unit is equivalent to the units defined by Seymen (1975) as red colored limestone strata in Kızıltepe formation, by Kalyoncuoğlu et al. (1975) as Upper-Cretaceous limestone, by Terlemez and Yılmaz (1980) as Nebişeyh limestone member and by Koçak and Erzenoğlu (1987) as Lower-Cretaceous Nebişeyh limestone.

Tollu tuff-sandstone member and Nebişeyh limestone member which composes the lower elevation of Mesudiye formation, has filled the grabens that were formed due to the erode of Zinav limestone and in a condition that it perfused their surface, so we can say that there is a definite incompatibility between them.

Reşadiye Formation Member of Bereketli (Krb)

In the study zone, Bereketli member belonging to Reşadiye formation outcrops in the north of Karakil Hill. , Akyarbaşı H., Ağulu slope, around Gülayağı Neighborhood, and along 5^{th} -10^{th} km of Reşadiye-Bereketli Road.

Generally, there exist grey, greyish, pink, thin stratified, lamina in patches, in the unit composed of brittle marns, medium-stratified, clayey, sandy limestone substratum.Limestone is grey, large-grained, brittle fracture, calcite-filled, and rich in foraminifer.

Within this member, in the site between Karakil T. in the east and Zinav Lake in the west, rich bentonite beds are precipitated. The relationship of lower boundary of Bereketli member with Nebişeyh limestone can be seen in the south of Zinav channel and in Kaşpınar Village. It covers this member harmoniously and besides there is not gradual alteration between them. Moreover, this member covers Mesudiye formation harmoniously. On the Bereketli member, Paleocene Sarıkayalar detritus limestone member exits inharmoniously. The thickness of Bereketli member changes between 100 and 150 m. Terlemez and Yılmaz (1980) in their studies, measured this member as 130 m in the north of Reşadiye and observed the following fossils in the examples compiled from the mentioned member:

Globotruncana arca (cushman)
G. cf. conica white
Orbitoides sp.
Siderolites sp.
Globigerina sp.
Gümbelina sp.

The unit is at Maastrichtian age according to these data.

This member is generally precipitated in a neritic environment, but sediments in pelagic characteristics precipitated in the places where the sea becomes deeper in patches (Terlemez and Yılmaz, 1980).

Bereketli member; Kalyoncuoğlu et al. (1975)'s Upper-Createous flysh is equivalent to Terlemez and Yılmaz (1980)'s Bereketli member, Koçak and Erzenoğlu (1987)'s Upper-Cretaceous flysh strata, some strata of Seymen (1975)'s Upper-Campanian - Lower-Maastrichtian covered formation.

Alluvium (Qal)

In the project site, the unit observed as River alluvium, being so little along the Zinav Stream, is (1-2 m) miscellaneous origin and covers all the units inharmoniously.

Talus

Talus was formed by particularly Mesudiye formation and by accumulation of fault breccia material on the slopes in the faulty zones of Zinav limestone. It has been observed that it reaches to a thickness of 1-8 m around regulator and power plant site.

STRUCTURAL GEOLOGY

Faults

In the places where rocks don't conform to mechanics of shape, variable fractures and faults have been occurred. The majors are:

Northern Anatolia Fault Zone is crushed fault zone, where a team of active faults lying parallel to each other or intersecting at acute angle at approximately NW-SE direction, formed in a zone of 2 km width in the north and south of Kelkit Valley. It has been observed that, right-oriented strike-slipped faults lie about 11 km and intersect Tertiary, Quaternary units. Besides, in this crushed zone, about 1 km length of NW-SE oriented cleavage fracture occurred in thermal spring travertine close to Reşadiye. Plenty of water springs exist around this fracture. In the north of Reşadiye, NE-SW oriented 3 usual faults, parallel to each other and 2.5 km in length, exist. These faults intersects Upper-Cretaceous and Paleocene units.

Earthquake Condition

The area of investigation is within the 1st degree earthquake zone according to Turkey Earthquake Map of the General Directorate of Disaster Affairs. Active ground acceleration coefficient should be considered as (Ao): 0.40 for 1st degree earthquake zone.

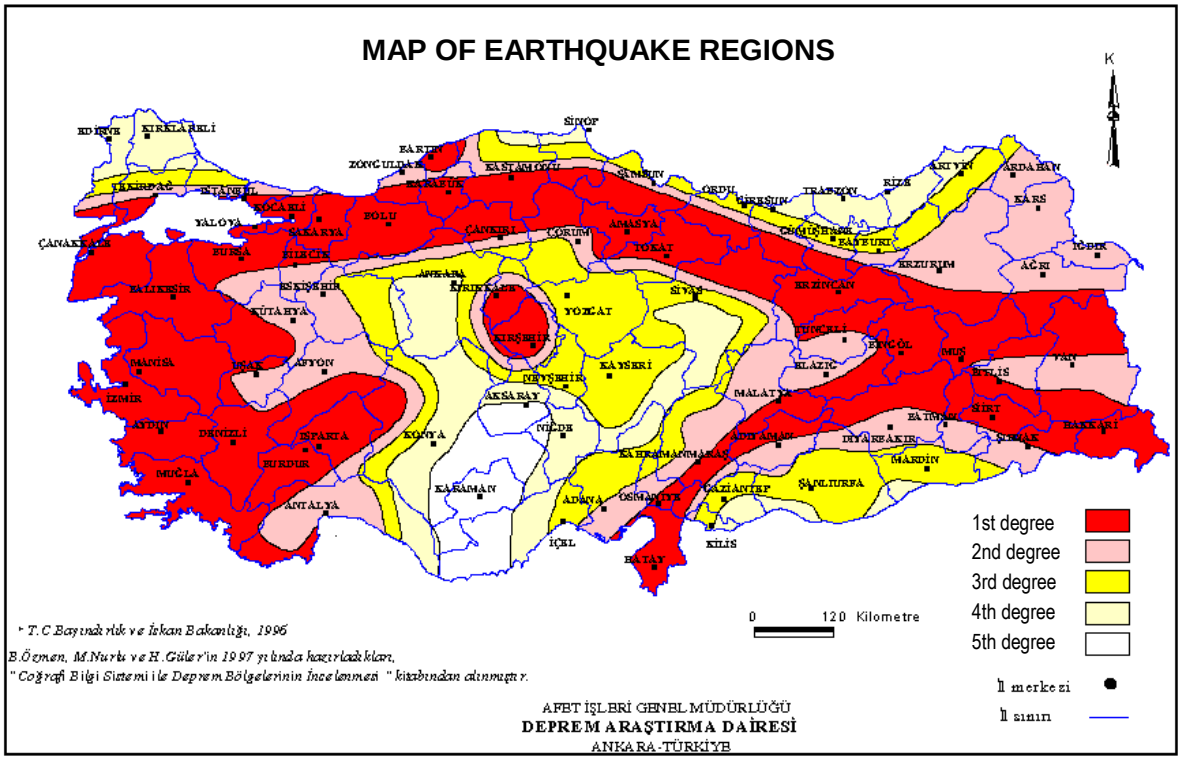

Figure 4.2.2.1. Earthquake Map of Turkey

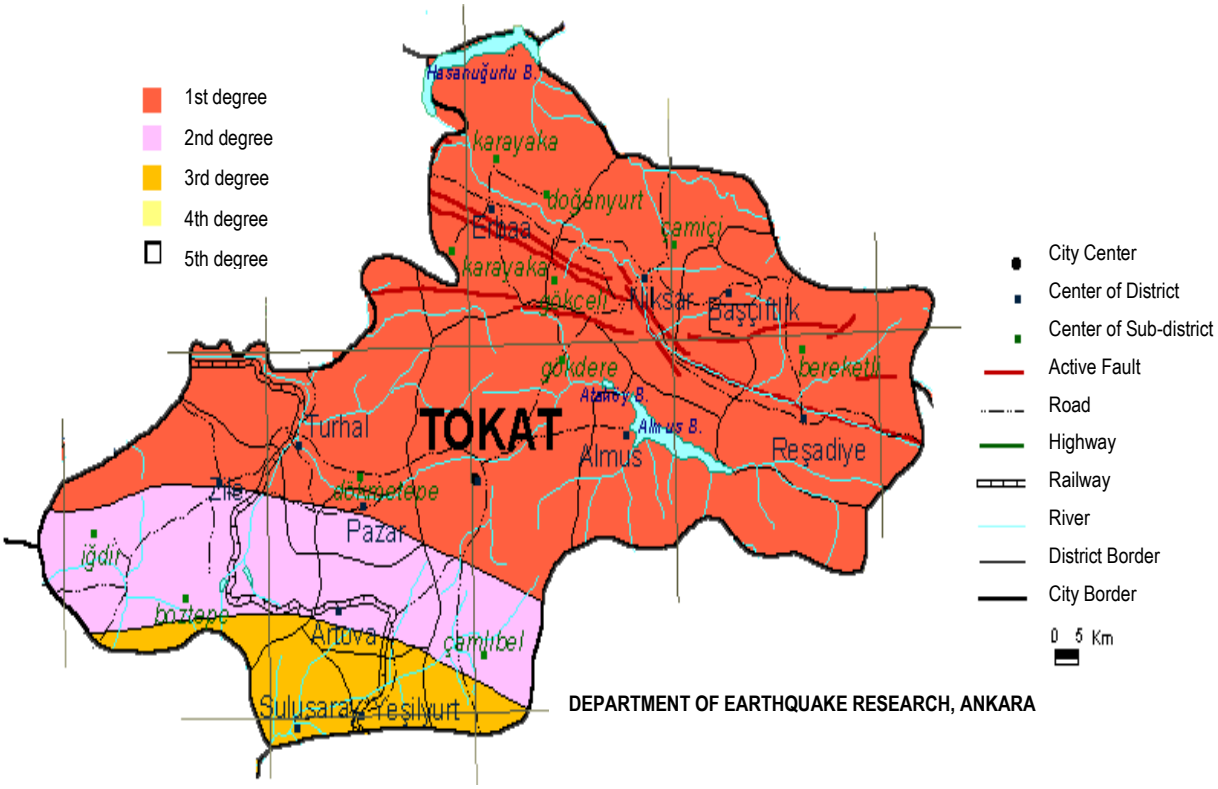

Figure 4.2.2.2. Map of Earthquake Regions of Tokat Province

ENGINEERING GEOLOGY

Ground Research

Within the scope of Onur Regulator and HEPP project, soil exploration for regulator, sedimentation pool, energy tunnel, and powerhouse have been examined in terms of geological and geotechnical features; and within the prepared research programme research drillings, on-site experiments and lab experiments have been conducted.

Ground Drillings

Within the scope of Onur Regulator and HEPP project, with the aim of determining geological and geotechnical features, totally 727.10 m of ground drilling operations have been conducted by 16 Crealius XC-90H and D-750 type drilling machines. The depth of these drillings and groundwater levels are given in the table below.

Table 4.2.2.1. The Depth of Conducted Drillings and Groundwater Level

NO	DRILLING NO	DRILLING SITE	TOTAL DRILLING DEPTH	GROUNDWATER LEVEL	DRILLING ALTITUDE	COORDINATES	
						X	Y
1	RSK-1	REGULATOR	35.00	11.10	1181	4484993	607064
2	RSK-2	REGULATOR	27.00	2.00	1171	4485014	607088
3	RSK-3	REGULATOR	29.00	0.50	1171	4485014	607110
4	RSK-4	REGULATOR	36.00	13.30	1182	4484970	607080
5	RSK-5	REGULATOR	24.00	8.00	1183	4485233	607094
6	RSK-6	REGULATOR	24.00	17.20	1193	4485278	607255
7	RSK-7	REGULATOR	35.00	17.20	1189	4485084	606998
8	RSK-2-1	REGULATOR	22.50	3.20	1172	4485029	607078
9	SSK-1	POWERHOUSE	31.00	6.50	960	4482106	608435
10	SSK-2	POWERHOUSE	26.00	3.50	957	4482111	608421
11	SSK-3	POWERHOUSE	25.00	4.00	958	4482084	608424
12	SSK-4	POWERHOUSE	24.60	12.00	972	4482134	608494
13	TSK-1	TUNNEL ROUTE	200.00	--	1311	4484391	607490
14	TSK-2	TUNNEL LOCATION	145.00	--	1323	4483451	607916
15	KSK-1	BRIDGE	15.50	3.80	1179	4485764	607085
16	KSK-2	BRIDGE	15.50	3.90	1179	4485786	607113

Regulator Area Drilling Wells

They were opened during the ground drilling works at the regulator area with aim of determining geological and geotechnical characteristics and the location and thickness of the units underground.

RSK-1, RSK-2, RSK-2-1, RSK-3, RSK-4, RSK-5, RSK-6, RSK-7; totally 7 ground drilling wells were opened and totally 232.5 m of drilling were made.

- **Drilling Well NoRSK-1:**

0.00-7.00 m talus: The unit which is composed ofpebbles and blocks of basalt changing from 1 cm to 3 m size, brownish-colored clay in patches (the blocks of basalt are grey-silver colored and include air pores in patches, exist blocks whose size reach to 2 m also exist).

7.00-22.50 m greenish-colored clay: clay and from place to place pebbles of basalt exist.

22.50-31.15 m greenish-colored clay.

31.15-35.00 m greenish-colored sandstone: joints with plenty of sections developed vertically and longitudinal, and hardened a little.

- **Drilling Well NoRSK-2:**

0.00-2.50 m talus: The unit which is composed of pebbles and blocks of basalt changing from 1 cm to 2 m size, brownish-colored clay in patches (the blocks of basalt are grey-silver colored and include air pores in patches).

2.50-9.20 m greenish-colored clay:units composed of pebbles of basalt and blocks with greenish-colored clay intercalation.

9.20-24.00 m greenish clay stone:sandy clay stone with few pebbles (the sand of low-medium indurated units and colored clays are greenish.

24.00-26.50 m greenish-colored conglomerate 1-3 cm pebble size, units' grains that are little sandy and clayey are rounded.

26.50-27.00 m greenish-colored sandstone with lots of cracks and pieces

- **Drilling Well NoRSK-3:**

0.00-2.00 m talus: The unit which is composed of pebbles and blocks of basalt, changing from 1 cm to 2 m size, brownish-colored clay in patches.

2.00-24.20 m greyish-colored sandstone: the sand of low-medium indurated units is reddish and colored clays are greenish.

Between 24.20 and 29.00 m approximately 25.00 m greenish-colored loose cemented conglomerate (1-3 cm size rounded pebbled); up to 25.00-28.50 m greenish-colored fractured sandstone; between 28.50 and 29.00 m greenish-colored loose cemented conglomerate is observed.

- **Drilling Well NoRSK-4:**

0.00-6.00 m talus: The unit which is composed of pebbles and blocks of basalt changing from 1 cm to 3 m size, brownish- colored clay in patches (between 6 and 9 mlight brownish colored clayey sandstone passed. Blocks of basalts are grey colored, includeair pores in patches).

6.00-36.00 m. greenish-colored clay: pebbles of basalt are passed in patches.

- **Drilling Well NoRSK-5 :**

0.00-2.50 m talus: The unit is composed of pebbles and blocks of basalt changing from 1 cm to 2 m size, brownish-colored clay in patches (the blocks of basalt are grey-silver colored and include air pores in patches)

2.50-24.00 m sandy clay stone: (the sand of low-medium indurated units is reddish colored andclays are greenish.

- **Drilling Well NoRSK-6:**

0.00-2.00 m talus: The unit is composed of pebbles and blocks of basalt changing from 1 cm to 2 m size, brownish-colored clay in patches (the blocks of basalt are grey-silver colored and include air pores in patches)

2.00-24.00 msandy claystone: (the sand of low-medium indurated units is reddish and colored clays are greenish.)

- **Drilling Well NoRSK-7:**

0.00-2.00 m talus: The unit is composed of pebbles and blocks of basalt changing from 1 cm to 2 m size, brownish-colored clay in patches (the blocks of basalt are grey-silver colored and include air pores in patches)

2.00-12.20 mincludes the unit composed of pebbles and blocks of basalt and whitish-colored clay intercalation.

12.20-18.20 msandy claystone: (the sand of low-medium indurated units is reddish and colored clays are greenish.)

18.20-24.00 m includes the unit composed of pebbles and blocks of basalt and whitish-colored clay intercalation.

24.00-24.70 mgreenish-colored conglomerate: its pebbles are medium rounded and in the shape of strip.

24.70-35.00 mfew pebbled sandy claystone : the sand of low-medium indurated units is reddish and colored coldbond clays are greenish.

<u>The Drilling Wells on The Route of Energy Tunnel</u>

On the axis of the tunnel, the two drilling wells no. TSK-1 and no. TSK-2 are opened and worked on with the aim of determining the location and thickness of the units.

- **The Drilling Well NoTSK-1;**

0.00-18.00 m Bereketli Member: Upper-parts (0-4.0m) constitute greenish colored clay(wide bentonite beds in the region) and there are medium-layered, clayey, sandy limestone interfingers in the unit composed of generally grey, greyish pink colored, laminated in patches, fragile marns.

As limestone are grey, large-grained, hard cracked, calcite-filled, whitish pinkycolored sandstones; the unit that is composed of siltstone and limestone in patches has vertical and angle joint system and its surface is rough.

18.00-88.00m Nebişeyh Limestone: Yellowish, pinkycolored, sandy in patches, the unit composed of siltstone and limestone in patches have vertical and angle joint system and its surface is rough and rusty in patches.

88.00-145.00 m Zinav Limestone: It is generally a whitish, grey or dark grey colored limestone. The unit is very crackled, calcite-filled, fine-grained, uniform filled, and sometimes oolitic textured. Having recrystallized feature, this limestone includes vertical and angled joints, and their surface is rough and rusty in patches.

- **Drilling Well NoTSK-2;**

0.00-28.50 m Bereketli Member: Its upper-parts (0-6.9m)develop greenish clay, and the unit which is generally grey, greyish pink colored, laminated in patches, there are medium-layered, clayey, sandy limestone intercalations. Limestone are grey, large-grained, hard crackled, calcite-filled, and the surface of the unit which has whitish pinkycolored sandstones, siltstones and limestone in patches, own a vertical and angled joint system and rough.

28.50-72.00m Nebişeyh Limestone: Yellowish, pinkycolored, sandy in patches, the unit composed of siltstone and limestone in patches have vertical and angle joint system and its surface is rough and rusty in patches.

72.00-200.00 m Zinav Limestone: Generally whitish, grey, dark-grey colored limestone. The unit has a hard-crackled, calcite-filled, in some parts oolitic texture. In these limestone that are recrystallized include vertical and angled joints, its surface is rough and rusty in patches.

Power Plant Area Drilling Wells

At powerhouse area, 4 drilling wells numbered SSK1-SSK2-SSK3-SSK4 have been opened in order to determine the location and thickness of the units.

- **The Drilling Well NoSSK-1;**

0.00-6.50m Talus: 0.5-4 cm clay including size limestone, siltstone, sandstone pebbles, interbedded talus.

6.50-20.50m clayey, pebbled sandstone: greyishcolored, mow-medium indurated clayey sandstone; sandstones' crackles filled with clay (10-30 cm brownish clay strips are used). Between 13.50 and 13.90 m, conglomerate strip is used. In 19.00-20.50 m brownish-reddishcolored sandy limestone, there are whitish colored limestone up to 2mm-2cm.

20.50-31.00 m limestone: whitish and pinky in patches limestone were observed. Crackled in width and length, the cracked surface of limestone are filled with calcite. Sometimes, pinky colored clay intercalation are available.

- **The Drilling Well NoSSK-2;**

0.00-6.50m Talus: 0.5-4 cm size limestone, siltstone, sandstone pebbles, interbedded talus.

6.50-14.00m claystone-siltstone: clayey elevations are passed in patches in reddishcolored claystone, and there are conglomerate strips.

14.00-26.00 mlimestone: whitish in patches, mostly pinky colored limestone largely has angled joint system. It has been observed that vertical joints are developed, and their surface is smooth and rarely rusty.

- **Drilling Well No SSK-3:**

0.00-7.50 m Talus: 1-3 cm size composed of claystone, sandstone and clay intercalation.

7.50-12.80 m: There are brownish, reddishcolored clayey sandstone, limestone intercalation at lower levels, andlimestone are reddish, much crackled and fragmental. Sandstones are latitudinal and angled-junction and its crackled surface is clayey.

12.80-25.00 mSandstone: greyishcolored sandstone is calcite-filled in patches, and in the unit round-grained conglomerate strips of 30-50 and 100 cmare used.

- **Drilling Well No SSK-4:**

0.00-8.00 m Talus: composed of 1-3 cm size claystone, sandstone and clay intercalations.

8.00-24.60 m pinky-reddishcolored claystone composed of conglomerate strips are rather crackled, the joint structure are angular developed, and the surface is rough.

Research Holes

Totally 5 research holes were opened at the regulator area, particularly on the right bank, where the walls will be built and potential flowing will happen. .

- **Research Hole No A.Ç.-1:**

The unit with generally a brownish looking, changing from 1cm to 80 cm size basalt pebbles and blocks which is composed sandy clays exist in this research hole at the regulator area, on the right bank, where the regulator wall will be placed. Groundwater hasn't been encountered.

- **Research Hole A.Ç.-2:**

The unit with generally a brownish looking changing from 1 cm to 30 cm size basalt pebbles and blocks which is composed sandy clays exist in this research hole at the regulator area, on the right bank, where the regulator wall will be placed. Groundwater hasn't been encountered.

- **Research Hole No A.Ç.-3:**

In this research hole which was opened on the right bank for any kind of risk that can happen during the digging of regulator wall, from 1 cm to 30 cm size unit composed of basalt pebbles and blocks including composed sandy clays exist. The clay is brownish and greenish in patches. Groundwater hasn't been encountered.

- **Research Hole No A.Ç.-4**

In this research hole which was opened on the right bank for any kind of risk that can happen during the digging of regulator wall, from 1 cm to 30 cm size unit composed of basalt pebbles and blocks including composed sandy clays exist. The clay is brownish and greenish in patches. Groundwater hasn't been encountered.

- **Research Hole No A.Ç.-5:**

In the research hole which was opened for the flows that might happen at the clayey levels, greenish colored clays were observed. The thickness of this unit that was defined as bentonite roughly is thought to be 5-7 m. Groundwater hasn't been encountered.

On-Site Experiments

Necessary field tests for the construction which will be made in this activity area have been done. In the power plant area, ground bearing capacity have been calculated by doing the pressiometer experiment. In the studies made at the regulator area, ground bearing capacity has been calculated by doing the Standard Penetration Test (SPT), additionally an opinion has been formed on ground permeability by doing Pressurized Water Test (PWT). Moreover,PWT has been done at the drillings made on energy tunnel route.

Standard Penetration Tests (SPT)

The SPT experiments done in the units in the regulator and bridge area are summarized in **Table 4.2.2.2**.

Table 4.2.2.2. The Results of StandardPenetration Test

	Drilling No					
Depth (m)	**RSK-1 N30**	**RSK-4 N30**	**RSK-5 N30**	**RSK-6 N30**	**KSK-1 N30**	**KSK-2 N30**
1.50-1.95	50/3	-	50/12	34	50/7	50/11
3.00-3.45	-	-	-	24	50/2	50/9
4.50-4.95	50/3	-	-	26	50/9	50/8
6.00-6.45	-	50/3	50/8	50/8	50/8	50/4
7.50-7.95	50/3	-	-	50/3	56	50/2
9.00-9.45	50/2	-	-	50/2	50/9	68
10.50-10.95	50/4	-	63	-	27	28
12.00-12.45	50/4	-	-	-	28	28
13.50-13.95	50/4	-	50/7	-	29	31
15.00-15.45	50/4	-	50/7	-	31	29
16.50-16.95	50/4	-	-	-	-	-
18.00-18.45	50/4	-	-	-	-	-
19.50-19.95	-	-	-	-	30	33

Pressurized Water Test (PWT)

Pressurized Water Test (PWT) has been doneat the rock unit which is located under talus at the regulator area. The experiments have been done at 2-4-6-8-10 bar levels by turns. The results of the experiments are displayed in **Table 4.2.2.3.**

Table 4.2.2.3. The Experiment Results of Pressurized Water Test (PWT)

RSK-1 Pressurized Water Test	
Depth(m)	Water Leakage-Lugeon
23.00-25.00	Packer could not be attached.
25.00-27.00	4.45
27.00-29.00	2.98
29.00-31.00	Packer could not be attached.
31.00-33.00	3.83
33.00-35.00	4.06
RSK-2 Pressurized Water Test	
Depth(m)	Water Leakage-Lugeon
12.00-14.00	Packer could not be attached.
14.00-16.00	Packer could not be attached.
16.00-18.00	1.26
18.00-20.00	1.13
20.00-22.00	1.16
22.00-24.00	1.22
24.00-26.00	1.11
RSK-3 Pressurized Water Test	
Depth(m)	Water Leakage-Lugeon
11.00-13.00	Packer could not be attached.
13.00-15.00	1.32
15.00-17.00	0.99
17.00-19.00	1.03
19.00-21.00	0.84
21.00-23.00	0.79
23.00-25.00	1.03
25.00-27.00	1.03
27.00-29.00	1.08

Pressiometer Experiment

Pressiometer experiments have been made at various depths at RSK-4 and RSK-2-1 wells at the regulator area and SSK-1 and SSK-2 wells at power plant area. Depths and net limit pressure are given in **Table 4.2.2.4.**

Table 4.2.2.4. Pressiometer Experiment Results

RSK-4 Pressiometer Experiment	
Depth(m)	Net Limit Pressure (kg/cm²)
24.00	24.9
26.00	24.9
28.00	26.9
30.00	26.9
32.00	26.9
RSK-2-1 Pressiometer Experiment	
Depth(m)	Net Limit Pressure (kg/cm²)
11.00	24.9
13.00	24.9
15.00	24.9
17.00	26.9
19.00	27.6
21.00	20.9

23.00	26.9
SSK-1 Pressiometer Experiment	
Depth(m)	Net Limit Pressure (kg/cm²)
12.00	26.9
14.00	26.9
16.00	24.9
18.00	26.9
20.00	24.9
22.00	24.9
24.00	24.9
26.00	26.9
SSK-2 Pressiometer Experiment	
Depth(m)	Net Limit Pressure (kg/cm²)
14.00	26.9
16.00	24.9
18.00	27.9
20.00	26.9
22.00	26.9
24.00	24.9
26.00	24.9

Lab Experiments

Sieve analysis, Atterberg limits, water content, unit weight, unconfined compressive strength, point load test, the uniaxial compression test, triaxial compression tests, shear box test, poisson ratio, elasticity modulus, the Los Angeles test, Frost resistance (Na_2SO_4), and water chemistry experiments have been conducted on the disturbed and undisturbed samples taken from the drillings and research holes.

The Results of Lab Experiments on Regulator Area Ground

The results of the experiments conducted on the samples taken from RSK-1, RSK-2, RSK-3, RSK-4, RSK-5, RSK-6 RSK-7, RSK-2-1 numbered research drillings and A.Ç.-1, A.Ç.-2, A.Ç.-3, A.Ç.-4, A.Ç.-5 numbered research holes are given in **Table 4.2.2.5.** as a summary. Additionally, the details of lab experiments are given in Appendix.

Table 4.2.2.5. The Results of Lab Experiments on Regulator Area Ground

Drilling-Research Hole No	Sample no	Depth (m)	Ground Class	Atterberg limits			Unit Weight (g/cm^3)	Uniaxial compression test qu (kg/cm^2)	Point load test Is (kg/cm^2)
				LL%	PL%	PI%			
RSK-1	CR-1	18.00	CH	57.3	27.3	30.0			
RSK-2	CR-1	16.80-16.95					2.05		1.1
RSK-2	CR-1	21.30-21.50					2.06	8.7	
RSK-2-1	CR-1	13.50-13.70					2.01	10.5	
RSK-2-1	CR-2	18.00-18.20					2.05	10.2	
RSK-3	CR-1	13.00-13.15					2.07		0.8
RSK-3	CR-2	16.85-17.00					2.06	11.0	
RSK-3	CR-3	22.50-22.70					2.05	9.0	
RSK-6	SPT-2	3.00	MH	78.9	48.1	30.8			
RSK-6	SPT-4	6.00	MH	65.3	33.6	31.7			

Drilling-Research Hole No	Sample No	Depth (m)	Ground Class	Atterberg limits			Unit weight	Direct Shear (UU)	
				LL%	PL%	PI%	g/cm^3	(Q ^{0})	qu-kg/cm^2
AÇ-1	NUM-1	2.0-4.0	GM	58.6	30.9	27.7	1.87	14	0.307
AÇ-2	NUM-2	1.0-3.0	CH	57.0	26.9	30.1	1.89	11	0.360
AÇ-3	NUM-3	1.0-3.0	CH	64.9	28.6	36.3	1.90	10	0.371
AÇ-4	NUM-4	0.5-2.5	CH	68.1	30.2	37.9	1.91	9	0.425
AÇ-5	NUM-5	1.0-2.0	CH	78.1	31.9	46.2	1.91	9	0.451

The Results of Lab Experiments on Power Plant Area Ground

The results of the lab experiments conducted on SSK-1, SSK-2, SSK-3, and SSK-4 numbered research drillings opened at power plant area are summarized in**Table 4.2.2.6.**

Table 4.2.2.6. The Results of Lab Experiments on Power Plant Area Ground

Drilling-Research Hole No	Depth Meter	Elevation of Groundwater	Unit weight g/cm^3	Uniaxial compression test qu kg/cm^2	Point load test Is kg/cm^2	Triaxial compression tests	
						C kgf/cm^2	Ø (˚)
SSK-1	8.80-9.00				25.5		
SSK-1	10.80-11.00		2.05			67	46
SSK-1	11.00-11.20		2.06	281.9			
SSK-1	13.75-1385		2.01		10.6		
SSK-1	16.60-16.70		2.05		9.9		
SSK-1	20.10-20.25		2.07		11.7		
SSK-2	10.75-11.00		2.06			44	32
SSK-2	11.00-11.30		2.05		6.3		
SSK-2	12.40-12.55				28.5		
SSK-2	19.10-19.30				30.1		
SSK-2	22.80-23.00				6.9		
SSK-2	26.10-26.25				6.6		
SSK-3	10.80-11.00			7.50			
SSK-3	13.80-14.00				5.0		

The Results of Lab Experiments on Energy Tunnel Drillings

The results of the lab experiments conducted on the TSK-1 and TSK-2 numbered research drillings opened on the route of energy tunnel are given in **Table 4.2.2.7.**

Table 4.2.2.7. The Results of Lab Experiments on Energy Tunnel Drillings

Drilling-Research Hole No	Depth Meter	Elevation of Groundwater	Unit Weight g/cm^3	Uniaxial compression test qu kg/cm^2	Point load test Is kg/cm^2	Elasticity Module ε Gpa	Poisson Ratio V
TSK-2	11.00-11.05	--	2.59		18.9		
TSK-2	22.10-22.20	--	2.60		17.8		
TSK-2	34.40-34.50	--	2.69		13.5		
TSK-2	46.00-46.10	--	2.70		14.0		
TSK-2	52.70-52.80	--	2.66		13.6		
TSK-2	61.00-61.20	--	2.69	132.6		4.4	0.37
TSK-2	186.50-186.70	--	2.62	222.6			
TSK-2	191.20-191.40	--	2.62	468.1			
TSK-2	193.50-193.60	--	2.64		33.4		

Engineering Characteristics of Construction Area

The Engineering characteristics of Regulator Area:

Sandy claystones compose Mesudiye formation, which is the bedrock at the regulator area. The unit consisted of basalt (basalt pebbles and blocks) and clay intercalations cover this unit in patches. 1-2 m thickness blocked alluviums exist in the river bed. On the right bank, there is talus whose thickness varies from 2 to 7 m on Mesudiye formation and on the left bank, the talus is at 2-3 m thickness.

Bearing Capacity of The Regulator Area

At the regulator area, regulator will be built on low-medium hardened sandy claystone ground in case of talus and alluviumis stripped by excavation. In order to determine the bearing capacity of the foundation ground, presiometer on-site tests were conducted at RSK-2-1 and RSK-4 drilling wells and also lab experiments were conducted on the samples taken from the drilling wells. The bearing capacity of the ground were calculated with regard to the results of lab and presiometer tests.

A- The bearing capacity of the unit composed of basalt (basalt pebbles and blocks) and clay intercalation:

For the safe bearing capacity of this unit at the regulator area (especially the part where the regulator wall is on the right bank), the parameters obtained in lab will be used.

q_u : Ultimate bearing capacity of foundation ground

c : Cohesion of foundation ground : 0.383 (average)

(Q ^{0}) : Angle of internal friction : 11 (average)

D : Ground depth (m) : 10 m

B : Ground width (m) : 4 m

γ_1 : Unit weight of the foundation on ground level : 1.90 g/cm^3(average)

γ_2 : Unit weight of the ground under the foundation level : 1.90 g/cm^3 (average)

N_c, N_q, N_γ: Bearing capacity factors found by utilizing angle of internal friction of foundation ground.

$$q = K_1 \times c \times Nc + \gamma_1 \times D_f \times Nq + K_2 \times N_\gamma \times B \times \gamma_2$$

By using Terzaghi'sbearing capacity equation,

qd = 100.20 ton /m^3

By taking the safety factor as SF = 4; the safe bearing capacity of this unit at the regulator area is found as **(Qa)=2.5 kg/cm^2**.

BEARING CAPACITY CALCULATED BY PRESSIOMETER DATA

At the drilling No RSK-1;

Ground Depth : 20.00

q = Bearing capacity

q_{em} = Safe Bearing Capacity

$q = (q_0 + (kg \times P_l^*)$

$q_{em} = (q_0 + (kg \times P_l^*)) / 4$

kg = 0.8

q_0 = 3.80 kg/cm^2

P_l^* = 20.90 kg/cm^2

$$q_{em} = \frac{3.80 + (0.8 \times 20.9)}{4} = 5.130 \text{ kg/cm}^2$$

51.300 q_{em} = ton/m^2

According to on-site pressiometer tests average results, it is found as **5.13 kg/cm^2**.

The Bearing Capacity of Sandy Claystone Unit:

The regulator axle(body) at the regulator area will be at 1158 elevation. As it will be built on this unit, the parameters obtained at laboratory will be used for safe bearing capacity. Rocky grounds whose unconfined compressive strength is under 10 kg/cm^2 are classified as large-grained isolated grounds and evaluated as the ground while allowable stress is calculated.

q_u : Ultimate bearing capacity of foundation ground

c : Cohesion of foundation ground : 9.90 (average)

(Q ^{0}) : Angle of internal friction : 0 (average)

D : Ground depth (m) : 7 m

B : Ground width (m) : 3 m

γ_1 : Unit weight of the foundation on ground level : 2.05 g/cm^3 (average)

γ_2 : Unit weight of the ground under the foundation level : 2.05 g/cm^3 (average)

N_c, N_q, N_γ: Bearing capacity factors found by utilizing angle of internal friction of foundation ground.

$$q = K_1 \times c \times Nc + \gamma_1 \times D_f \times Nq + K_2 \times N_\gamma \times B \times \gamma_2$$

By using Terzaghi bearing capacity equation,

qd = 296.80 ton /m^3

By taking the safety factor as **SF = 4**; the safe bearing capacity of this unit at the regulator area is found as (**Qa)=7.42 kg/cm^2.**

BEARING CAPACITY CALCULATED BY PRESSIOMETER DATA

At the drilling No RSK-2-1;

Ground Depth : 22.00

Q = Bearing capacity

q_{em} = Safe Bearing Capacity

$q = (q_0 + (kg \times P_l^*))$

$q_{em} = (q_0 + (kg \times P_l^*)) / 4$

kg = 0.8

q_0 = 4.18 kg/cm^2

P_l^* = 24.90 kg/cm^2

$$q_{em} = \frac{4.18 + (0.8 \times 24.9)}{4} = 6.025 \text{ kg/cm}^2$$

60.25

q_{em} = 0 ton/m^2

According to average results of on-site pressiometer experiments, it was found as **6.03 kg/cm^2**.

According to these results, though there is not any bearing capacity problem on the axle (body) part of the regulator, a bearing problem is expected as there is much load on the foundation under the regulator wall.

"Jet-Grout", "Secant Piles" and "Bored Piles" can be benefited for the bearing problem of the subject area. Which system is the most suitable should be decided considering the soil structure and the economy of the work.

Permeability of the Regulator Area

Pressurized Water Tests, at 2 m intervals and 2-4-6-8-10-8-6-4-2 bar levels, were conducted in the wells numbered RSK-1,RSK-2,ESK-3 which were opened at the regulator area.

Permeability was measured in the Pressurized Water Tests (PWT) conducted in the RSK-2 and RSK-3 numbered wells in regulator axle (body) area. The results displayed that permeability was "impermeable or low-permeable" (water leakage varies between 0.79 lugeon and 1.32 lugeon). In the experiments conducted in RSK-1 well, the result is "low-permeable" (water leakage varies between 2.98 lugeon and 4.45 lugeon).Packer couldn't be attached especially at upper levels dependent on the key provision of the wells where pressurized water texts were conducted. Foundation ground is loose-little cemented at upper levels where packer couldn't be attached. Considering the fact that RSK-1 numbered well, which was opened on the right bank,has the feature of being low-permeable (close to permeability edge); wells will be opened along the regulator wall and regulator axle at 3 m intervals. It will be suitable to design an injection curtain at a depth of 8-10 m with regard to the ground of the wells.

Permeability-Lugeon	Permeability
< 1	Impermeable
1-5	Low-permeable
5-25	Permeable
>25	High-permeable

Slopes of the Regulator Area

It will be enough to take slope excavation as 3/1 (3 vertical / 1 horizontal) in the excavation to be conducted in the regulator axle area.

By benefiting from natural land, lab experiments were carried out on the disturbed samplestaken from the excavation conducted for the regulator wall on the right bank at the regulator area. On the results of these experiments, ground shear strength parameters cohesion is between (c) : 0.307 and 0.451 kgf/cm^{2}angle of internal friction is between (Ø) 9^o and 14^o. Conversion analysis were made by taking the average values in calculations and using slide slope 5.0 program. It was sloped at 1/1 incline of slope so that slope height will be 8 m and palya width 5 m. It will provide stability on this sloped ground until regulator and wall construction are finished. Calculations and drawings are displayed in the Appendix.

The left bank wall of the regulator axle are composed by basalts. The hill named as Castle Hill is entirely composed of basalts. There exist rocks which are decomposed, split or nearly split under atmospheric conditions. In order not to experience any problem both during the construction and subsequent to project, it is necessary to clean hill basalt fallouts and potential fallout parts.

The Engineering Characteristics of Power Plant Area

The bedrockat the power plant area is composed by Mesudiye formation Tolluk member limestone. Various origin talus rubbles are observed on this unit.

Bearing Capacity of Power Plant Area

In case talus rubbles are stripped by stripping excavations in the power plant area, power plant foundation will be built on sandy limestone. In order to determine ground bearing capacity, on-site pressiometer experiments were conducted in SSK-1 and SSK-2 numbered drilling wells and additionally lab experiments were done on the samples taken from the drilling wells.The bearing capacity of the ground was determined with regards to the results of lab and pressiometer tests.

The following parameters determined in the lab will be used for the safe bearing capacity in power plant area. Though ground is rocky, it is considered as the ground due to the fact that the lowest uniaxial value is 7.50 kg/cm^2.

q_u : Ultimate bearing capacity of foundation ground

c : Cohesion of foundation ground : 7.50/2- 3.75 (the lowest uniaxial result)

(Q ^{0}) : Angle of internal friction : 0

D : Ground depth (m) : 8 m

B : Ground width (m) : 4 m

γ_1 : Unit weight of the foundation on ground level : 2.05 g/cm^3 (average)

γ_2 : Unit weight of the ground under the foundation level : 2.05 g/cm^3 (average)

N_c, N_q, N_γ: Bearing capacity factors found by utilizing angle of internal friction of foundation ground.

By using Terzaghi bearing capacity equation,

$$q = K_1 \times c \times Nc + \gamma_1 \times D_f \times Nq + K_2 \times N_\gamma \times B \times \gamma_2$$

qd = 230.15 ton /m^3

By taking the safety factor as **SF = 4**; the safe bearing capacity of this unit at the regulator area is found as **(Qa)=5.75 kg/cm^2.**

BEARING CAPACITY CALCULATIONS BY PRESSOMETER DATA

At the drilling No SK-1;

Ground Depth : 8.00

Q = Bearing capacity

q_{em} = Safe bearing capacity

$q = (q_0 + (kg \times P_l^*))$

$q_{em} = (q_0 + (kg \times P_l^*)) / 4$

kg = 0.8

q_0 = 1.52 kg/cm^2

P_l^* = 24.90 kg/cm^2

$$q_{em} = \frac{1.52 + (0.8 \times 24.9)}{4} = 5.360 \text{ kg/cm}^2$$

53.60

q_{em} = 0 ton/m^2

According to on-site pressiometer test, average result is found as **5.36 kg/cm^2**.

The Slope of Power Plant Area

The power plant will be built on sandy limestone.As it is thoughtthat approximately 8 m excavations will happen, considering the crackled systems of the unit and the structure of the rock, slope excavation rate will be suitable as1:1.5 (1:horizontal,1.5 vertical). However, excavation of the talus above and removal of it from the construction area will hamper excavating problems that are caused by the flowing of these materials into the excavation hole with surface water.

Besides, as the powerhouse is located in Olca river bed, the flowing direction of the stream should be changed against flood or overflow risk, or necessary rehabilitation works should be carried out.

The Engineering Characteristics of Tunnel Route

Two different formations will be cut in the energy tunnel whose approximate length will be 3125 m. These formations are Nebişeyh Limestone member (Kmn) and Zinav limestone (Jkz). Limestone that is between 0+000 - 0+060 km, yellowish pinkycolored, sandy in patches, at claystone and marn levels will be cut and the tunnel portal will be opened in this unit. Whitish, grey, dark grey colored limestone will be reached from 0+060 to 3+125 m which is the end of the tunnel. The unit is very crackled, calcite-filled, fine-grained, and ootilic texture in patches in addition to having recrystallization feature.

The Bearing Capacity of the Tunnel Route

The tunnel route will be composed of two different units. In order to determine the bearing capacity of foundation ground , lab experiments were conducted on the samples taken from TSK-1 and TSK-2 numbered drilling wells. The bearing capacity of the foundation ground was calculated according to the experiment results.

For the safe bearing capacity in the power plant area, the following parameters obtained in the lab will be used. Though ground is rocky, it is considered as the ground due to the fact that the lowest uniaxial value is 13.00 kg/cm^2.

q_u : Ultimate bearing capacity of foundation ground

c : Cohesion of foundation ground : 13.00/2: 6.50

(Q ^{0}) : Angle of internal friction : 0

D : Ground depth (m) : 1 m

B : Ground width (m) : 1 m

γ_1 : Unit weight of the foundation on ground level : 2.60 g/cm^3 (average)

γ_2 : Unit weight of the ground under the foundation level : 2.60 g/cm^3 (average)

N_c, N_q, N_γ: Bearing capacity factors found by utilizing angle of internal friction of foundation ground.

$$q = K_1 \times c \times Nc + \gamma_1 \times D_f \times Nq + K_2 \times N_\gamma \times B \times \gamma_2$$

By using Terzaghi bearing capacity equation;
qd = 149.10 ton /m^3

By taking the safety factor as **SF = 4**; the safe bearing capacity of this unit at the regulator area is found as (Qa)=11.18 kg/cm^2.

The Permeability of the Tunnel Route

Pressurized Water Tests, at 2 m intervals and 2-4-6-8-10-8-6-4-2 bar levels, were tried to be conducted in the wells numbered TSK-1,TSK-2 which were opened in the tunnel route. However, as the ground is very crackled and 2 bar pressure couldn't be maintained, and well was constantly taken water in. Therefore, as the permeability of the tunnel route is more than 25 lugeon, it is a high-permeable unit.

Permeability-Lugeon	Permeability
< 1	Impermeable
1-5	Low-permeable
5-25	Permeable
>25	High-permeable

For this reason, contact and consolidation injections should be given attention during the construction of the tunnel.

Tunnel Route Characteristics

Two different formations will be cut in the energy tunnel whose approximate length will be 3125 m. These formations are Nebişeyh Limestone member (Kmn) and Zinav limestone (Jkz). Limestone that is between 0+000 - 0+060 km, yellowish pinky colored, sandy in patches, at claystone and marn levels will be cut and the tunnel portal will be opened in this unit. Whitish, grey, dark grey colored limestone will be reached from 0+060 to 3+125 m which is the end of the tunnel. The unit is very crackled, calcite-filled, fine-grained, and ootilic texture in patches in addition to having recrystallization feature.

Tunnel Entrance Portal; Between 0+000 and 0+060 km

Sandy Unit, clayey limestone
Natural Unit Weight (γdoğ) : 2.66-2.70 g/cm³. Average 2.68 g/cm³
Uniaxial Pressure Strength : 132.6 kg/cm²
Point Load Strength : 13.5-14.0 kg/cm²
RQD : % 25 (at tunnel cross-section)

Tunnel Axis and Exit Portal ; Between 0+060 and 3+125 km

Unit Limestone
Natural Unit Weight (γdoğ) : 2.62-2,64 g/cm³,Average 2.63 g/cm³
Uniaxial Pressure Strength :222.6-468.1kg/cm², Average 345.35 kg/cm²
Point Load Strength : 33.4 kg/cm² .
RQD : % 25 (at cross-section of the tunnel)
Permeability :between 57.07 and 63.66 Lugeon, >25 high permeable

RMR classification of Bieniawski and Q classification developed by Barton et al. (1974) were used in mass classification in the tunnel route. So that approach regarding tunnel support system will be made.

According to this; Nebişeyh limestone, that is, entrance portal and following 60 m (0+000–0+060) km, so RMR: 4 + 8 + 10 + 20 + 4 -5 = 41 , the descriptions about this are given in the table.

Table 4.2.2.8. A-Classification Parameters and Scores

1	*Strength of solid rock*		*Point load strength index*	*>1000MPa*	*4-10 MPa*	*2-4 MPa*	*1-2 MPa*	*Uniaxial Strength*		
			Uniaxial compressive index	*>250MPa*	*100-200 MPa*	*50-100 MPa*	*25-50 MPa*	*5-25 MPa*	*1-5 MPa*	*<1 MPa*
	Score			*15*	*12*	*7*	***4***	*2*	*1*	*0*
2	*Rock quality indicator*			*90-100%*	*75-90%*	*50-75%*	*25-50%*	*<25%*		
	Score			*20*	*17*	*13*	***8***	*3*		
3	*Discontinuity range*			*> 2 m*	*0.6-2 m*	*20-60 cm*	*6-20 cm*	*< 6 cm*		
	Score			*20*	*15*	***10***	*8*	*5*		
4	*Discontinuity condition*			*Very rough surfaces*	*Slightly rough surfaces*	*Slightly rough surfaces*	*Friction traced surfaces*	*Soft fault filling*		
				Discontinuous	Diversion < 1 mm	Diversion < 1 mm	< 5 mm or 1-5 mm open joints	> 5 mm thickness or open joints		
				No diversion	Hard joint surfaces	Soft joint surfaces	Continuous joints	> 5 mm constant discontinuity		
				Hard joint surfaces						
	Score			30	25	**20**	10	0		
	GW	Water flow in the first 10 m of the tunnel		None	10 L/min	10-25 L/min	25-125 L/min	>125 L/min		
			Water pressure at the joint	0	0-0.1	0.1-0.2	0.2-0.5	>0.5		

5		Ratio	Major principle stress					
		General conditions		Dry	Moist	Wet	Dripping	Water Flow
	Score			15	10	7	**4**	0

Table 4.2.2.9. B-Discontinuity Slope at the Tunnel and Effect of Slope Direction

Direction perpendicular to tunnel axis				Direction parallel to tunnel axis		Slope regardless of direction 0-20
Proceeding in downdip direction		Proceeding against slope				
Slope 45-90	Slope 20-45	Slope 45-90	Slope 20-45	Slope 45-90	Slope 20-45	
Very Appropriate	Appropriate	**Average**	Inappropriate	Not Applicable	Average	Average

Table 4.2.2.10 C-Correction with respect to Discontinuity Orientation

Direction and slope of discontinuities		Very Appropriate	Appropriate	Average	Inappropriate	Not Applicable
Score	Tunnel	0	-2	**-5**	-10	-12
	Foundation	0	-2	-7	-15	-25
	Slopes	0	-5	-25	-50	-60

Table 4.2.2.11 D- Rock Classes and Scores

Class No	I	II	III	IV	V
Definition	Very Good Rock	Good Rock	Medium Rock	Weak Rock	Very Weak Rock
Score	100-81	80-61	**60-41**	40-21	<20

RMR: 4 + 8 + 10 + 20 + 4 - 5 = 41 (related definitions are given in table above)

According to the table above, Rock class is Weak-Medium (III-IV).

Support Load; P=[(100-RMR)/100] x γ x B

For Tunnel entrance portal

where;

B : tunnel width,m (4.00 m)

γ : natural unit volume weight, kN/m³ (2.68 g/cm³)

P=[(100-32)/100] x 26.8 x 4.00= 73.90 kN

As tunnel entrance portal is the member of Mesudiye formation Nebişeyh limestone, and claystone and on the border of the unit composed of limestone which has marn strata, it will be better to classify it as II-IV class rocks (Weak-Medium rock). Accordingly, the primary fortifications are given in the table.

Table 4.2.2.12 The Primary Support

Rock Weight Class	Excavation	Rock Bolts (resin with 20 mm diameter)	Shotcrete (gunned concrete)	Steel Mesh
III	Roof arch and floor proceeding Proceeding 1.5-3 mfrom roof Complete buttress up to 10 m distance to face	Systematic bolts of 3-4 mlength, wire-mesh walls at arch and 1.5-2 m spaced at arch	5-10 cm at roof arch 3 cm at side walls	None
IV	Proceeding at ceiling and floor Proceeding 1-1.5 m from roof Proper to excavationbuttress up to 10 m distance to face	At wire-meshed walls and arch, systematic bolts of 2.0-2.5 m length with 0.5-0.75 space	100-150 mm at roof arch 100 mm at side walls	1.5 m spaced light structures of steel timbering where needed

ACCORDING TO Q ROCK CLASSIFICATION

If the tunnel route is examined by Q rock mass system developed by Barton et al.(1974);

	Factors	Tunnel route
1	RQD	%25
2	Number of joint sets (Jn)	Three joint sets (9)
3	Joint roughness score (Jr)	Rough and irregular wavy (3)
4	Joint surface diversion score(Ja)	Less diverged joint surfaces, non-softening mineral liner (2)
5	Joint water intake factor (Jw)	Medium level water flow or pressure, in some places washing of joint fills (0.66)
6	Stress reduction factor (SRF)	Loose or open joints, much jointed, in “cube sugar” appearance (5)

Q = (RQD / Jn) x (Jr / Ja) x (Jw /SRF)
Q= (25/9) x (3/2) x (0.66/5) = 0.55

a- The largest unsupported opening

Bmax = 2 x (ESR) x Q
ESR : Safety factor (for long-lasting hydraulic water tunnels: 1.6)
Bmax = 2 x 1.6 x 0.55 = 2.52 m

b- Roof support pressure

Proof = (2/Jr) x Q kg/cm²
Proof = (2/3) x 0.55 =0.81 kg/cm²= 81kN/m²

Rock bolt
Bolt L = 2 + 0.15 x B/ESR) B: 5.0 m
= 2 + 0.15 x (5/1.6) = 2.46 m

Anchor L = 0.4 x (H/ESR)
= 0.4 x (5.0/1.6) = 1.25 m

The length of the bolts usually depend on excavation width; and the ones used at the walls depend on excavation length. As the cross-section is circular, the same value can be accepted for the wall.

The results and suggestion of the geological survey report prepared for the activity site are given below. Previous to the construction works and during the construction phase of the project, parameters and evaluations in geotechnical survey report will certainly be complied with.

Results and suggestions:

1- On the ground of the activity area, Medium,Upper Jura-Low Cretaceous Zinav limestone is situated. Upper-Cretaceous age Mesudiye formation Nebişeyh limestone member covers the unit incompatibly. The contact of Mesudiye formation which is a volcano-sedimentary stacking are Nebişeyh member and Tolluk member, and gradationally in patches. Mesudiye formation is covered by the Bereketli member of Upper-Cretaceous old Reşadiye formation compatibly. Yolüstü basalts cover all the units incompatibly.The youngest units are talus and alluviums.

2- The project site is situated in Black Sea Region, within the borders of Tokat Province, between 4 483 000-4 488 000 latitudes and 352 000-354 000 longitudes on 1/25 000 scaled Tokat H38-b-1 map, and at a distance of about 15 km in the north of Reşadiye District, on Zinav Stream in the south of Bereketli District. The project area can be reached by Erzincan-Tokat highway at a distance of 20 km.

3- Zinav Stream flows through the activity area. The project will be built on this stream. Groundwater levels vary between 0.5 m and 17.00 m in the regulator part. According to the results of the measurements conducted in the main drilling wells at the axle area, groundwater is at thalweg elevation and over the river elevation on the right and left bank. Therefore, it was determined that the slopes feed the stream.

4- RSK-1, RSK-2, RSK-3, RSK-2-1, RSK-4 numbered wells were opened in the regulator axle. These wells are opened at approximately 1182-1171 elevations. The foundation ground of the regulator is composed of low-medium indurated claystone.

SSK-1, SSK-2, SSK-3,and SSK-4 numbered wells were opened in the power plant area. The foundation ground of the power plant is composed of low-medium indurated sandy limestone. Both units are classified as low-very low strong according to uniaxial pressure strength.

Bearing strength of soil should be taken as it is stated in the report.

5-According to the pressurized water tests done at the main drilling wells (RSK-1, RSK-2, RSK-3) opened on the right and left banks at the regulator axle area, they are low-permeable (0.97-4.96 Lu). With the aim of providing impermeability, 10 m length injection curtain at 3 m intervals should be formed on the right bank.

6- The left bank wall of the regulator axle are composed by basalts. The hill named as Castle Hill is entirely composed of basalts. There exist rocks which are decomposed, split or nearly split under various conditions. In order not to experience any problem both during the construction and subsequent to construction, it is necessary to clean hill basalt fallouts and potential fallout parts. Moreover, splitting works must be done and slope cutting ratio should be taken at 1/1 (1 horizontal / 1 vertical) scale.It will be suitable to take slope cutting ratio also as 1/1.5 at power plant area.

During the excavations,the units to be exposed to atmospheric conditions for a long period of time will cause weathering and deteriorations. Therefore, this issue should be considered during the implementation phase and the excavations should be carried out correspondingly.

Additionally, dislocations are seen on both the right and the left banks. As a result of the drillings made so far, these parts are defined as 4-7 m thick benthonic group clays. As these clays which swell pretty much by water, the finding that these parts are flowing has been reached. When water is retained in the lake area, small scaled flowing may be expected at talus and at the weathered parts of the bedrockdue to water movement. However, these will not reach to an extent that can affect lake stability adversely.

7- Within the scope of Onur HEPP project, concrete aggregate which will be needed in the concrete buildings, can be provided from the limestone on the right bank of Zinav canyon, at distance of about 500 m in the downstream direction. Also, aggregate provision from the limestonefound in 1000 m distance towards upstream is possible.

According to the water analysis made, pH degree of water is 7.75 and does not have any harmful effect. Free CO_2 value is 8.27 mg/L, and does not have any harmful effect. Ammonium value is 0.63 mg/L and does not have any harmful effect. Magnesium value is 6.93 mg/L and does not have any harmful effect. Sulfate value is 4 mg/L. The values of these five parameters are in ideal water class both for the cements to stay under the chemically harmful effects of water, ground and gas according to TS 3440 and TS 1008 and for mixed water effect.

8- The study site is within the 1stlevel earthquake zone. The principles of “Regulation on Buildings to be Built in Disaster Areas”,which was published by General Directorate of Disaster Affairs, should be complied with during the construction of the buildings. According to the regulation of ground group and classification in “Regulation on Buildings to be Built in Disaster Areas”, the grounds located in the study site can be involved in C group and Z3 local ground class. Spectrum characteristics periods are TA 0.15 s , TB 0.6 s, A0 =0.4. Additionally, active ground acceleration coefficient should be taken as (Ao): 0.40.

IV.2.3. Hydrogeological characteristics (groundwater and thermal water resources, groundwater levels, their amount, locations and elevations of any kinds of wells, such as caisson,deep, artesian, etc. still available with overshot lithological, geomechanical features with mass permeability values, their distance to the project area, safe abstraction values, physical, chemical and bacteriologic features of water, determination of the flow of resources and the condition of groundwater, their existing and planned usage)

The main stream in the study area is Zinav Stream, and its flow rate is 1-10 m^3 according to the season. At about 400 m downstream of the regulator axle, a stream with 70-80 L/s flow from Toklar Village also flows into Zinav Stream. According to the groundwater level measurements which were carried out in the drilling wells opened at the regulator area, the groundwater levels on the slopes are over the stream elevation and slopes feed the stream.

Zinav limestone which is among the geological units present in the project site, have karstic features. Groundwater hasn't been encountered in TSK-1 and TSK-2 numbered wells opened in Zinav Limestone on the energy tunnel route. Mesudiye formation Nebişeyh limestone can carry limited amounts of groundwater which includes clayey and sandy strata. Apart from this, other members of Mesudiye formation and Bereketli formation cannot carry groundwater due to their lithological features. Around the project site and its vicinity, there is not any essential resource depletion and opened well.

Table 4.2.3.1 Groundwater Levels at Foundation Drilling Wells

NO	DRILLING NO	PLACE OF DRILLING	TOTAL DRILLING DEPTH	GROUNDWATER LEVEL	OPEN STANDPIPE
1	RSK-1	REGULATOR	35.00	11.00	30.00
2	RSK-2	REGULATOR	27.00	2.00	27.00
3	RSK-3	REGULATOR	29.00	0.50	29.00
4	RSK-4	REGULATOR	36.00	13.30	29.00
5	RSK-5	REGULATOR	24.00	8.00	24.00
6	RSK-6	REGULATOR	24.00	17.20	24.00
7	RSK-7	REGULATOR	35.00	17.20	35.00
8	RSK-2-1	REGULATOR	25.50	3.20	22.00
9	SSK-1	POWERHOUSE	31.00	6.50	30.00
10	SSK-2	POWERHOUSE	26.00	3.50	25.00
11	SSK-3	POWERHOUSE	25.00	4.00	25.00
12	SSK-4	POWERHOUSE	24.60	12.00	24.00
13	TSK-1	TUNNEL ROUTE	145.00	none	none
14	TSK-2	TUNNEL ROUTE	200.00	none	none
15	KSK-1	BRIDGE	20.00	3.80	20.00
16	KSK-2	BRIDGE	20.00	3.90	20.00

The data obtained as a result of the chemical analysis conducted on the water samples which were taken from about 100 m downstream of the regulator area were evaluated.

According to this, the pH value of water is 7.75 and doesn't have any harmful affect. Free CO_2 value is 8.27 mg/l and doesn't have any harmful affect. Ammonium value is 0.63 mg/l and does not have any harmful effect. Magnesium value is 6.93 mg/l and does not have any harmful effect. Sulfate value is 4 mg/l. The values of these five parameters are in the ideal water class both for the cements that will be under the chemically harmful effects of water, ground and gas according to TS 3440 and TS 1008 and for mixed water effect.

Order no	Examined Property	The Degree of Harmful Effect		
		Weak	Strong	Very Strong
1	pH value	6.5-5.5	5.5-4.5	lower than 4.5
2	Decalcifier (CO_2 mg/l)	15-30	30-60	lower than 60
3	Ammonium mg/l	15-30	30-60	higher than 60
4	Magnesiummg/l	100-300	300-1500	higher than1500
5	Sulfate mg/l	200-600	600-3000	higher than 3000

The potable water necessary within the scope of the activity will be brought from Toklar Village, and no well will be opened.

IV.2.4. Hydrological Characteristics: (shallow water resources, existing and planned use, distance to the activity area, flow (the display of 1/25,000 scaled topographical map, whether the water resource feeds a any lake ecosystem or drinking water resource, whether it is situated in a shallow water basin that provides drinking, utility, irrigation water) the physical, chemical, bacteriological, and ecological features of sea, lake, river and the other wetlands,the flow of rivers, seasonal alterations, the areas that have the risk of flood, catchment area, sedimentation, drainage, the coastal uses and ecological features of all water resources, the uses of shallow water resources in the area and near surrounding, (drinking, utility, irrigation water, electricity, transportation, tourism, dam, lake, pond, the range of products in the generation of water products, amount of production, and the other uses with the features of use)Location according to the project site, distance, access road constructions on shallow water resources that flow within, on the border, or nearby the project site

When Onur Regulator retains water, the bridge that connect Bereketli Town to Toklar Village will submerge. Therefore, a new bridge will be built in the upstream of the current bridge. Apart from this, the lake area does not feed any drinking water resource by the topography. For the rest, there will not be any trouble on the issues such as tourism or irrigation etc. 1/25,000 scaled topographic map that displays the water resources nearby to the activity site is given in **Appendix: 14**.

The result of the analysis made in order to put forth the pollution load of Zinav Stream is given in **Appendix:20** and the water classes according to the result of the analysis in **Table 4.2.5.1.** Within this scope, water quality came out as 1st class in general. However, some values are 3rd class water with regards to nitrite nitrogen and total phosphorus, and it is 2ndclass water according to pH, Oxygen Saturation, Ammonium Nitrogen, Phenolic Substances, Total Kijedahl Nitrogen, MBAS, Mineral Oils and Derivatives, Mercury, Total Coliform, Zinc, Fecal Coliform values.

IV.2.5. Conducting the measurements and assessment of water quality (all parameters, except radioactivity values) once based on environmental permission according toRegulation on Water Pollution Control, which came into force by being published in Official Gazette dated 31.12. 2004 and numbered 25687, considering transmission channel (closed system or piped system) or upstream and downstream between tunnel and regulator, the results of the analysis.

The results of water analysis that was conducted in order to put forth the current pollution load of Zinav Lake is given in **Appendix: 20**, and water classes according to the results of the analysis in**Table 4.2.5.**

Within this scope, water quality came out as 1st class in general. However, some values are 3rd class water with regards to nitrite nitrogen and total phosphorus, and it is 2nd class water according to pH, Oxygen Saturation, Ammonium Nitrogen, Phenolic Substances, Total Kijedahl Nitrogen, MBAS, Mineral Oils and Derivatives, Mercury, Total Coliform, Zinc, Fecal Coliform values.

Table 4.2.5.The Results of Water Analysis

Parameter	Class with respect to Measurement Results	Parameter	Class with respect to Measurement Results
pH	Class II	Total Phosphorus	Class III
Chemical Oxygen Demand	Class I	Temperature	Class I
Dissolved Oxygen	Class I	Nitrate Nitrogen	Class I
Oxygen Saturation	Class II	Total Pesticide	Class I
Chloride	Class I	Mineral Oil and Derivatives	Class II
Ammonia Nitrogen	Class II	Sodium	Class I
Biochemical Oxygen Demand	Class I	Total Chromium	Class I
Phenolic Substances	Class II	Chromium +6	Class I
Nitrite Nitrogen	Class III	Boron	Class I
Total Dissolved Substance	Class I	Total Cyanide	Class I
Total Organic Carbon	Class I	Fluoride	Class I
Total Kjeldahl Nitrogen	Class II	Free Chlorine	Class I
MBAS	Class II	Mercury	Class II
Sulfate	Class I	Total Coliform	Class II
Color	Class I	Fecal Coliform	Class II
Sulfur	Class I		

IV.2.6. Giving the last 10 years' average monthly maximum, minimum and average flows of Zinav Stream as m^3/s concerning the catchment area of the regulator to be established

Onur Regulator site monthly average flow values are given in **Appendix: 16-g.**

IV.2.7. Water use condition at the basin where the project is located, (including whether it is located in a basin of water channel used for the purpose of potable water; if it happens, removing the HEPP out of absolute and short-range conservation area, etc.), the relationship of precipitation and flow rate, ecological potential, long term monthly average values(m^3/s) belonging to water resource(s) where the project will be established, the long term flow charts that represent the places of gauging stations and regulator, presenting with the approval of relevant institutions(the institutions where the data were obtained)

The project site is situated in Kelkit Basin of Yeşilırmak River Basin, and on Zinav Stream which is a branch of Kelkit Stream. Zinav Stream is the only river that shows a constant flow in the activity zone. It is used for small scaled agricultural irrigation works and for watering the animals by the local people. The banks of Zinav Stream is not rich in vegetation, as the stream flows in a valley, and the layer of alluvium is thick, and as the ground is rocky.

Zinav Lake is situated at 1250 m distance to the activity area (the place of power plant). Lake water is fresh and fed by Zinav Stream. Water coming out of the lake flows into Kelkit Stream.

Onur Regulator and HEPP project will be established in Kelkit River Basin, on Zinav Stream, at 1165.50m thalweg elevation. The drainage area of the place of Onur HEPP regulator is 196.50 km^2. In the Kelkit River Basin where Onur Regulator is located, there are three gauging stations founded by SHW. The general features of gauging stations are summarized in table 4.2.7.1

Table 4.2.7.1. The Gauging Stations in the Activity Zone and its Near Surrounding

Station No	Name of the Station	Operating Institution	River	Elevation (m)	Drainage Area (km^2)	Observation Period
14-122	Gökçebayır	SHW	Karakuş Stream	925	363	1990-2009 (2000-2002 and 2005 incomplete data)
14-121	Kevgir Kalesi	SHW	Karakuş River	571	679	1990-2006 (1995,1996, 1999-2000 incomplete data)
14-117 (14-32)	Gökdere	SHW	Çilkoru Stream	734	90	1966-2007 (alteration in the station name and place.)

There doesn't exist any gauging station on Zinav Stream where Onur Regulator and HEPP facility will be established. However, Karakuş River lies in the northwest of Zinav Stream. By considering the facts that these are neighbor river basins and they are nourished from the same height, 14–122 and 14–121 numbered gauging stations on Karakuş River are used in the regulator calculations. 14–121 and 14–117 (14–32) numbered gauging stations' observations are used in the completion of the missing years of 14-122 numbered gauging station. The natural flow rate regarding Onur Regulator area was calculated by taking drainage area ratio (196.50 km^2/ 363.00 km^2),making use of Karakuş Stream-Gökçebayır gauging station long daily average flow. Onur Regulator area flow ratio prepared with this approach is displayed in **Appendix: 16-g** (1966-2009) being approved by SHW.

Long-term annual average flow rate of Onur Regulator area is 3,218 m^3/s. The minimum and maximum values of long-term annual average flow rate are 0.021 m^3/s and 1.204 m^3/s, respectively. On the other hand, long-term monthly flows ranges between 0.672 m^3/s (August) and 8.111 m^3/s (April) (Chart 3).

In Figure 4.2.7.1, Onur Regulator area monthly average data are compared to monthly average precipitation of Bereketli meteorology station. In the graphic, it is observed that Onur regulator area flows are affected by snow melting in the high elevations in the early months of spring. During the rest of the year, a flow serial which is parallel to the precipitation observed in the Bereketli station is seen. The lowest precipitation and flow rates are seen in July and August.

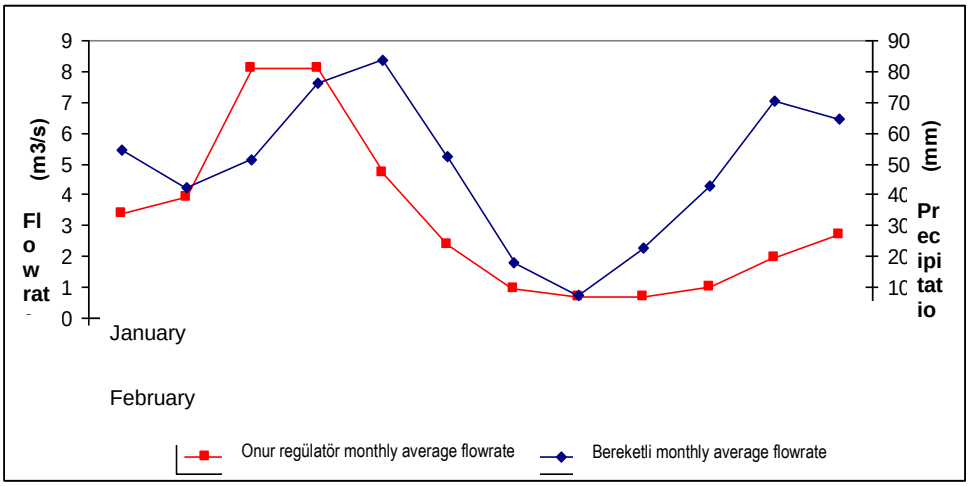

Figure 4.2.7.1. The comparison of Onur Regulator area monthly average flows and Bereketli meteorology station average total precipitation

In the revised Feasibility Report, environmental flow has been determined as the flow that is equivalent to 10% of the last ten years' (2000-2009) annual average flows in Onur Regulator and HEPP project. Under this circumstances, environmental flow has been calculated as 0.277 m^3/s, which is equivalent to 10% of the last 10 years' annual average flow rate; 2,769 m^3/s.For the place of Onur Regulator, long years' (1966-2009) annual average flow is 3,218 m^3/s,andenvironmental flow is determined as 0.450 m^3/s for June-July-August regardinglong-term average, and for the other months as 0.350 m^3/s.

IV.2.8. Soil characteristics and status of use (physical and biological features of soil, classification of land use capability, carrying capacity, slope stability, slipperiness, erosion, current use of soil, usage as natural vegetation, grassland, meadow etc.)

Cultivated area composes 31.9 %, meadow grassland 13.2 %, forest and scrub fields 38.7%, arable space 5.3%, and wasteland 16.2% of Tokat Province acreage. Although the fields are rough, except some major lowlands, cultivation is made intensively in the province. In Tokat Province, production pattern considerably determined by the irrigation of the field. In wet conditions; beet, sunflower and tomatoesenters the production pattern, and get a significant share in total cultivation. The land use distribution of Tokat Province is given in Table 4.2.8.1 and distribution of land in Figure 4.2.8.1 schematically.

Table 4.2.8.1 LandUse

Acreage			**998,242 (Ha)**	
Distribution of Land			Area (Ha)	%
1	Agricultural land (cultivated)		321,549	32
2	Grassland –meadow land		131,683	13.2
3	Forest land		386,239	38.7
4	Other lands		158,771	16.2
	A	Water surface	29,312	
	B	Floodplain	13,441	
	C	Bare rock debrises	20,938	
	D	Residential Area	44,691	
	E	Adable empty lands	50,419	
TOTAL			998,242	100

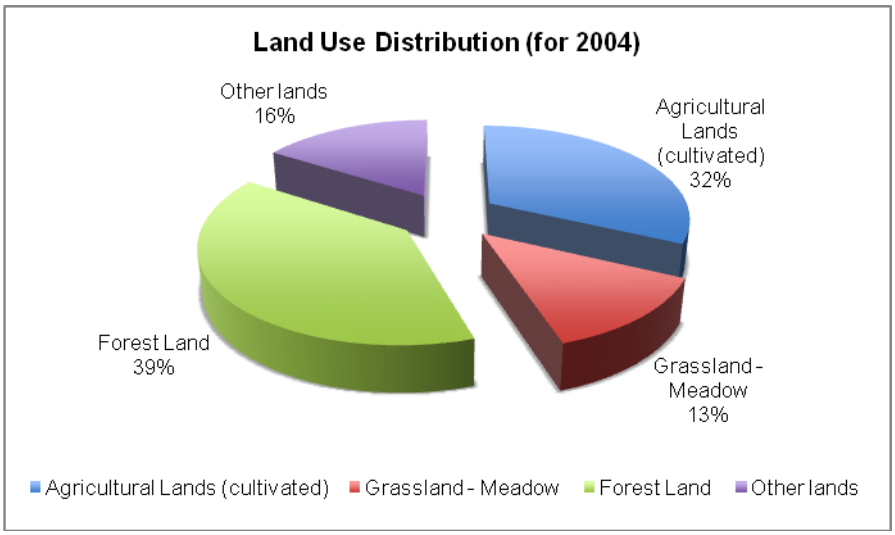

Figure 4.2.8.1. Land Use Distribution in Tokat Province

Classes of Land

Eight capability classes of land use exist,andsoil damage and classification increases gradually from 1st class to the 7th one. The first four classes of lands have the capability of growing cultivated plants adapted to the region and forest meadow, and grassland plants efficiently under an efficient management of soil. The 5th, 6th, and 7th classes are suitable for the growing of adapted local plants. Granted that soil and water precautions are taken, some plants can also be cultivated in the 5th and 6th classes. If rather efficient and expendive improvement operations are carried out within the 7th class lands, in the current market conditions, the yielded products cannot meet the product investment expenditures. In The distribution of land classes are given in Table 4.2.8.2 and Figure 4.2.8.2

Table 4.2.8.2. The Distribution of Land Classes

Land Use Classes	Area (ha)	%
1st Class Lands	75,766	7.6
2nd Class Lands	65,417	6.6
3rd Class Lands	94,101	9.4
4th Class Lands	75,852	7.6
5th Class Lands	1,631	0.2
6th Class Lands	144,695	14.4
7th Class Lands	522,933	52.4
8th Class Lands	10,122	1
Water Surfaces, Residential Areas	7,725	0.8
Total	998,242	100

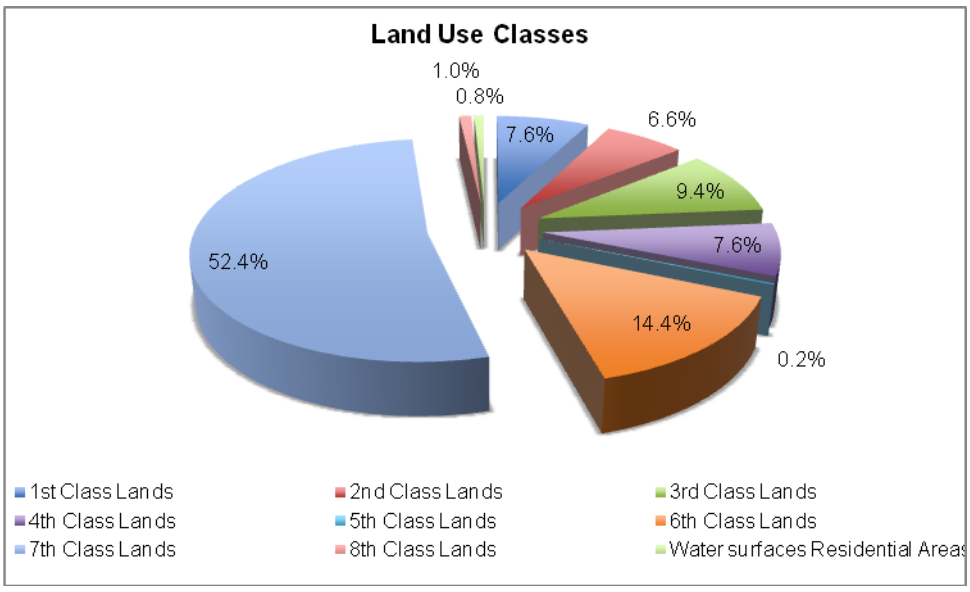

Figure 4.2.8.2. Distribution of Land Use Classes

Class 1: The topographies are almost flat. The damages of soil and wind erosion are so little. Soil depth is large, drainage is fine. There don't exist salinity, alkalinity, and stoniness problems. Its water-holding capacity is high and fertility is good. As being very fertile, it has a wide selection range of plant. As well as allocating them for growing cultivated plants, they can be used as grasslands, meadows and forests. The total 1st class range is 75,766, and it covers 7.65% of the general acreage. 73.29% alluvial, 3.20% colluvial, 0.79% brown forests, 2.22% hazel, 13.27% red hazel,and 7.23% brown soils compose these lands.

Class 2: Lands in this class require a careful soil management including protection applications, made in order to improve the relationship between air and water, during cultivation. These lands are used for cultivated plants, grasslands, meadows and forests. The range of 2nd class lands is 65.417 hectare in total, and covers 6.59% of the province acreage. 2.53% alluvial, 30.64% colluvial, 21.61% brown forests, 0.24% limeless brown, 17.73% hazel, 22.58% red hazel, 3.97% brown and 1,7% red brown soils composes these lands.

Class 3: The lands in this class have more classifications than the 2nd one. When they are required to be used for the cultivated plants, taking precautionary measures and insuring the persistence of these measures are rather difficult. As well as allocating them for growing cultivated plants, they can be used as grasslands, meadows and forests. The total class range of these lands is 94.101 hectare, and it covers 9.47% of the general acreage.2.06% alluvial,10.8 % colluvial, 41.86% brown forests, 25.01% hazel, 9.66% limeless brown forest, 1.15% brown soils, and 0.19% red brown forest compose these lands.

Class 4: In this class, the restrictions in the use of lands is more than the ones in the 3rd class and plant selection is more limited. They require a more careful management when cultivated. As they can be used as grasslands, meadow, and forest, they could also be used for farm or garden plants if the necessary precautions are taken. The total range of 4th class lands is 75.852 hectare and covers 7.64& of the province acreage. 55.97% brown forest, 20.15% limeless brown forest, 20.15% hazel, 6.80% red hazel, 0.51% alluvial, and 51% colluvial soils compose these lands.

Class 5: These lands have the restrictions that limit the type of cultivating plants, and prevent ordinary growing of cultivated plants. They are constantly wet, very stony or rocky due to frequent flooding. The range of these lands is 1,631 hectare, and covers 0.2% of the province acreage.

Class 6: The physical conditions within these soils make it practical to implement grassland improvements such as insemination, liming, fertilization, drainage ditches, diversion structures and water control with water distributors. The range of 6th class lands is 144.673 hectare in total, covers 14.56% of province general acreage. 64.92 % brown forest, 19.61% limeless brown forest, 11.9% hazel, 3.57% red hazel soils compose these lands.

Class 7: The physical conditions within these soils prevent it to be practical to implement grassland improvements such as insemination, liming, fertilization, drainage ditches, diversion structures and water control with water distributors. The range of 7th class lands is 522.902 hectare,and covers 52.64 % of province general acreage. 0.04% hydromorphical alluvial, 0.01% red-yellow podzolic, 0.83% grey-brown podzolic, 81.72% brown forest, 2.35% hazel, 0.53% red-hazel, 0,2% brown soils compose this class of lands.

Class 8: An income over the expenditures of forest management,which is made for cultivated plants, herbs and trees, won't be attained in the soils and land shapes in this class; however, they can be used for wildlife or as a resort. The range of 8th class lands is 10.122 hectare,and constitutes 1.8% of province general acreage. 0.41% brown forest lands, 29.36% river beds , 29.33% bare rocks and rubbles, %40,9 water surfaces compose this class of lands. (Resource: Tokat Province Environmental Condition Report, 2006).

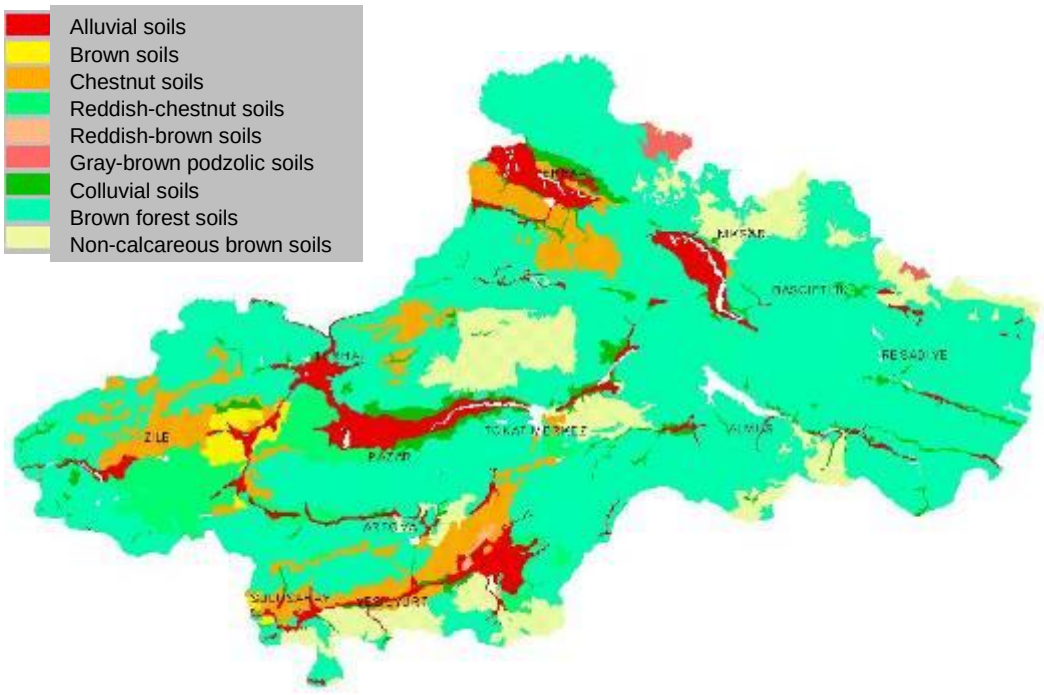

Figure 4.2.8.3. Tokat Province Soil Groups

Land use capability classification has been made by assessing the data, which was obtained as a result of the studies made in the lands between regulator and powerhouse (HEPP); General Directorate of Rural Affairs of Mülga, Tokat Province Land Existence Report and Mapping Information. In the classification of the lands whose boundaries were determined in place, Tokat province Land Existence Report of Mülga General Directorate of Rural Areas was utilized. According to land use capability classification, the lands determined by the definition of

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are classified as the lands which are out of cultivation, Bare Rocks and Robbles group lands in 8th class, that is under the provisions and possession of the government. The classes of land use capability map is given below:

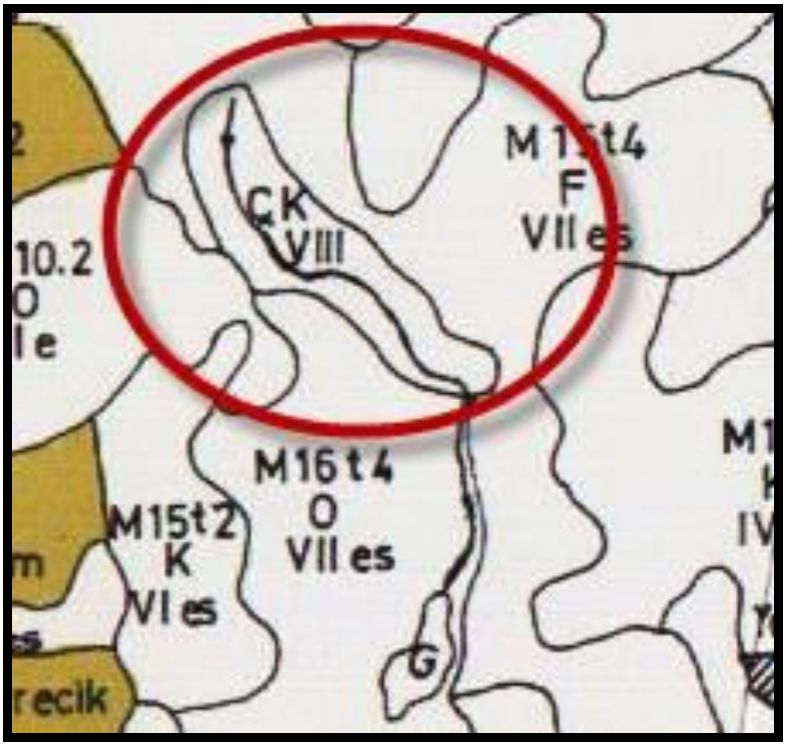

Figure 4.2.8.4. Map ofLand Use Capability Classes

The lands categorized according to the classification of land use capability, have been reclassified by changing into USBRIrrigatedAgriculturalLandClassification System used by SHW General Directorate. According to this classification, the lands mentioned are classified as

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W66X6

The lands in this classification are covered with bare rocks, 6th class un-irrigable area that have more than 10% of declination.

IV.2.9 Cultivation area (whether there exist a cultivation area or not;if exists agricultural development areas, specificareas ofplantationcrops) the magnitude of wet and dry cultivation lands, crop patterns and their annual production quantity , the rank and economic value of products within the national cultivation, (the designation of the irrigation water used in farmer conditions for one decare if there exist cultivation lands where irrigation is conducted, the determination of damages, and the compensations to be paid to the farmers)

As Tokat province has a transition region climate between Black Sea Region and Central Anatolia climates; it is a region, where cultivation is made from 230 meters to 1500 meters altitude along with its climate, soil and ecological structure,also which has a rich production pattern with a high agriculture potential. According to 10 years' average meteorological data, the number of days when the province has rainfall is 114 days, the rainfall per m^2 is 433 mm, and the number of days when the province is covered in snow is 28 days. 48.5% of the population of 828.027 people live in the urban and 51.4% live in the

rural areas. 70% of the population earn a living on agriculture. The economy is mainly based on agriculture and the industry that is dependent on agriculture. There are 64,148 agriculture establishments in the province. As nearly half of these establishments are small family businesses, and plant production is given priority at 78% and animal production at 22% of them. Though the cultivation area is restricted, 64,148 farmer families, which is a large proportion of the population, live on agriculture. 66,9% of the total 371,968 hectare lands are composed of fields, 4.5% of vegetable, 1.5% of vineyards, and the rest are composed of wastelands that are arable and suitable for fallow. The quantity of lands to be irrigated in the province is about 98,805.6 hectare

Table 4.2.9.1. The Distribution of Agricultural Lands

Land Type	Area (Ha)	%
Field	264,193.8	66.9
Fallow	26,912.9	7
Vegetable	18,554.9	4.5
Fruit	5,196.6	2.4
Vineyard	5,792.5	1.5
Poplar and Willow Grove	1,790	0.5
Arable Wasteland	53,236.2	14.4
Total	379,676.9	100

In Tokat Province, vegetable, fruit, legumes, poaceae, forage crops, industrial plants andornamental plants are grown. Besides this, the prominent agricultural products and their quantities in the province are given below

Product	Production Amount	Volume of Trade
Sugar Beet	645.716 tons	58.114.440 TL
Tomato	524.886 tons	125.972.640 TL
Wheat	465.359 tons	179.162.215 TL

The other agricultural products that are cultivated according to the districts in Tokat Province are given in **Table 4.2.9.2**

Table 4.2.9.2. The Prominent Agricultural Products Grown in Tokat Province and Its Districts

Product Name	The Production Site
Plum	Erbaa,Reşadiye
Sahlep	Erbaa,Reşadiye,Niksar, Center
Pear	Erbaa, Reşadiye,Niksar,Turhal
Thymus	Erbaa
Cranberry	Erbaa
Sumach	Erbaa
Sage	Erbaa
Mushroom	Erbaa,Reşadiye,Niksar,Turhal,Center,Başçiftlik
Balm	Erbaa,Center
Portulaca	Erbaa,Center
Gumbo	Erbaa
Onion	Erbaa,Center,Zile
Sour Cherry-Cherry	Erbaa,Reşadiye,Niksar,Turhal,Center,Zile,Artova,Almus
Walnuts	Erbaa,Reşadiye,Niksar,Zile,Almus
Strawberry	Erbaa, Niksar
Green Bean	Erbaa, Niksar,Pazar
Dried Bean	Erbaa, Niksar,Center
Chick-pea	Erbaa,Reşadiye,Niksar,Zile,Artova,Sulusaray

Green Lentil	Niksar,Reşadiye
Mulberry	Niksar
Grapes	Erbaa, Niksar,Center,Pazar,Zile,Turhal
Potatoes	Niksar,Center,Artova,Reşadiye,Yeşilyurt,Başçiftlik
Apple	Erbaa, Niksar,Center, Turhal,Artova

There exist four mills in ruins, which are lined up consecutively starting just from the downstream of Onur regulator involved in the project. The 80 L/s requirement of the consecutive four mills is figured as 80 L/s in calculations as water coming out of the mill situated in the spring will become inflow of the mill in the downstream.

The requirement of the mills will be calculated according to 12 months, however, in case of the restoration of the mills, this amount of water will be released as long as they work.

Apart from these mills, there is no other facility running by water in this area.

There doesn't exist any other water converting structure except Onur Regulator. Land which will be affected in terms of downstream water rights within the scope of Onur Regulator and HEPP project are the lands that is located between the regulator and station.

By assessing the data in the office obtained as a result of the investigations carried out in the lands located between regulator and station building (HEPP), General Directorate of Rural Affairs of Mülga, Tokat Province Land Existence Report and Map Information, land use capability classification has been made. The lands whose boundaries have been determined on the premises, Mülga Tokat Province od General directorate of Rural Land Property Report was benefited from in the first place . According to the Land use capability classification, the lands indicated by the

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equation have been classified as Bare Rocks and Robbles group lands in 8th class, that is under the provisions and possession of the government. The classes of land use capability map is given in **Figure 4.2.8.4.**

The lands classified by the land use capability classification have been reclassified by later being turned into USBR Irrigated Agricultural Land Classification System. With regards to this classification, the lands in question are classified as

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W66X6

In this classification, the lands are classified as the areas which are covered with bare rocks, 6th class un-irrigable areas possessing more than 10% of declination.

In the Water use rights report, the project site was examined as 1 unit. As agricultural land and trout plant etc. that can have water use right don't exist between the examined Onur regulator and energy tunnel, between penstock and HEPP, any kind of water use right is out of question. Therefore, any type of calculation for water consumptions have not been made.

In case of restoration in the project site, the amount of water that will be released from the regulator for the mills is given in **Table 4.2.9.3**. As to water use rights report, it is given in appendix: 18.

Table 4.2.9.3 Total Amount of Water to Be Released From the Regulator

MONTHS	THE REQUIREMENT OF MILL(L/ s)
JANUARY	80.00
FEBRUARY	80.00
MARCH	80.00
APRIL	80.00
MAY	80.00
JUNE	80.00
JULY	80.00
AUGUST	80.00
SEPTEMBER	80.00
OCTOBER	80.00
NOVEMBER	80.00
DECEMBER	80.00

Additionally, some arrangements will be made on the regulator bridge for the purpose of not adversely affecting the Toklar Village, situated nearby of the regulator area within the scope of the project and dealing with livestock breeding. Moreover, in order to prevent the villagers who deal with livestock breeding, from suffering, it will be supported to create new pasture areas. Within this scope, some kind of forage seeds like clover will be supplied to the villagers.

IV.2.10. Forest Areas (tree species and quantities, the size and closeness of the are they cover, the current and/or planning protection purposes of them, Forest Investigation Assessment Form, indicating that expropriation is out of question, guaranteeing that permissions will be taken pursuant to Forest Law No. 6831, 17/3 article changed by the Law no. 5192, 1/25.00 scaled map stand map which displays the project site, The distance of the project to the nearest forest area if it is out of the forest area, its effect

Onur Regulatorand Onur HEPP facility is located within the boundaries of Amasya Regional Directorate of Forestry, Niksar Directorate of Forestry, and Reşadiye Chiefdom of Forestry.

EIA Investigation and Assessment Form in question has been taken from Amasya Regional Directorate of Forestry (**Appendix: 16-a**). According to Investigation and Assessment Form based on EIA Document, the area is composed of 10.06 ha part,which is considered as forest area, and 14.52 ha part, not considered as forest area. The activity area is not within the scope of lands exposed to fire. The tree type of the activity area is oak. As to stand type, it is

- Agricultural Land (Z)
- Damaged, Oak , Swamp (ÇBMBt)

Reşadiye serial Stand map on which the project site is marked, is given in **Figure. 4.2.10.1.**

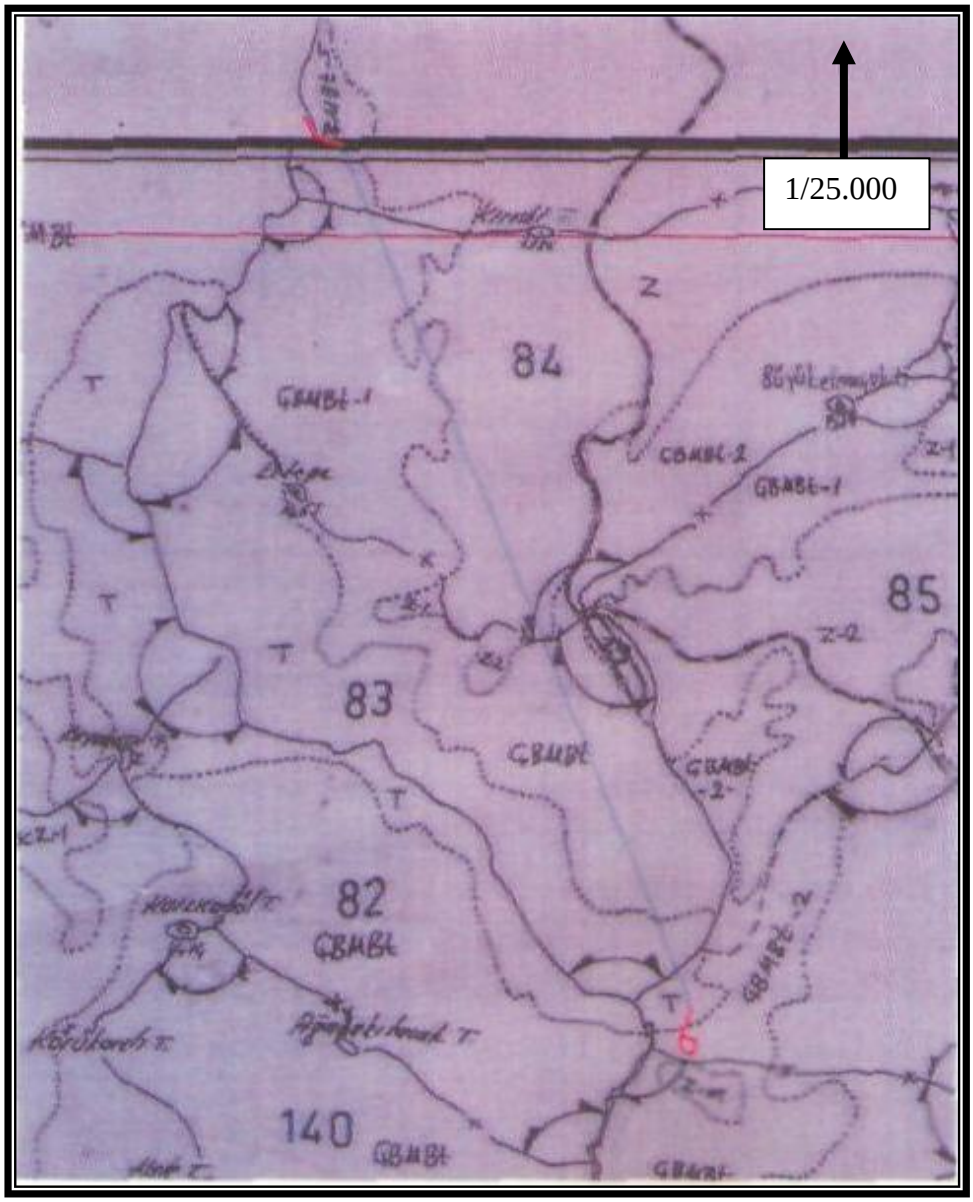


Figure 4.2.10.1. Activity Site Stand Map

The number of the trees to be cut down in the forest area which will be used within the scope of the project hasn't been determined yet, and right-altitude right will be taken for these trees from the concerning Regional Directorate of Forestry.

The number of the trees to be cut down in the forest area which will be used within the scope of the project hasn't been determined yet, and the forest permission by the force of Forest Law No. 6831 Article 17 will be taken due to the fact that the expropriation of the forest area used within the scope of the project is out of question.

IV.2.11. Conservationareas (areas under protection by national and international legislations; national parks, natural parks, wetlands, natural monuments, nature conservation areas, wildlife conservation areas, biogenetical reservoir areas, biosphere reservoirs, natural heritage sites and monuments, historical and cultural sites, private environment conservation zones , private environment conservation sites, tourism areas and centers, areas within the scope of pasture laws, the distance of the project to the areas under protection and its clear and colored display on 1/100,000 scaled map).

Reşadiye is a town which is situated in Central Black Sea Region, within Kızılırmak spring and on the banks of Kelkit river. Reşadiye is covered by pine forests in terms of geographical features.

In Reşadiye, which is located in the transition region between Central Anatolia and Black Sea Region in terms of climate, summer passes by hot and dry and winters cold and hard. Due to the mountainous terrain of the town, it doesn't have any wide plains

Apart form Kelkit Stream, by whose banks the town is located, Tozanlı Stream, Delice Stream, Tombalak Village and Reşit Stream exist. Besides, Zınav, Göllüköy, Gödölöş, Kurt, Gındıralı, Mehmetbey and Sülük lakes that are rich in natural beauties are among the geographical wealth of Reşadiye.

The Areas Indicated in " Conservation of Wetlands Legislations" came into force by being published in the 18.05.2005 dated Official Journal and No. 25818;

Zinav Lake

It is situated on Zinav Stream within the boundaries of Reşadiye District. The lake with fresh water characteristic is fed by Zinav Stream basically. The lake has 1.5 Km^2 acreage. The average depth of the lake is around 10-15meters. The waters releasing from the lake reaches to Kelkit Stream.

Onur HEPP project will be established on Zinav Stream that feeds Zinav Lake. Zinav Lake is at a distance of 1,250 meters to the activity site. At all phases of the activity, it will be granted that water quality isn't spoiled ; however, if it is spoiled, all the harms will be compensated by the activity owner in case Zinav Stream and Zinav Lake are affected adversely from the activity.

As water released from the power plant will reach the lake without any loss, it is expected that Zinav Lake will not be affected from the project.

Güllüköy Lake

It is within the boundaries of Reşadiye and fed by small streams and snow water melt in spring. The average depth of the lake is 6 m. It is at a distance of 18 km to the activity site.

Kaz Lake

It is located on Pazar-Zile motorway, in the district of Üzümören Town. Average acreage is 7,000 decare. Phase of reed thatch is dominant in the lake. It is at a distance of 97 km to the activity site

The areas designated by National Parks Legislation which came into force by being published in the 12.12.1986 dated Official Journal and No. 19309;

Ballıca Cave Natural Park

Tokat province is located in the boundaries of Pazar Town. It is at a distance of 33 km to Tokat Center of Province. Ballıca Cave is composed of crystallized limestone. When limited limestone formation is considered, volume of the cave is fabulously enormous. The limestone here do not have any bed; they are defective and broken. Moreover, the cracks are filled by calcium carbonate. Stalactites and stalagmites in the cave are among main source values. The vegetation outside the cave is composed of the species such as oak,beech, hornbeam, juniper, pine, hackberry. It is at a distance of 87 km to the activity site.

The areas designated by Land Hunting Law No. 4915 and 08.11.2004 dated Wildlife Conservation and Wildlife Improvement Area Legislations No. 25637:

Kaz Lake Wildlife Improvement Area

Kaz Lake is situated in Black Sea Region, Tokat Province, within the boundaries of Turhal and Pazar Towns. Between 40° 15' 00''- 40° 22' 30" north latitudes and 36° 07' 30''- 36° 15' 00'' east longitudes and has the altitude of 540 m.

Total area is 11,7 km^2. 9.69 km^2 of this area is land, and 2.01 km^2 of it water surface. It is a conservation area where water bird species are protected. It is at a distance of 100 km to the activity site

Tokat Province Partridge Raising Sites

Table 4.2.11.1. Tokat Province Partridge Raising Sites

PARTRIDGE RAISING SITES	QUANTITY
Turhal-Hasanlı Partridge Raising Site	250
Zile-Yünlü Partridge Raising Site	250
Tokat-Kızık-Karkıncık Partridge Raising Site	300
Pazar-Üzümören Partridge Raising Site	260
Niksar-Buzköy Partridge Raising Site	240

Source: Ecosystem Report

Apart from this, there do not exist any areas such as National Parks, Nature Conservation Areas, Wildlife Conservation Areas, Biogenetical Reservoir Areas, Biosphere Reservoirs, Natural Heritage Sites and Monuments, Historical and Cultural Sites, Private Environment Conservation Zones , Private Environment Conservation Sites, Tourism Areas and Centers, Areas within the scope of Pasture Laws. However, the activity area was announced as Zinav Thermal Tourism site by the Council of Ministers Decision on 16.07.2010.

The map displaying the distance of the activity area to linear scale protected area is given in **Appendix: 5.**

IV.2.12. The inland water species (lake, river) and aquatic species in the project site and project influence area (including aquatic flora and aquatic fauna, the natural characteristics of these species, species under protection by national and international legislations; their breeding, feeding, sanctuary and living conditions; the conservation decision determined for these conditions)

Kelkit Stream is one of the important branches of Yeşilırmak River, which is within the borders of Tokat Province, Reşadiye District. The studies intended for the detection of aquatic fauna existing in the area of Onur Regulator and HEPP, which is planned to be built on Zinav Stream, a branch of Kelkit Stream, were conducted in April, 2011. By interpreting the obtained results in this context, the effects of the project in question on aquatic ecosystem were assessed.

Fresh Water Algae

Algae are premier producers in aquatic organisms. Thanks to the pigments in their nature, they turn carbondioxide and water into carbohydrate by means of the effect of light, so they enable the increase of nutritional value and dissolved oxygen rate in aquatic environment. As a result, by insuring their development, they form the premier ring of food chain. Thus, they are essential in terms of their contributionto production and relationship with organisms at upper levels.

As Bacillariophyceae group composes the most dominant group at the two sampling points chosen in the studies which were conducted for the phytoplanktonic organisms in the project site, Euglenopyhta group is represented by the fewest species. Within the scope of the study, 11 species from Bacillariophyceae, 2 from Chlorophyceae and 1 from Euglenaphyceae were identified. The phytoplanktonic organisms detected in the area are given in the table below. Akbulut (1996), pointed out that species belonging to Bacillariophyta are more dominant than the others.

The actual distribution site of the phytoplanktonic organisms is dead water or loti habitat where the amount of discharge is too low. Since the discharge speed will cause drifting of phytoplanktonic organisms floating freely , they either do not exist in the fast flowing rivers or are represented by very little density.The actual dominant algae community in this area are attached algae. Attached algae, minimize the physical effect of the discharge by being stick to plants, rocks or sediments, and don't drift. Therefore, systems with fast flows are not the suitable habitats for phytoplankton and the number of the phytoplankton which were collected from the project site support this condition. Moreover, it is also thought that this condition is caused due to the fact that the field survey happened in winter season.

All the generally determined fresh water algaeare cosmopolitan, and any kind of endemic, rare, and imperial species peculiar to the region do not exist.

Zooplanktonic Organisms

Cladocera, Copepoda and Rotifera are microscopic organisms that compose zooplanktonic essential groups of organisms. A large majority of these zooplanktonic organisms show a spread in fresh water and as generally planktonic, they are found in the limnetic areas of lakes and stagnant parts of rivers. In determining the water quality of fresh water, the use of rotifera species as indicators is essential because of the fact that they compose the nutrition of plenty of invertebrate and vertebrate living in aquatic ecosystems. The zooplanktonic organisms detected in the project site are given in the table below.

According to this, 2 species of Cladocera, 1 species of Copepoda and 2 species of Rotifera were identified in the project site. All the zooplanktonic species detected in the study are cosmopolitan. They can be seen in all kinds of water extensively.

Zooplanktonic organisms frequently shift their places based on movements of water and live in dead water habitats. Their presence in the fast flowing parts of rivers is limited. Therefore, the diversity of species in river systems is low.

Among the determined species, no species that is under protection and/or danger according to Bern Convention (2002)and CITES(2004) has been encountered.

Benthic Organisms

Includes the organisms that spend al least a part of their life on the bottom in fresh water habitats (on the sediment,debris, macrophytes, filamentous algae). Nectons and forms buried under water are also included in the term benthic organisms. Since their moving ability is limited, Benthic invertebrates comes at the beginning of the groups followed in order to learn the current condition of aquatic environment and monitor the happening alterations

In the project site, larva that belong to the species in Tricoptera and Ephemeroptera orders included Insects class have been encountered.

Among the benthic organisms detected in general, any species whose generation is under danger and needs to be protected do not exist.

Figure4.2.12.1. Trichoptera Larvae

PHYTOPLANKTON			
DIVISION	**CLASS**	**SPECIES**	**STATION**
BACILLARIOPHYTA Haeckel 1878 emend Mann in Round et al.	PENNATIBACILLARIOPYCEAE	Amphora ovalis	1;2
		Cocconeis pediculus	1;2
		Cyclotella ocellata	1;2
		Cymbella ventricosa	
		Diatoma vulgaris	
		Fragilaria ulna	
		Gomphonema parvulum	
		Gyriosigma sp.	
		Navicula sp.	
		Nitzchia sp.	
		Surirella ap.	
CHLOROPHYTA (Green Algae)	CHLOROPYCEAE	Scenedesmus sp.	
		Spirogyra sp.	1;2
EUGLENOPHYTA	EUGLENOPHYCEAE	Euglena sp.	1;2

PHYLUM	**SUBPHYLUM**	**CLASS**	**ORDO**	**FAMILY**	**SPECIES**	**STATION**
ARTHROPODA	CRUSTACEAE	BARANCHIOPODA	CLADOCERA	DAPHNIIDAE	Daphnia longispina O. F. Müller, 1785	1;2
					Ceriodaphnia reticulata (Jurine, 1820)	1;2
		MAXILLOPODA	COPEPODA	CYCLOPOIDAE	Cyclops sp.	1
ROTIFERA					Lepadella sp.	1
					Keratella sp.	1;2
	INSECTA (HEXAPODA)		TRICOPTERA		LARVAE	1;2
			EPHEMEROPTERA		LARVAE	1;2

Fish

Fish are crucial biological componentsranking at the upper ring of the food chain. Fish that are fed such livings as algae, zooplankton or benthic organisms ranking at the upper ring of the chain of water. Some species of it gain value in terms of their economic importance as well as the ecological one.

During the field survey conducted at the project siteon 01.04.2011, 5 species in total including 4 from Cyprinidae family (Alburnoides bipunctatus, Barbus tauricus, Capoeta banarescui and Squalius cephalus) and 1 from Balitoridae (Oxynemacheilus sp.) were detected.

The protection status, habitats, population density of the species detected in the area on 01.04.2011 are given in the table below. In addition to this, some ecological characteristics of the species, which were detected in the studies both conducted on 15.02.2011 and previously in the project site, are given below.

Alburnoides bipunctatus (Bloch, 1782)- Spirlin

As its body flattens in profile, the body is covered with cycloid scales. Its color is dark in back part, parietal parts and ventral surface are silver white. Particularly in the breeding season, dark colored stripes are seen in the abdomen. Adolescents can reach 10-12 cm in average, and 16 cm in maximum length. They are usually fed by benthic insects' larvae and the organism floating on the surface. The breeding season is between May and July.

This species, whose population density is determined rather high, is involved species under protection in the Europe population status, but any protection status about its population in Turkey have not been determined.

Considering that both this species is well adapted to dead water system and can survive in the branches of Yeşilırmak River, and its population density is high; it does not seem possible for it to be affected adversely by the proposed HEPP.

Figure 4.2.12.2. Alburnoides bipunctatus

Barbus tauricus Kessler, 1877- Goatfish

This species, which prefer the fast flowing, clean, oxygen-rich; gravelly, stony, sandy bottom habitats of stream systems, can also accommodate the dead water systems. According to IUCN (2010), this species, which is regarded within the Europe population delicate species category, have been detected in both of the stations where sampling is done. The population density was evaluated as medium. While the adolescents of the

species lead a solitary life, younger individuals live in small groups. The young individuals live on benthic organisms. The nutrition preference of the adolescents is composed of small fish and plant materials. The species, whose breeding season is between April and July, like the other Cyprinidae (Cypriniformes) species, immigrate to the upper parts of streams. It prefers stony and sandy coastal parts as the ovulation areas, and breed when water temperature reaches to 12–18 °C.

The facts that it hasa high ecological tolerance, displays a very good adaptation in dead water and uses stream systems connected to Yeşilırmak River as living, breeding areas, and that it is a widespread species give the idea that this species will not be affected adversely from the project.

Figure 4.2.12.3. Barbus tauricus

Capoeta banarescui (Turan, Kottelat, Ekmekçi & Imamoglu, 2006)

This species, which prefer the lowflowing; gravelly, stony, sandy bottom habitats of stream midpoint zones, can also accommodate the dead water systems.Generally, the young individuals live on zooplankton and phytoplankton; butthey consume invertebrate, algae and hydrophyte during adolescence. Their breeding season is in May and June.

According to IUCN (2010), this species are not under any category of danger. In the project site, it was caught in both of the sampling points and population level was assessed as “high”.

The facts that it has a high ecological tolerance, and uses stream systems connected to Yeşilırmak River as living, breeding areas, well adapt to dead water and that it is a widespread dissemination give the opinion that this species will not be affected adversely from the project.

Figure 4.2.12.4. Capoeta banarescui

Squalius cephalus (Linnaeus, 1758): Chub

This species known as river fish, shows a very good adaptation to lakes and hard water. The breeding season is in May and June. They usually live on aquatic invertebrate, insect larvae, plant particles and small fish. The adolescents reach to sexual maturity at 3-4 years old.

According to IUCN, it is in “LC” category and not under danger. The ecological tolerance of this species, which was detected at both of the sampling points and whose population density was determined to be high, is also rather high. Additionally, the fact that it uses the stream systems as living and breeding area gives the viewpoint that it will not be affected from the project adversely.

Figure 4.2.12.5. Squalicus cephalus

Oxynemacheilus sp.

Oxynemacheilus sp (Stone Loach, Scavenger Fish) that belongs to Balitoridae family, generally prefers the flowing, gravelly and stony bottom parts of rivers. However, it can also continue its life on the coastal parts of rivers and lakes. Their nutrition is usually composed of intervebrates and zooplanktons. This species ,whose breeding season has been observed as between May and July, was caught in mild flowing, stony parts close to coast in the project site.

This species whose ecological tolerance is high, is densely present at Yeşilırmak Regulator and HEPP site and is also found intensively in the branches of Yeşilırmak River. According to IUCN Red List (2010), this species, whose protection status was not assessed, is thought not to be affected adversely by HEPP considering the facts that it is present

intensively on the branches of Yeşilırmak River and it can be adapted to dead water systems well.

Figure 4.2.12.6. Oxynemacheilus sp.

FAMILY		SPECIES	ENGLISH NAME	IUCN	BERN	Breeding Habitat	Living Habitat	DENSITY OF POPULATION
Cyprinidae	1	Alburnoides bipunctatus (Bloch, 1782)	Spirlin	-	Appendix-III	Stream	Stream River Lake	High
	2	Barbus tauricus Kessler, 1877	Goatfish	VU	-	Stream	Stream River Lake	Medium
	3	Capoeta banarescui Turan, Kottelat, Ekmekçi & Imamoglu, 2006	Siraz (İn) balık	-	-	Stream	Stream River Lake	High
	4	Squalius cephalus (Linnaes, 1758)	Chub	LC	-	Stream River Lake	Stream River Lake	High
Balitoridae	5	Oxynemacheilus sp.	Stone Loach-Scavenger	LC		Stream	Stream River Lake	High

Fish species, breeding and living habitats obtained as a result of the samplings conducted in the project site, danger categories according to IUCN and BERN, population density and the stations where they were sampled.

IV.2.13 Flora and Fauna (species, endemic especially local endemic plant species, animal species living naturally in the site, the species under conservation by national or international legislations such as Bern, IUCN, CITES, etc., species that are rare and got into danger and their presence sites in the area; the names of prey animals, their population and the Central Hunting Commission Decisions taken for them)the display of vegetation types in the project site on a map. The protection precautions needed to be taken for the living that will be affected from the project (during the construction and operation phases). The realization of flora studies to be conducted in the site in the vegetation period, and indication of this period, presentation of 2010-2011 Province Hunting Map determined by Central Hunting Commission in the Appendix.

FLORA

THE PURPOSE AND METHOD OF THE STUDY

The aim of this study is to examine the effects of Onur Regulator and HEPP Project, which will be on Zinav Stream flowing into Kelkit Stream within Yeşilırmak River Basin in the borders of Reşadiye District in Tokat province, on floristic diversity.

"**Floristic Analysis**" study is based on office and short-term field studies.

Office Studies; What was planned and carried out in office studies is literature search on the floristic structure of"Onur Regulator and HEPP Project, which will be on Zinav Stream flowing into Kelkit Stream within Yeşilırmak River Basin in the borders of Reşadiye District in Tokat province" and its vicinity.

Field Studies: This is based on short-term field search with the aim of determining the floristic diversity in the planned HEPP and its vicinity.

In the floristic assessment studies, a corridor, which has a 2 km width, 1 km from the right and 1 km from the left of HEPP regulator route, was based on as the "study site".

ECOLOGICAL STRUCTURE

The study area is phytogeographically located within the borders of Europe-Siberia floristic region.

Figure 4.2.13.1. Phytogeographical Regions in Turkey (Modified from Filiz,Z., 2007)

VEGETATION

The main vegetation types of the valley:

I- Degraded Forest Vegetation
II-Stream Vegetation (Riparian)
III-Steppe (Moorland) Vegetation

I-Degraded Forest Vegetation;

Deciduous forest vegetation, where oaken species exist, is dominant along the valley

Dominant and Widespread Tree and Bush Species In This Zone;

Quercus pubescens Willd., Quercus trojana Webb (oak), Colutea cilicica Boiss. & Balansa (Colutea), Prunus divaricata Ledeb. subsp. divaricata, Rosa foetida Herrm., Rosa horrida Fisch., (Rosehip), Sorbus umbellata (Desf.) Fritsch,taurica (G.Zinserl.) Gabr. (Sorb apple)

Figure 4.2.13.2. Degraded Forest Vegetation

The vegetation type,which can also be named as galleria forest consisted of hygrophyte and mesophyll characteristic species, is dominant along the streams.

Along the river; hygrophyte and mesophyll species such as Platanus orientalis L. (Sycamore), Salix alba, (Willow), Rubus caesius L., Rubus sanctus Schreb. (Blackberry) from trees and bunches; Clematis orientalis L. (Vitis) from volventes; Carex atrata L. subsp. atrata , Carex kukkonenii Ö. Nilsson, Carex orbicularis Boott subsp. kotschyana (Boiss. et Hohen) Kukkonen, C. oreophila C.A.Mey. (Saparna), Juncus conglomerates L. , Juncus effusus L., Luzula campestris (L.) DC. , Luzula forsteri (Sm.) DC. , Mentha aquatica (water mint) from herbaceous species are dominant.

Riparian vegetation develops totally based on water.

Figure4.2.13.3. Riparian Vegetation

III-Steppe (Moorland) Vegetation

Along the valley, in the sloping areas where devastation is high, a steppe vegetation including such chamaepphyte species as Nepeta fissa C.A.Mey., Nepeta nuda L. subsp. nuda , Salvia tomentosa Mill., Scutellaria rubicunda Hornem subsp. brevibracteata (Stapf) J.R.Edm., Stachys iberica Bieb. subsp. stenostachya (Boiss.) Rech.f., Teucrium polium L. Thymus leucotrichus Hal. var. leucotrichus, Ziziphora capitata L., Althea hirsuta L., Jasminum fruticans L., Papaver dubium L. Astragalus hamosus L., Astragalus micropterus Fisch. are dominant.

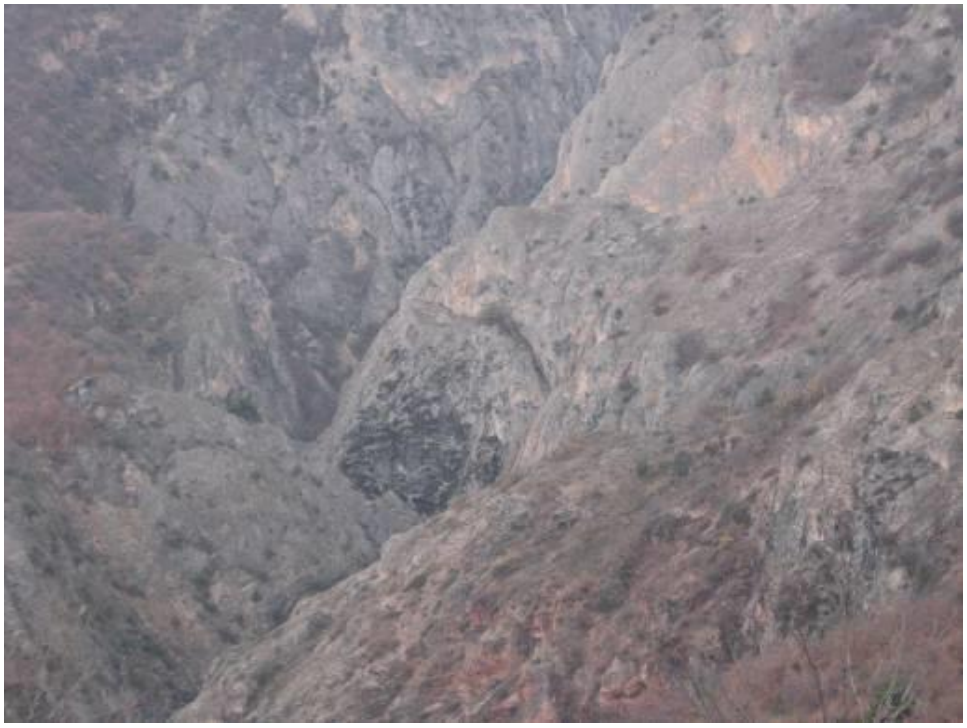


Figure 4.2.13.4. SteppeVegetation

FLORISTIC FINDINGS

Alarge majority of the plants that were picked up from the site as a result of conducted field studies and literature search have been identified and the list of species is given in the table. In the table, Family Name, Species Name, English Name, Phytogeographical Name, Endemism and IUCN Danger Category order has been followed.

In these fields,which is located within European-Siberian Floristic borders, floristic studies have still been conducted by a lot of national and foreign researchers as they were in the past. Particularly, we can regard Tchihatcheff, Sintenis, Czeczott, Zohary, Davis and Quézel among foreign researchers working in Northern Anatolia. Additionally, Karaer F, Kutbay HG, Kılınç M (1995), Karaer F, Kılınç M, Kutbay HG (1995). Kılınç M (1985). Kılınç M (1990). Özen F (1995), Yıldız B (1996). Floristic Characteristics of Köse Mountain (Sivas), Turk J Bot 20: 417-456. Ozen F, Kilinc M (2002), Karakaya H, Kilinc M (1996), Korkmaz H, Engin A (2001), Kutbay HG, Kilinc M, Karaer F (1995), Ozbucak Bayrak T, Kutbay HG, Ozbucak S (2006), Korkmaz,H., Yalcin, E., Berk,E., (2008) İlarslan R (1994), Karaer, F., Kılınç, M., (2001) can be regarded, as well.

The study is found within A6 grid according to the gridding system that is used for the flora of Turkey by Davis. 314 species that belong to 64 family has been detected based on field survey and performed literature studies.

ONUR REGULATOR AND HEPP PROJECT FLORA LIST

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
PTERIDOPHYTA					
ASPIDIACEAE	*Dryopteris pallida (Bory) Fomin*	-	Mediterranean		
ASPLENIACEAE	*Ceterach officinarum DC.*	-	-		
ATHYRIACEAE	*Cystopteris fragilis (L.) Bernh.*	-	-		
EQUISETACEAE	*Equisetum arvense L.*	Marsh Horsetail	-		
SPERMATOPHYTA					
GYMNOSPERMAE					
CUPRESSACEAE	*Juniperus excelsa M.Bieb.*	Common juniper	-		
CUPRESSACEAE	*Juniperus foetidissima Willd.*	Stinking juniper	-		
CUPRESSACEAE	*Juniperus oxycedrus L. subsp. oxycedrus*	Cade juniper	-		
EPHEDRACEAE	*Ephedra major Host*	Seagrape	-		
ANGIOSPERMAE					
DICOTYLEDONAE					
AMARANTHACEAE	*Amaranthus retforlexus L.*	Amaranth	-		
AMARANTHACEAE	*Amaranthus blitoides S.Watson*	Amaranth	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
ANACARDIACEAE	*Pistacia terebinthus L. subsp. palaestina (Boiss.) Engl.*	Terebinth	Mediterranean		
ANACARDIACEAE	*Rhus coriaria L.*	Sumach	-		
APIACEAE (UMBELLIFERAE)	*Anthriscus caucalis M.Bieb.*				
APIACEAE (UMBELLIFERAE)	*Anthriscus cerefolium (L.) Hoffm.*	-	Europe- Siberia		
APIACEAE (UMBELLIFERAE)	*Anthriscus nemorosa (Bieb.) Sprengel*	-	-		
APIACEAE (UMBELLIFERAE)	*Bunium microcarpum (Boiss.) Freyn subsp. bourgaei (Boiss.) Hedge & Lamond*	-	-		
APIACEAE (UMBELLIFERAE)	*Bupleurum rotundifolium L.*	-	-		
APIACEAE (UMBELLIFERAE)	*Caucalis platycarpos L.*	-	-		
APIACEAE (UMBELLIFERAE)	*Daucus carota L.*	Carrot	-		
APIACEAE (UMBELLIFERAE)	*Johrenia tortuosa (Fisch. & C.A.Mey.) D.F.Chamb.*				
APIACEAE (UMBELLIFERAE)	*Malabaila secacul Banks & Sol.*	-	-		
APIACEAE (UMBELLIFERAE)	*Scandix stellata Banks & Sol.*	Coriander	-		
APIACEAE (UMBELLIFERAE)	*Scandix aucheri Boiss.*	Coriander	Iran-Turan		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
APIACEAE (UMBELLIFERAE)	*Torilis japonica (Houtt.) DC.*	-	-		
APIACEAE (UMBELLIFERAE)	*Torilis leptophylla (L.) Rchb.*	-	-		
APIACEAE (UMBELLIFERAE)	*Turgeniopsis foeniculacea (Fenzl) Boiss.*	-	-		
APIACEAE (UMBELLIFERAE)	*Zosima absinthifolia (Vent.) Link*	-	-		
ARALIACEAE	*Hedera helix L.*				
APOCYNACEAE	*Vinca herbacea Waldst. & Kit.*	-	-		
ASCLEPIADACEAE	*Vincetoxicum fuscatum (Hornem.) Rchb.f. subsp. fuscatum*	-	-		
ASTERACEAE (COMPOSITAE)	*Anthemis cotula L.*	Daisy	-		
ASTERACEAE (COMPOSITAE)	*Anthemis cretica L. subsp. tenuiloba (DC.) Grierson*	Daisy	-		
ASTERACEAE (COMPOSITAE)	*Anthemis tinctoria L. var. discoidea (All.) DC.*	Daisy	-		
ASTERACEAE (COMPOSITAE)	*Artemisia scoparia Waldst. & Kit.*	Santonica	-		
ASTERACEAE (COMPOSITAE)	*Carduus nutans L.*	Eryngium	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
ASTERACEAE (COMPOSITAE)	*Carduus iberica Trev. ex Spreng.*	Centaurea diffusa	-		
ASTERACEAE (COMPOSITAE)	*Centaurea solstitialis L. subsp. solstitialis*	Centaurea diffusa	-		
ASTERACEAE (COMPOSITAE)	*Centaurea urvillei DC. subsp. urvillei*	Centaurea diffusa	Eastern Mediterranean		
ASTERACEAE (COMPOSITAE)	*Centaurea urvillei DC. subsp. armata Wagenitz*	Centaurea diffusa	Eastern Mediterranean		
ASTERACEAE (COMPOSITAE)	*Chondrilla juncea L. var. juncea*	-	-		
ASTERACEAE (COMPOSITAE)	*Conyza canadensis (L.) Cronquist*	Fleabane	-		
ASTERACEAE (COMPOSITAE)	*Crepis alpina L.*	-	-		
ASTERACEAE (COMPOSITAE)	*Crepis foetida L. subsp. rhoaedifolia (M.Bieb.) Celak.*	-	-		
ASTERACEAE (COMPOSITAE)	*Crepis sancta (L.) Babc.*				
ASTERACEAE (COMPOSITAE)	*Crupina crupinastrum (Moris) Vis.*	-	-	-	
ASTERACEAE (COMPOSITAE)	*Echinops pungens Trautv. var.pungens*		Iran-Turan		
ASTERACEAE (COMPOSITAE)	*Hieracium reductum Freyn & Sint.*	-	-	Endemic	LR (cd)
ASTERACEAE	*Inula aschersoniana Janka*	Elecampane			LR (lc)

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
(COMPOSITAE)					
ASTERACEAE (COMPOSITAE)	*Inula montbretiana DC.*	Elecampane	Iran-Turan		
ASTERACEAE (COMPOSITAE)	*Inula thapsoides (M.Bieb. ex Willd.) Spreng. subsp thapsoides*	Elecampane	-		
ASTERACEAE (COMPOSITAE)	*Leontodon crispus Vill. subsp. asper (Waldst. & Kit.) Rohlena, var. asper*	-	-		
ASTERACEAE (COMPOSITAE)	*Logfia arvensis (L.) Holub*	-	-		
ASTERACEAE (COMPOSITAE)	*Mycelis muralis (L.) Dum. Sorger*	-	Europe- Siberia		
ASTERACEAE (COMPOSITAE)	*Picnomon acarna (L.) Cass.*	-	Mediterranean		
ASTERACEAE (COMPOSITAE)	*Picris strigosa M.Bieb. subsp. strigosa*	-	Iran-Turan		
ASTERACEAE (COMPOSITAE)	*Pilosella x auriculoides (L.ng) Sell & West*	-	-		
ASTERACEAE (COMPOSITAE)	*Riechardia glauca Matthews*	-	Iran-Turan		
ASTERACEAE (COMPOSITAE)	*Scolymus hispanicus L.*	-	Mediterranean		
ASTERACEAE (COMPOSITAE)	*Scariola viminea (L.) F.W.Schmidt*	-	-		
ASTERACEAE (COMPOSITAE)	*Senecio vernalis Waldst. & Kit.*	Groundsel	-		
ASTERACEAE	*Steppetorhamphus tuberosus (Jacq.)*	-	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
(COMPOSITAE)	*Grossh.*				
ASTERACEAE (COMPOSITAE)	*Tanacetum albipannosum Hub.-Mor. & Grierson*	Feverfew	-		
ASTERACEAE (COMPOSITAE)	*Tripleurospermum elongatum (Fisch. & C.A.Mey.) Bornm.*	-	-		
ASTERACEAE (COMPOSITAE)	*Xeranthemum annuum L.*	Mountain cloves	-		
ASTERACEAE (COMPOSITAE)	*Xanthium strumarium L. subsp. cavanillesii (Schouw) D.L.ve & Dans.*	-	-		
BERBERIDACEAE	*Berberis crataegina DC.*	Berberis	-		
BORAGIANCEAE	*Alkanna orientalis (L.) Boiss. var. orientalis*	-	-		
BORAGIANCEAE	*Anchusa leptophylla Roem. & Schult. subsp. incana (Ledeb.) D.F.Chamb.*	Anchusa	Iran-Turan	Endemic	LR (lc)
BORAGIANCEAE	*Cynoglossum officinale L.*	Gypsyflower	Europe-Sib.		
BORAGIANCEAE	*Echium italicum L.*	-	Mediterranean		
BORAGIANCEAE	*Heliotropium europaeum L.*	-	-		
BORAGIANCEAE	*Lappula barbata (M.Bieb.) Gürke*	-	-		
BORAGIANCEAE	*Myosotis sicula Guss.*	Myosotis	-		
BORAGIANCEAE	*Myosotis ramosissima Rochel ex Schult. subsp. ramosissima*	Myosotis	-		
BORAGIANCEAE	*Nonea caspica (Willd.) G.Don*	-	Iran-Turan		
BORAGIANCEAE	*Nonea stenosolen Boiss. & Balansa*	-	Iran-Turan	Endemic	LR (lc)

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
BORAGIANCEAE	*Onosma isauricum Boiss. Et Heldr.*	-	Iran-Turan	Endemic	LR (lc)
BORAGIANCEAE	*Rochelia disperma (L.f.) C. Koch var. disperma*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Aethionema arabicum (L.) Andrz.*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Alyssum huetii Boiss.*		Iran-Turan	Endemic	LR (lc)
BRASSICACEAE (CRUCIFERAE)	*Alyssum sibiricum Willd.*		-		
BRASSICACEAE (CRUCIFERAE)	*Arabis caucasica Willd. subsp. caucasica*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Capsella bursa-pastoris (L.) Medik.*	Shepherd's pouch	-		
BRASSICACEAE (CRUCIFERAE)	*Calepina irregularis (Asso) Thell.*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Cardaria draba (L.) Desv. subsp. chalepensis (L.) O.E.Schulz*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Clypeola jonthlaspi L.*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Conringia planisiliqua Fisch. & C.A.Mey.*		Iran-Turan		
BRASSICACEAE (CRUCIFERAE)	*Draba rigida Willd. var. rigida*	-	-	Endemic	LR (Lc)
BRASSICACEAE (CRUCIFERAE)	*Fibigia eriocarpa (DC.) Boiss.*	-	-		
BRASSICACEAE	*Hutchinsia petraea (L.) R.Br.*		-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
(CRUCIFERAE)					
BRASSICACEAE (CRUCIFERAE)	*Hesperis bicuspidata (Willd.) Poir.*	Night Viola	-		
BRASSICACEAE (CRUCIFERAE)	*Isatis cappadocica Desv. subsp. cappadocica*	Anil	Iran-Turan		
BRASSICACEAE (CRUCIFERAE)	*Matthiola longipetala (Vent.) DC. subsp. longipetala*	Wallflower	-		
BRASSICACEAE (CRUCIFERAE)	*Sisymbrium orientale L.*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Sisymbrium loeselii L.*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Sobolewskia clavata (Boiss.) Fenzl*	-	-		
BRASSICACEAE (CRUCIFERAE)	*Thlaspi perfoliatum L.*	-	-		
CAMPANULACEAE	*Asyneuma limonifolium (L.) Janch. subsp. limonifolium*	-	Iran-Turan		
CAMPANULACEAE	*Asyneuma virgatum (Labill.) Bornm. subsp. virgatum*	-	-		
CAMPANULACEAE	*Campanula involucrata Aucher ex A.DC.*	Çan çiçeği	Iran-Turan		
CAMPANULACEAE	*Legousia pentagonia (L.) Thell.*	-	Eastern Mediterranean		
CAPRIFOLIACEAE	*Lonicera etrusca Santi var. etrusca*	Lonicera	Mediterranean		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
CARYOPHYLLACEAE	*Arenaria serpyllifolia L.*	-	-		
CARYOPHYLLACEAE	*Arenaria leptoclados (Rchb.) Guss.*	-	-		
CARYOPHYLLACEAE	*Dianthus floribundus Boiss.*	Dianthus	Iran-Turan		
CARYOPHYLLACEAE	*Dianthus zonatus Fenzl var. aristatus (Boiss.) Reeve*	Dianthus	Iran-Turan		
CARYOPHYLLACEAE	*Dianthus zonatus Fenzl var. zonatus*	Dianthus	-		
CARYOPHYLLACEAE	*Gypsophila sphaerocephala Fenzl ex Tchich. var. cappadocica Boiss.*	Chalk plant	Iran-Turan	Endemic	LR (lc)
CARYOPHYLLACEAE	*Holosteum umbellatum L. var. umbellatum*				
CARYOPHYLLACEAE	*Minuartia anatolica (Boiss.) Woronow var. polymorpha McNeill*	-			
CARYOPHYLLACEAE	*Minuartia hamata (Hausskn.) Mattf.*	-	-		
CARYOPHYLLACEAE	*Minuartia juniperina (L.) Maire & Petitm.*	-	-		
CARYOPHYLLACEAE	*Minuartia mesogitana (Boiss.) Hand.-Mazz. subsp. mesogitana*		Eastern Mediterranean		
CARYOPHYLLACEAE	*Minuartia montana L. subsp. wiesneri (Stapf) McNeill*	-	Iran-Turan		
CARYOPHYLLACEAE	*Minuartia sclerantha (Fisch & C.A.Mey.) Thell.*	-	Iran-Turan		
CARYOPHYLLACEAE	*Saponaria prostrata Willd. subsp. prostrata*	Soapwort	Iran-Turan	Endemik	LR (lc)
CARYOPHYLLACEAE	*Silene alba (Miller) Krause subsp. divaricata (Reichb) Walters*	Scabiosa	-		
CARYOPHYLLACEAE	*Silene chlorifolia Sm.*	Scabiosa			

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
CARYOPHYLLACEAE	*Silene conica L.*	Scabiosa	-		
CARYOPHYLLACEAE	*Silene spergulifolia (Desf.) M.Bieb.*	Scabiosa	Iran-Turan		
CARYOPHYLLACEAE	*Telephium imperati L. subsp. orientale (Boiss.) Nyman*				
CARYOPHYLLACEAE	*Velezia rigida L.*				
CELASTRACEAE	*Euonymus verrucosus Scop.*	Spindle Tree	-		
CHENOPODIACEAE	*Chenopodium botrys L.*	-	-		
CHENOPODIACEAE	*Noaea mucronata (Forssk.) Asch. & Schweinf. subsp. mucronata*	-	-		
CISTACEAE	*Helianthemum nummularium (L.) Mill. subsp. nummularium*	-	-		
CONVOLVULACEAE	*Convolculus arvensis L.*	Scammony	-		
CONVOLVULACEAE	*Convolvulus cantabrica L.*	Scammony	-		
CRASSULACEAE	*Sedum acre L.*	Stonecrop	-		
CRASSULACEAE	*Sedum album L.*	Stonecrop	-		
CRASSULACEAE	*Sedum hispanicum L. var. hispanicum*	Stonecrop	-		
DIPSACACEAE	*Scabiosa columbaria L. subsp. ochroleuca (L.) Cù elak. var. ochroleuca (L.) Coult.*	Scabiosa	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
DIPSACACEAE	*Scabiosa rotata M.Bieb.*	Scabiosa	Iran-Turan		
ELEAGNACEAE	*Elaeagnus angustifolia L.*	Silverberry	-		
EUPHORBIACEAE	*Andrachne telephioides L.*	-	-		
EUPHORBIACEAE	*Chrozophora tinctoria (L.) Raf.*	-	-		
EUPHORBIACEAE	*Euphorbia falcata L. subsp. falcata var. falcata*	Gum-plant	-		
EUPHORBIACEAE	*Euphorbia ledebourii Boiss.*	Gum-plant	-		
EUPHORBIACEAE	*Euphorbia herniariifolia Willd. var. herniariifolia*				
EUPHORBIACEAE	*Euphorbia rhabdotosperma Radcl.-Sm.*	Gum-plant	Iran-Turan		
EUPHORBIACEAE	*Euphorbia virgata Waldst. et Kit.*	Gum-plant	-		
EUPHORBIACEAE	*Mercurialis annua L.*	Gum-plant	Auxin		
FABACEAE (LEGUMINOSAE)	*Astragalus hamosus L.*	Wild-liquorise	-		
FABACEAE (LEGUMINOSAE)	*Astragalus micropterus Fisch.*	Wild-liquorise	Iran-Turan	Endemic	LR (lc)
FABACEAE (LEGUMINOSAE)	*Astragalus squalidus Boiss. & No.*	Wild-liquorise	-		
FABACEAE (LEGUMINOSAE)	*Astragalus sesameus L.*	Wild-liquorise	Mediterranean		
FABACEAE	*Colutea cilicica Boiss. & Balansa*	Colutea	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
(LEGUMINOSAE)					
FABACEAE (LEGUMINOSAE)	*Coronilla scorpioides (L.) Koch*	-	-		
FABACEAE (LEGUMINOSAE)	*Coronilla varia L. subsp. varia*	Crown vetch	-		
FABACEAE (LEGUMINOSAE)	*Hippocrepis unisiliquosa L. subsp. unisiliquosa*	-	-		
FABACEAE (LEGUMINOSAE)	*Hedysarum pestalozzae Boiss.*	-	Iran-Turan	Endemic	LR (lc)
FABACEAE (LEGUMINOSAE)	*Lathyrus setifolius L.*	Bitter-vetch	-		
FABACEAE (LEGUMINOSAE)	*Medicago minima (L.) Bartal. var. minima*	-	-		
FABACEAE (LEGUMINOSAE)	*Medicago sativa L. var. sativa*	Alfalfa	-		
FABACEAE (LEGUMINOSAE)	*Pisum sativum L. subsp. sativum var. arvense (L.) Poir.*	Green Peas	-		
FABACEAE (LEGUMINOSAE)	*Psoralea bituminosa L.*		Mediterrenaen		
FABACEAE (LEGUMINOSAE)	*Trigonella spruneriana Boiss. var. spruneriana*		Iran-Turan		
FABACEAE (LEGUMINOSAE)	*Trigonella monspeliaca L.*		Mediterrenaen		
FABACEAE (LEGUMINOSAE)	*Trigonella spicata Sibth. & Sm.*		Mediterrenaen		
FABACEAE (LEGUMINOSAE)	*Vicia ervilia (L.) Willd.*	Vetch			

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
FAGACEAE	*Quercus pubescens Willd.*	Oak bark	Auxin		
FAGACEAE	*Quercus trojana Webb*	Swamp oak	Eastern Mediterrenaen	-	-
GERANIACEAE	*Erodium cicutarium (L.) L'Herit. subsp. cicutarium*	Pincushion	-		
GERANIACEAE	*Geranium pyrenaicum Burm. fil.*	Pincushion	-		
GERANIACEAE	*Geranium rotundifolium L.*	Pincushion	-		
GLOBULARIACEAE	*Globularia orientalis L.*	-	Iran-Turan		
GLOBULARIACEAE	*Globularia trichosantha Fish. & C.A.Mey. subsp.trichosantha*	-	-		
HYPERICACEAE (GUTTIFERAE)	*Hypericum avicullariifolium Jaub. & Spach subsp.depilatum (Freyn & Bornm.) Robson var.depilatum*	Centuary	Iran-Turan	Endemik	LR (lc)
HYPERICACEAE (GUTTIFERAE)	*Hypericum lydium Boiss.*	Centuary	-		
ILLECEBRACEAE	*Hernaria incana Lam.*	-	-		
ILLECEBRACEAE	*Paronychia kurdica Boiss. subsp. kurdica var. kurdica*	-	-		
LAMIACEAE (LABIATAE)	*Acinos rotundifolius Pers.*	-	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
LAMIACEAE (LABIATAE)	*Ballota nigra L. subsp. nigra*	Black Horehound	Europe-Sib.		
LAMIACEAE (LABIATAE)	*Clinopodium vulgare L. subsp. arundanum (Boiss.) Nyman*	-	-		
LAMIACEAE (LABIATAE)	*Lamium amplexicaule L.*	-	Iran-Turan		
LAMIACEAE (LABIATAE)	*Lamium garganicum L. subsp. reniforme (Montbret & Aucher ex Benth.)R.Mill*	-	Europe-Sib.		
LAMIACEAE (LABIATAE)	*Marrubium globosum Montbret & Aucher ex Benth. subsp. globosum*	-	Iran-Turan	Endemic	LR (lc)
LAMIACEAE (LABIATAE)	*Micromeria myrtifolia Boiss. & Hohen*		Eastern Mediterranean		
LAMIACEAE (LABIATAE)	*Micromeria cristata (Hampe) Griseb. subsp. cristata*	-	Mediterranean		
LAMIACEAE (LABIATAE)	*Nepeta fissa C.A.Mey.*	-	Iran-Turan		
LAMIACEAE (LABIATAE)	*Nepeta nuda L. subsp. nuda*	-	-		
LAMIACEAE (LABIATAE)	*Salvia tomentosa Mill.*	Sage	Mediterranean		
LAMIACEAE (LABIATAE)	*Salvia verticillata L. subsp. amasiaca (Freyn & Bornm.) Bornm.*	Sage	Iran-Turan		
LAMIACEAE (LABIATAE)	*Salvia virgata Jacq.*	Sage	Iran-Turan		
LAMIACEAE (LABIATAE)	*Salvia viridis L.*	Sage	Mediterranean		
LAMIACEAE (LABIATAE)	*Scutellaria rubicunda Hornem subsp. brevibracteata (Stapf) J.R.Edm.*		Eastern Mediterranean	Endemic	LR (lc)
LAMIACEAE (LABIATAE)	*Scutellaria orientalis L. subsp. pinnatifida J.R.Edm.*	-	-		
LAMIACEAE (LABIATAE)	*Sideritis montana L. subsp. montana*	Sideritis	Mediterranean		
LAMIACEAE (LABIATAE)	*Stachys iberica Bieb. subsp. stenostachya (Boiss.) Rech.f.*	Sage	Iran-Turan		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
LAMIACEAE (LABIATAE)	*Teucrium chamaedrys L. subsp. syspirense (C.Koch) Rech.f.*	-	Iran-Turan		
LAMIACEAE (LABIATAE)	*Teucrium polium L.*	-	Iran-Turan		
LAMIACEAE (LABIATAE)	*Thymus leucotrichus Hal. var. leucotrichus*	Thymus	Eastern Mediterranean		
LAMIACEAE (LABIATAE)	*Ziziphora capitata L.*	-	Iran-Turan		
LAMIACEAE (LABIATAE)	*Ziziphora tenuior L.*	-	Iran-Turan		
MALVACEAE	*Althea hirsuta L.*	Eastern hollyhock	-		
MALVACEAE	*Malva neglecta Walk*	Mallow	-		
MORACEAE	*Ficus carica L. subsp. carica*	Fig	-		
OLEACEAE	*Jasminum fruticans L.*	Jasmine	Mediterranean		
PAPAVERACEAE	*Fumaria asepala Boiss.*	-	Iran-Turan		
PAPAVERACEAE	*Hypecoum imberbe Sibth. & Sm.*	-	-		
PAPAVERACEAE	*Papaver dubium L.*	Papaver	-		
PLANTAGINACEAE	*Plantago lanceolata L.*	Shield	-		
PLANTAGINACEAE	*Plantago scabra Moench*	Shield	-		
PLATANACEAE	*Platanus orientalis L.*				

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
PLUMBAGINACEAE	*Acantholimon acerosum (Willd.) Boiss. var. acerosum*		Iran-Turan		
PLUMBAGINACEAE	*Plumbago europaea L.*		Europe-Sib.		
POLYGALACEAE	*Polygala pruinosa Boiss. subsp. pruinosa*	Gand flower	-		
POLYGONACEAE	*Polygonum lapathifolium L.*	Smartweed	-		
POLYGONACEAE	*Rumex acetosella L.*	Dock	-		
PRIMULACEAE	*Androsae maxima L.*	-	-		
PRIMULACEAE	*Cyclamen coum Mill. var. coum*	Sowbread	-		Bern
RANUNCULACEAE	*Adonis flammea Jacq.*	Adonis	-		
RANUNCULACEAE	*Clematis orientalis L.*	Delphinium			
RANUNCULACEAE	*Consolida regalis Gray subsp. paniculata (Host.) So. var. paniculata*	Delphinium			
RANUNCULACEAE	*Consolida thirkeana (Boiss.) Schr.*	Delphinium	-	Endemic	LR (Lc)
RANUNCULACEAE	*Nigella nigellastrum (L.) Willk.*	Nigella	-		
RANUNCULACEAE	*Ranunculus damascenus Boiss. & Gaill.*	Botterflower	Iran-Turan		
RANUNCULACEAE	*Ranunculus oxyspermus Willd.*	butteflower	-		
RANUNCULACEAE	*Thalictrum minus L. var. majus (Crantz) Cr.p.*	-	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
RESEDACEAE	*Reseda lutea L. var. lutea*	Wild Mignonette			
RHAMNACEAE	*Paliurus spina-christi Mill.*	Black thorn	-		
RHAMNACEAE	*Rhamnus catharticus L.*	Buckthorn	Europe-Sib.		
RHAMNACEAE	*Rhamnus rhodopeus Velen. subsp. anatolicus*	Buckthorn	-		
ROSACEAE	*Cerasus prostrata (Labill.) Ser. var. prostrata*	Sourctaherry	Mediterranean		
ROSACEAE	*Cotoneaster integerrimus Medik. Euro-Sib.*	Cotoneaster	-		
ROSACEAE	*Cotoneaster nummularia Fisch. et Mey.*	Cotoneaster	-		
ROSACEAE	*Crataegus monogyna Jacq. subsp. monogyna*	Hawthorn	-		
ROSACEAE	*Geum urbanum L.*	Water Clove	Europe-Sib.		
ROSACEAE	*Potentilla recta L.*	-	-		
ROSACEAE	*Prunus divaricata Ledeb. subsp. divaricata*	Plum	-		
ROSACEAE	*Rosa foetida Herrm.*	Rose	Iran-Turan		
ROSACEAE	*Rosa horrida Fisch.*	Rose	-		
ROSACEAE	*Rubus caesius L.*	Blackberry	-		
ROSACEAE	*Rubus sanctus Schreb.*	Blackberry	-		
ROSACEAE	*Sanguisorba minor Scop. subsp. muricata (Spach) Briq*	-	-		
ROSACEAE	*Sorbus umbellata (Desf.) Fritsch var. taurica (G.Zinserl.) Gabr.*	Rowan	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
RUBIACEAE	*Asperula arvensis L.*	-	Mediterranean		
RUBIACEAE	*Crucianella bithynica Boiss.*	-	Eastern Mediterranean		
RUBIACEAE	*Crucianella exasperata Fisch. & C.A.Mey.*	-	Iran-Turan		
RUBIACEAE	*Cruciata taurica (Pall. ex Willd.) Ehrend.*	-	Iran-Turan		
RUBIACEAE	*Galium album Mill. subsp. prusense (C.Koch) Ehrend. & Krendl*	-	-		
RUBIACEAE	*Galium aparine L.*				
RUBIACEAE	*Galium fissurense Ehrend. et Schönb.-Tem.*	-	Auxin	Endemik	LR (lc)
RUBIACEAE	*Galium incanum Sm. subsp. eiatius (Boiss.) Ehrend.*	-	Iran-Turan		
RUBIACEAE	*Galium paschale Forssk.*	-	Eastern Mediterranean		
RUBIACEAE	*Galium palustre L.*	-	Europe-Sib.		
RUBIACEAE	*Galium spurium L. subsp. spurium*		Europe-Sib.		
RUBIACEAE	*Galium verum L. subsp. glabrescens Ehrend.*	-	Iran-Turan		
RUBIACEAE	*Sherardia arvensis L.*	-	Mediterranean		
RUTACEAE	*Haplophyllum armenum Spach*	-	-	Endemik	LR (lc)
SALICACEAE	*Populus nigra L. subsp. nigra*	Black poplar	-		
SALICACEAE	*Poplus tremula L*	Aspen	Europe-Sib.		
SALICACEAE	*Salix alba L.*	Willow	Avrupa-Sib.		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
SCROPHULARIACEAE	*Anarrhinum orientale Benth.*	-	Iran-Turan		
SCROPHULARIACEAE	*Digitalis lamarckii Ivan.*	Digitalis	Iran-Turan	Endemik	LR (lc)
SCROPHULARIACEAE	*Linaria corifolia Desf.*	Linaria	Iran-Turan	Endemik	LR (lc)
SCROPHULARIACEAE	*Linaria simplex (Willd.) DC.*	Linaria	Mediterranean		
SCROPHULARIACEAE	*Scrophularia libanotica Boiss. subsp. libanotica var. pontica R.Mill.*	-	Iran-Turan		
SCROPHULARIACEAE	*Scrophularia scopolii [Hoppe ex] Pers. var. scopolii*	-	-		
SCROPHULARIACEAE	*Scrophularia xanthoglossa Boiss. var. decipiens (Boiss. etKotschy) Boiss.*	-	Iran-Turan		
SCROPHULARIACEAE	*Verbascum orientale (L.) All.*	Mullein	Mediterranean	-	-
SCROPHULARIACEAE	*Verbascum glomeratum Boiss.*	Mullein	Iran-Turan	-	
SCROPHULARIACEAE	*Verbascum splendidum Boiss.*	Mullein	Eastern Mediterranean	Endemic	LR (lc)
SCROPHULARIACEAE	*Veronica hederifolia L.*	-	-		
SCROPHULARIACEAE	*Veronica multifida L.*	-	Iran-Turan	Endemic	LR (lc)
SCROPHULARIACEAE	*Veronica praecox All.*	-	-		
TAMARICACEAE	*Tamarix smyrnensis Bunge*	Tamarix	-		
ULMACEAE	*Celtis australis L.*	Hackberry	Mediterranean		
URTICACEAE	*Parietaria judaica L.*	-	Europe-Sib.		
URTICACEAE	*Parietaria lusitanica L.*	-	Eastern Mediterranean		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
VALERIANACEAE	*Centranthus longiflorus Stev. subsp. longiflorus*	-	İran-Turan		
VALERIANACEAE	*Centranthus calcitrapa (L.) Dufr.*	-	Mediterranean		
VALERIANACEAE	*Valeriana dioscoridis Sm.*	Polemonium	Mediterranean		
VIOLACEAE	*Viola alba Besser subsp. alba*	Viola	-		
VIOLACEAE	*Viola kitaibeliana Roem. & Schult.*	Viola	-		
VITACEAE (AMPELIDACEAE)	*Vitis sylvestris C.C.Gmel.*	Vitis			
ZYGOPHYLLACEAE	*Peganum harmala L.*	Harmal	-		
MONOCOTILEDONAE (LILIOPSIDA)					
CYPERACEAE	*Carex atrata L. subsp. atrata*	Sarsaparilla	Europe-Sib.		
CYPERACEAE	*Carex kukkonenii Ö. Nilsson*	Sarsaparilla	Iran-Turan		
CYPERACEAE	*Carex orbicularis Boott subsp. kotschyana (Boiss. et Hohen) Kukkonen*	Sarsaparilla	-		
CYPERACEAE	*C. oreophila C.A.Mey.*	Sarsaparilla	Iran-Turan		
JUNCACEAE	*Juncus conglomerates L.*	Typha	-		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
JUNCACEAE	*Juncus effusus L.*	Typha	-		
JUNCACEAE	*Luzula campestris (L.) DC.*	-	Europe-Sib.		
JUNCACEAE	*Luzula forsteri (Sm.) DC.*	-	Europe-Sib.		
LILIACEAE	*Allium flavum L. subsp. tauricum (Besser ex Rchb.) Stearn var. tauricum*	Wild onion	-		
LILIACEAE	*Allium paniculatum L. subsp paniculatum*	Wild onion	-		
LILIACEAE	*Asparagus officinalis L.*	Asparagus	-		
LILIACEAE	*Muscari neglectum Fuss.*	Mountain hyacinth	-		
LILIACEAE	*Ornithogalum nivale Boiss.*		Eastern Mediterranean		
POACEAE	*Aegilops triuncialis L.*	-	-		
POACEAE	*Avena barbata Pott ex Link subsp. barbata*	-	Mediterranean		
POACEAE	*Brachypodium sylvaticum (Huds.) P.Beauv.*	-	Europe-Sib.		
POACEAE	*Bothriochloa ischaemum (L.) Keng*	-	-		
POACEAE	*Bromus commutatus Schrad.*	Bromine	-		
POACEAE	*Bromus japonicus Thumb. subsp. japonicus*	Bromine	-		
POACEAE	*Bromus sterilis L.*	-	-		
POACEAE	*Chrysopogon gryllus (L.) Trin. subsp. gryllus*	-	-		
POACEAE	*Dactylis glomerata L. subsp. glomerata*	-	Europe-Sib.		

Division/ Family	Species	English Name	Phytogeographical Region	Endemism	IUCNand BERN
POACEAE	*Echinaria capitata (L.) Desf.*	-	-		
POACEAE	*Elymus lazicus (Boiss.) Melderis subsp. divaricatus (Boiss. & Balansa) Melderis*	-	Iran-Turan		
POACEAE	*Festuca callieri (Hack. ex St.-Yves)*	-	Iran-Turan		
POACEAE	*Melica ciliata L. subsp. ciliata*	-	-		
POACEAE	*Milium vernale M.Bieb. subsp. vernale*	-	-		
POACEAE	*Pennisetum orientale Rich.*		Iran-Turan		
POACEAE	*Phleum exaratum Hochst. ex Griseb. subsp. exaratum*	-	Europe-Sib.		
POACEAE	*Poa bulbosa L. var. vivipara*	-	-		
POACEAE	*Poa pratensis L.*	-	Europe-Sib.		
POACEAE	*Piptatherum coerulescens (Desf.) P.Beauv.*				
POACEAE	*Setaria viridis (L.) P. Beauv*	-	-		
POACEAE	*Stipa bromoides (L.) D.rfl.*	Sticky acacia	Mediterranean		
POACEAE	*Taeniatherum caput-medusae (L.)*	-	-		
POACEAE	*Vulpia unilateralis (L.) Stace*				
TYPHACEAE	*Typha latifolia L.*	Arundinaria	-		

	Family	Species
Pteridophyta	4	4
Spermatophyta		
Gymnospermae	2	2
Angiospermae		
Dicotyledonae	53	269
Monocotyledonae	5	37
Total	**64**	**314**

THE PHYTOGEOGRAPHICAL CHARACTERISTICS OF THE SITE

The study site is situated on the transition zone between Europe-Siberia and Iran-Turan Floristic Region.

As it can also be seen in the distribution of the species in the study site according to phytogeographical regions, Iran-Turan Plant geography origin species are predominant with 46 species.

In addition to the fact that the study site is situated on the transition zone between Europe-Siberia and Iran-Turan Floristic region in general , Mediterranean origin species are predominant. It is due to the fact that the site is Mediterranean ENCLAVE.

Table 4.2.13.1 The Distribution of the Species in the Study Site according to Phytogeographical Regions

Phytogeographical Regions	Number of Taxa	%
Iran-Turan	46	15
Mediterranean	25	8
Europe-Siberia	20	6
Eastern Mediterranean	11	4
Endemic	20	6

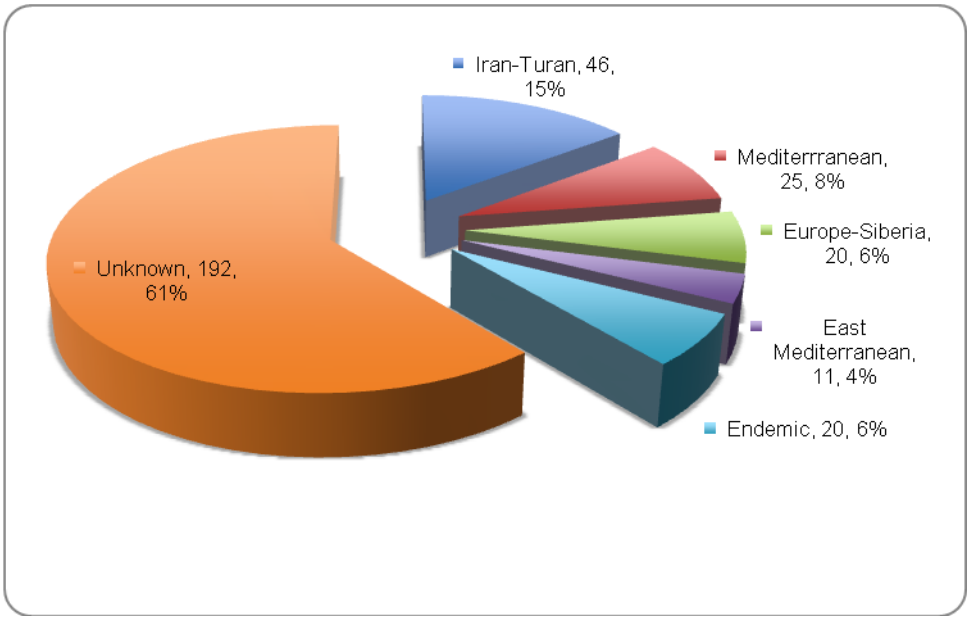


Figure 4.2.13.5 Phytogeographical Regions Spectrum

ENDEMIC PLANT SPECIES

In the site, 20 endemic plant species have been detected, and the endemism rate is 6%in the site. This rate is rather below the Turkey flora average.

Endemic plants have been classified according to IUCN categories and nineteen of the endemic species are in LR(Ic) and LR(cd) categories.

IUCN endangered categories have been assessed on the basis of the works called "Red Data Book of Turkish Plants (Pteridophyta and Spermatophyta) Ekim et al. 2000, Ankara

IUCN Categories;

CR-CRITICALLY ENDANGERED-Much in Danger: If a taxon is under the risk of extinction in the near future, it is put into this category.

EN-ENDANGERED-In danger**:**If a taxon is under a high risk and under the danger of extinction in the near future but not in CR group yet, it is put into EN group.

VU-VULNERABLE-May be harmed**:**Besides the fact that it is not possible to put the them in CR and EN groups, the taxa that are thought to become under much danger in nature in the medium-term future are put in this group. In our country, the species that are considered to be under danger in the medium-term future and the species that are known to be from more than one locality are put in this category. Moreover, some species whose conditions seems not to be under danger for now, are put into this category so that they can be protected in the future.

LR-LOWER RISK-Under Little Danger: The plants that cannot be put in any categories above and have better population with regards to the others are put in this category. The ones whose population is rather good and which are known to be at least 5 locality are put in this category. With regards to their condition in the future, there are three sub-categories that can be ranked by their risk of danger.

LR (cd) Conservation Dependent – Requiring a Measure of Conservation

Taxon will be put in one of the categories above in 5 years, and they are the ones requiring a special protection status in terms of both the species and the habitat.

LR (nt) Near Threatened - Possibly Be Under Danger

Species do not take place in the previous group, but the candidates that are close to take place in VU category.

LR (LC) Least Concern –Giving The Least Concern

The ones that do not require any kind of conservation and are not under danger.

Endemic species and Danger Categories

Family	Species	English Name	Phytogeographic Region	Endemism	IUCN/ Bern
ASTERACEAE (COMPOSITAE)	*Hieracium reductum Freyn & Sint.*	-	-	Endemic	LR (cd)
BORAGIANCEAE	*Anchusa leptophylla Roem. & Schult. subsp. incana (Ledeb.) D.F.Chamb.*	Anchusa	Iran-Turan	Endemic	LR (lc)
BORAGIANCEAE	*Nonea stenosolen Boiss. & Balansa*	-	Iran-Turan	Endemic	LR (lc)
BORAGIANCEAE	*Onosma isauricum Boiss. Et Heldr.*	-	Iran-Turan	Endemik	LR (lc)
BRASSICACEAE (CRUCIFERAE)	*Alyssum huetii Boiss.*		Iran-Turan	Endemic	LR (lc)
BRASSICACEAE (CRUCIFERAE)	*Draba rigida Willd. var. rigida*	-	-	Endemic	LR (lc)
CARYOPHYLLACEAE	*Gypsophila sphaerocephala Fenzl ex Tchich. var. cappadocica Boiss.*	Chalk plant	Iran-Turan	Endemic	LR (lc)
CARYOPHYLLACEAE	*Saponaria prostrata Willd. subsp. prostrata*	Soapwort	Iran-Turan	Endemic	LR (lc)
FABACEAE (LEGUMINOSAE)	*Astragalus micropterus Fisch.*	Wild liquorice	Iran-Turan	Endemic	LR (lc)
FABACEAE (LEGUMINOSAE)	*Hedysarum pestalozzae Boiss.*	-	Iran-Turan	Endemic	LR (lc)
HYPERICACEAE (GUTTIFERAE)	*Hypericum aviculariifolium Jaub. & Spach subsp.depilatum (Freyn & Bornm.) Robson var.depilatum*	Centuary	Iran-Turan	Endemic	LR (lc)
LAMIACEAE	*Marrubium*	-	Iran-Turan	Endemic	LR (lc)

Family	Species	English Name	Phytogeographic Region	Endemism	IUCN/ Bern
(LABIATAE)	*globosum Montbret & Aucher ex Benth. subsp. Globosum*				
LAMIACEAE (LABIATAE)	*Scutellaria rubicunda Hornem subsp. brevibracteata (Stapf) J.R.Edm.*		Eastern Mediterranean	Endemic	LR (lc)
RANUNCULACEAE	*Consolida thirkeana (Boiss.) Schr.*	Delphinium	-	Endemic	LR (lc)
RUBIACEAE	*Galium fissurense Ehrend. et Schönb.-Tem.*	-	Auxin	Endemic	LR (lc)
RUTACEAE	*Haplophyllum armenum Spach*	-	-	Endemic	LR (lc)
SCROPHULARIACEAE	*Digitalis lamarckii Ivan.*	Digitalis	Iran-Turan	Endemic	LR (lc)
SCROPHULARIACEAE	*Linaria corifolia Desf.*	Digitalis	Iran-Turan	Endemic	LR (lc)
SCROPHULARIACEAE	*Verbascum splendidum Boiss.*	Mullein	Eastern Mediterranean	Endemic	LR (lc)
SCROPHULARIACEAE	*Veronica multifida L.*	-	Iran-Turan	Endemic	LR (lc)

PLANT SPECIES UNDER CONSERVATION BY BERN CONTRACT

Turkey has become a member of the Bern Contract which is known as “Convention on the Conservation of European Wildlife and Natural Life” on 20.02.1984. The purpose of the contract is to protect natural plant and animal species and their habitat and to cooperate with the other member countries for this purpose. The countries signed the contract are obliged to take the necessary legal and administrative precautions in order to protect endangered plant and animal species.

In the site, any species under conservation by Bern Contract have not been encountered.

FLORISTIC RESULTS:

The research areais located on Zinav Stream flowing into Kelkit Stream in Yeşilırmak River Basin within the borders of Reşadiye District in Tokat Province.

The research area is located in A6 square according to grid system by Davis, which is used in the flora of Turkey.

On the basis of the literature search and field survey conducted, 314 species belonging to 64 families and sub-species taxa have been detected.

As 20 endemic plant species have been detected in the area, the endemism rate is 6%. This rate is rather below the Turkey flora average.

Endemic plants have been classified according to IUCN categories, 19 of them are involved in LR(lc) category, and 1 of them in LR(cd) category.

Accordingly, highly endangered species (CR and EN) have not been encountered in the area.

The research area is situated within the borders of European-Siberia plant geography in general terms.

As it is also seen in the distribution of the species in the filed of study according to phytogeographical regions, Iran-Turan plant geography origin species are predominant with the 46 kinds.

Although the research area is situated within the borders of European-Siberia plant geography, Mediterranean origin plants are at a size that cannot be neglected. This is because of the fact that the area is MEDITERRANEAN ENCLAVE.

THE ECOLOGICAL IMPORTANCE OF THE REGION

The research area, due to its closeness to Kelkit Valley which has the feature of "Vestiges of Tethys, Mediterranean Enclave", has importance. Kelkit Valley is extremely rich floristically and it is a region that includes variable and indigenous species.

EFFECTS AND THE PRECAUTIONS TO BE TAKEN

The effects of the dams on river ecology shows a big variety in a very wide context. Dams have climatic, hydrological, ecological, socio-economical and cultural effects.

At this point, an assessment was conducted **phytoecologically**.
In Central Black Sea Region, the IUCN danger categories of possible species that are rare and under the threat of extinction in Zinav Stream flowing into Kelkit Stream and its vicinity in Yeşilırmak River Basin within the borders of Reşadiye District in Tokat Province are given below.

Accordingly, total 20 species and sub-taxa, 19 in LR(lc)catogory and 1 in LR(cd), have been detected in the area.

Species that are high endangered (CR and EN) and require special conservation have not been encountered in the area.

Only 1 species in LR(cd) category(Conservation Dependent) has been encountered (Hieracium reductum Freyn & Sint). However, the canal system of the HEPP project planned to be carried out will be in the shape of a TUNNEL, it doesn't pose any threat for this species.

Moreover, in the case of the realization of the project, usual flow along the river will be obstructed. This situation will have adverse effects for the ecosystems dependent on water, primarily the riparian vegetation in the river bed

As the canal system has been planned as "tunnel", any devastation of habitats will not matter.

Releasing the amount of water that the species in the riverbed needs is crucial for the continuity of Riparian vegetation.

Onur Regulator and HEPP Project on Zinav Stream flowing into Kelkit Stream and its vicinity in Yeşilırmak River Basin within the borders of Reşadiye District in Tokat Province is in the vicinity of Kelkit Valley which is a “Mediterranean Enclave”. Therefore, it is “One of the Sites where Floristic Diversity is Dense”. Glacier movements that happened at different geological periods contributed to the biological diversity of Anatolia. Anatolia was affected by the immigration of plant and animals happened glacial and interglacial periods. Kelkit Valley is also a Tethys (Ancient Mediterranean) remnant and important in that sense.

Due to the reasons explained above, carrying out all kinds of activities in the area meticulously and taking the necessary precautions are important in terms of protecting floristic diversity.

In conclusion, The protection of floristic diversity and habitat unity in the project site and its vicinity, Tethys remnant is important because of its closeness to Kelkit Valley.

HEPP project has been planned as a tunnel and a restoration will be made in the areas to be affected from the construction such as building roads in accordance with “Ecological Restoration” principles. Also, it is assumed that taking the precautions mentioned above and some other measures will minimize the adverse affects on floristic diversity.

FAUNA

The Characteristics of Project Impact Zone and Ecosystems

The project site, situated the North-eastern Central Anatolia, is located within the borders of Tokat Province and its impact zone lies through the borders of Amasya, Samsun and Sivas provinces. Therefore, faunastic assessment is required to be carried out at spatial dimension rather than spot size.

In the region, Yedikır Dam in Amasya is an important bird site and ,in the east of Amasya, Kelkit Valley which is formed by Kelkit Stream and includingTokat, Samsun and Sivas provinces is another important site for birds. Oak forests, calabrian pine, scotch pine, black pine and fagus forests and cedar communities in addition to maquis communities peculiar to Mediterranean have the characteristics and Mediterranean microclimate (Eken et al., 2006).

According to General Directorate of Nature Protection and National Parks, there don’t exist any National park, Nature Conservation Area and Nature monuments in the area. The only Nature park within the borders of Tokat province is Ballıca Cave Nature Park in the borders of Pazar Town which is at a distance of 33 km to the center. Tokat Kaz Lake has been determined as Tokat Province wildlife Development Area and water birds are under conservation in this area. Kaz Lake is situated in the west of Kazova between Tokat and Turhal. Kaz Lake and its vicinity are rich concerning fauna. A variety of fish lives in the lake and various mammal and reptile species in reedy, marshy and woodland areas in the surrounding. Moreover, due to their convenient features, the lake and its vicinity compose a sheltering environment for local and immigrant birds. At the lake and its vicinity, lots of birds accommodate in the area due to the fact that they show intense plant existence and fresh water ecosystem; 69 bird species wereobserved in 2002 and 74 in 2003. Kaz Lake is among the B Class aquatic lands according to the criteria accepted by International Union of Nature Conservation (IUCN) (Zeybek 2005).

When it is taken into account in general, as the region that forms Black Sea and Central Anatolia line has a high biodiversity with the ecoton feature that it constitutes and with the stream and dam lakes that it has. Therefore, it is essential for wildlife.

When vertebrate fauna of Turkey is considered within this scope;the following species are represented in the area with their approximate numbers:

Sea fish: with approximately 500 species
Fresh water fish: with approximately 200 species
Amphibia: with approximately 25 species
Reptiles: with approximately 125 species
Birds: with approximately 460 species
Mammals: with approximately 165 species

Totally, about 1400 vertebrate animals live in aquatic and terrestrial ecosystems in our country.

The project site situated on Zinav Stream flowing into Kelkit Stream and its vicinity in Yeşilırmak River Basin within the borders of Reşadiye District in Tokat Province has an altitude changing between 950 and 1200 m.

The predominant vegetation in the area is deciduous forest (oak) and it also includes high Steppe that constitutes a feature of transition between and Central Anatolia Steppe and Black Sea. In the project impact zone, 3 main ecosystems; Aquatic ecosystems, Steppe Featured Ecosystem and cultivation lands, deciduous forest ecosystem, which are important for terrestrial fauna, are present.

Figure 4.2.13.6. Mixed Deciduous Forests Vegetation and Mountain Steppe in the HEPP Impact Zone

The Faunastic Structure of The Area

The species, which are widespread in the region, belonging to Amphibia, Reptilia, Aves and Mammalia classes, are explained below.The numerical rates of the classes to each other in the faunastic structure that they form are given below. According to it, birds are the numerically predominant species and mammals follow it. Reptile species are more compared to amphibious species.

Some of the species, which are becoming more widespread in the area, belonging to Amphibia, Reptilia, Aves and Mammalia classes, are under conservation by various conservation agreements. The protection status are displayed for each species in the related parts. One of them, Wildlife and Habitat Conservation Contract (Bern Contract) Appendices are Appendix-II: Primarily Protected Animal Species, Appendix-III: Animal Species under conservation; Appendix-IV: Banned Hunting Methods.

IUCN (International Union of Nature Conservation) categories are Extinct-EX, Extinct in the Wildlife - EW, Critically Endangered- CR, Endangered- EN, Vulnerable-VU, Near Threatened-NT, Least Concern-LC, Data Deficient -DD, Non-Evaluated-NE.

According to the decisions of 2010-2011 Hunting Season Central Hunting Commission, the species hunting of which is allowed and under conservation are listed in different Appendices. The wildlife animals under conservation by the Ministry of Urban and Environment are listed in Appendix List -I, the hunting animals under conservation by Hunting Season Central Hunting Commission in Appendix List-II and the hunting animals hunting of which is is allowed in certain terms in Appendix List-III.

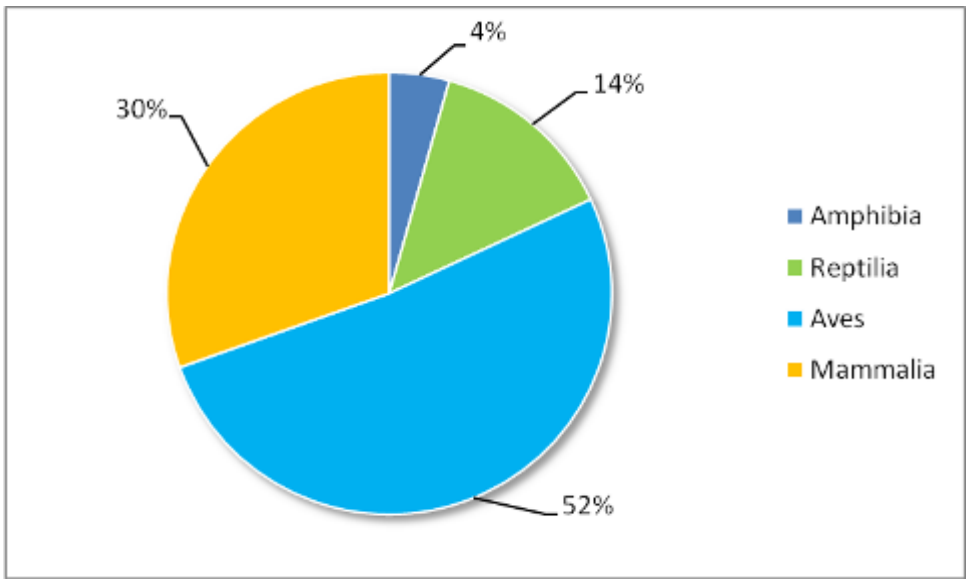


Figure 4.2.13.7. The Numerical Rates of the Spread ofFaunastic Structures at the Site

Amphibia

Salamander, toad frogs and water frogs constitute the members of this group. As the members of this group which are all poikilothermic hibernate, they cannot be seen in the land actively. Nocturnal and diurnal species are found in these classes. Generally, these species are sampled by ladling or collecting them manually while strolling around the aquatic and terrestrial lands during day and night. In this report,April which is our study period is a convenient term with regards to weather temperature for the observation on the life of amphibia. Therefore, evaluation has been carried out as the fauna list was made by both the field of study and literature review. In Turkey, about 25 amphibia are distributed, 7 of them have a high possibility of distribution in the project impact zone (Table). 3 of these species are salamander, 2 are toad frogs, 1 is water frog and 1 of them is tree frog.

Amphibia species belonging to Urodela (Tailed frog -Salamanders) and Anura (tailless frog) groups distributed in the project site and its vicinity, are given in the table with their protection status.3 of the species existent in the area are involved in Bern Contract Appendix-II, and 3 of them are in Appendix-III. According to IUCN categories, there is no amphibian under threat, all the species are in LC category.

Figure 4.2.13.8. Of widespread amphibian species in the area, Night Frog Bufo viridis

Table 4.2.13.2. Amphibian species (salamander and frogs)detected in streams, ponds and terrestrial ecosystems in Onur project impact zone and their protection status

No	Order Species and English Name	Habitat	Protection status Bern & IUCN	Central Hunting Commission
Urodela –Tailed Frogs =Salamanders				
1	*Triturus vulgaris* Small Pond Salamenders	The still flowing sedgy parts of the streams that turned into lake	Appendix-III & LC	-
2	*Triturus karelinii* Southern Crested Newt	The still flowing sedgy parts of the streams that turned into lake	Appendix-II & LC	-
3	*Triturus vittatus* Triturus	The still flowing sedgy parts of the streams that turned into lake	- & LC	-
Anura – Tailless Frogs				
4	*Bufo bufo* European Toad	As edge of the creek is dense, humid soil	Append.- III & LC	-
5	*Bufo viridis* Night Toad	As edge of the creek is dense, humid soil	Appendix-II & LC	-
6	*Rana ridibunda* Pond Toad	In streams and by the banks of rivers	Appendix-III & LC	-
7	*Hyla arborea* Tree Toad	On the leaves of bush and trees by the banks of streams and in humid areas	Appendix-II & LC	-

Reptilia (Reptiles)

Considering the examples of the reptile class in Turkey, it is seen that turtles, lizards and Snakes arewidespread in our country. Our country is rich in reptile fauna with approximately 125 species and most of the species are under conservation. In addition to the fact that he members of this class are poikilothermic animals, they all hibernate compulsorily in the geography they exist in Turkey. April, when the study was carried out, is a month in which reptiles begin their activities.Therefore, it was possible to observe some species in the site. The resources were benefited from for the unobserved species. Generally, in the studies which are intended to detect the reptile fauna; the land is strolled, underneath of the rocks are checked, and long-handled pliers are used to catch them.

In our study, 22 reptile species have been foreseen to be able to spread in the HEPP impact zone and 3 of these reptiles are turtle, 7 are lizard and 12 are snake species (see Table). Chelonia turtles, which are one of the two orders in Reptile species, and Squamata includes lizards and snakes. The protection status of the reptiles are also given in the table. According to it, most of the species, 14 species, are under conservation by Bern Contract Appendix-II. According to IUCN, widespread tortoise is in Testudo graeca VU category, as European pond turtle being in Emys orbicularis and Yellow snake in Emys orbicularis, two endangered species are in NT category. Apart from them, the rest are widespread and in LC category. According to Central Hunting Commission decisions, all the reptile species are under conservation by Appendix List-I.

Figure 4.2.13.9. Of the reptile species widespread in the site, Black Snake, Dolicophis jugularis

Table 4.2.13.3. Reptile species detected in streams, ponds and terrestrial ecosystems in Onur Project impact zone and their conservation status

No	Order, Species, and English Name	Habitat	Protection Status Bern & IUCN	Central Hunting Commission
Chelonia -Turtles				
1	*Testudo graeca* Tortoise	At forests and forest openings within the project influence zone	Appendix-II & VU	Annex-I
2	*Emys orbicularis* European pond tortoise	In streams within the project influence zone	Appendix-II & NT	Annex-I
3	*Mauremys caspica* Striped-neck turtle	In aquatic ecosystems within the project influence zone	Appendix-II & -	Annex-I
Squamata - Lizards				
4	*Mediodactylus kotschyi* Kotschy's Gecko	At rocky areas and building walls	Appendix-II & -	Annex-I
5	*Hemidactylus turcicus* Mediterranean house gecko	At rocky areas and building walls	Appendix-III & LC	Annex-I
6	*Lacerta viridis* Green Lizard	At grassy and bushy areas in forest	Appendix-II & LC	Annex-I
7	*Darevskia rudis*	On stones in grassy and bushy areas in forest	Appendix-III & LC	Annex-I
8	*Podarcis muralis* Common Wall Lizard	On stones in grassy and bushy areas in forest	Appendix-II & LC	Annex-I
9	*Ophisops elegans* Snake-eyed Lacertid	At forests and forest openings within the project influence zone	Appendix-III & LC	Annex-I
10	*Anguis fragilis* Slow Worm	Beneath rocks in forest	Appendix-III & LC	Annex-I
Squamata - Snakes				
11	*Typhlops vermicularis* European Blind Snake	Under ground in forest	Appendix-III & -	Annex-I
12	*Dolichophis schmidti* Red-Bellied Racer	Under ground in forest	Appendix-II & LC	Annex-I
13	*Dolichohis jugularis* Large Whip Snake	At Steppe lands	Appendix-II & LC	Annex-I
14	*Platyceps najadum* Dahl's Whip Snake	At forest and under ground where plenty of grass exist	Appendix-II & LC	Annex-I
15	*Coronella austriaca* Smooth Snake	Under ground in forest	Appendix-II & -	Annex-I

No	Order, Species, and English Name	Habitat	Protection Status Bern & IUCN	Central Hunting Commission
16	*Eirenis modestus* Ring Headed Dwarf Snake	At Steppe lands and agricultural fields within the project influence zone	Appendix-III & LC	Annex-I
17	*Elaphe longissima* Aesculapian Snake	Under ground in forest	Appendix-II & LC	Annex-I
18	*Elaphe quatuorlineata* Four-lined Snake	Under ground in forest	Appendix-II & NT	Annex-I
19	*Natrix natrix* Grass Snake	At grasslands near water	Appendix-III & LC	Annex-I
20	*Natrix tessellata* Dice Snake	In water and water edges	Appendix-II & LC	Annex-I
21	*Vipera ammodytes* Nose-horned Viper	Under ground in forest	Appendix-II & LC	Annex-I
22	*Montivipera xanthina* Ottoman Viper	Under ground in forest	Appendix-II & LC	Annex-I

Aves (Birds)

Within the scope of HEPP project study, the main bird species encountered in the region, their immigration status, habitat preference, distribution and protection status in Turkey are summarised in the Table. Because of Yeşilırmak River and aquatic living environment in its vicinity, plenty of water birds visit the study area and feed themselves here. The bird species given in the table belong to 13 orders. 5 of these orders, which include water birds, are Pelecaniformes, Gruiformes, Charadriiformes, Ciconiiformes, and Anseriformes. Falconiformes include daytime predatory birds and Strigiformes includes nighttime predatory birds. The birds belonging to these orders usually live on big insects, fish, amphibian, reptile, birds and mammals. Dependent on the abundant number of the species and individuals in aquatic environment, they can be found in a large number. Columbiformes (Pigeons), Caprimulgiformes (Nihthawk), Apodiformes (Swifts), Coraciformes (Kingfishers, Bee-Eaters, and Rollers), Piciformes (Woodpeckers) and Passeriformes (Singing Birds) that live on animal and plant nutrition are land birds, they usually live on insects in various size and different parts of plants changing dependent on the species.In this region, the species belonging to these orders are the ones that live in forests and bushes.

34 of the widespread species in the region are summer migrants (SM) and 8 of them are winter migrants (WM); and 38 of them are available and breeding in the region as being local (L), the other species are observed as being passing visitors (PV) in certain terms in the region (Table). The rate of the immigration status of the bird species available in the region are given in the figure below.

According to Bern Contract, 48 of the bird species available in the region are under conservation by Appendix-II and 27 of them by Appendix-III, but 5 species are not included in any Appendix.

According to IUCN categories, the species available in the site are mostly in LC category and widespread. Egyptian Vulture Neophron percnopterus is included in EN category, Imperial Eagle Aquila heliacal and Lesser Kestrel Falco naumanni in VU category, Roller Coracias garrulous and Anatolian (Small) Nutcracker Sitta krueperi in NT category.

In the table, the Appendices to which the observed bird species belong according to Central Hunting Commision decisions are given. With regards this, only 14 of the species take part in Appendix List-III, and the other ones are under conservation.

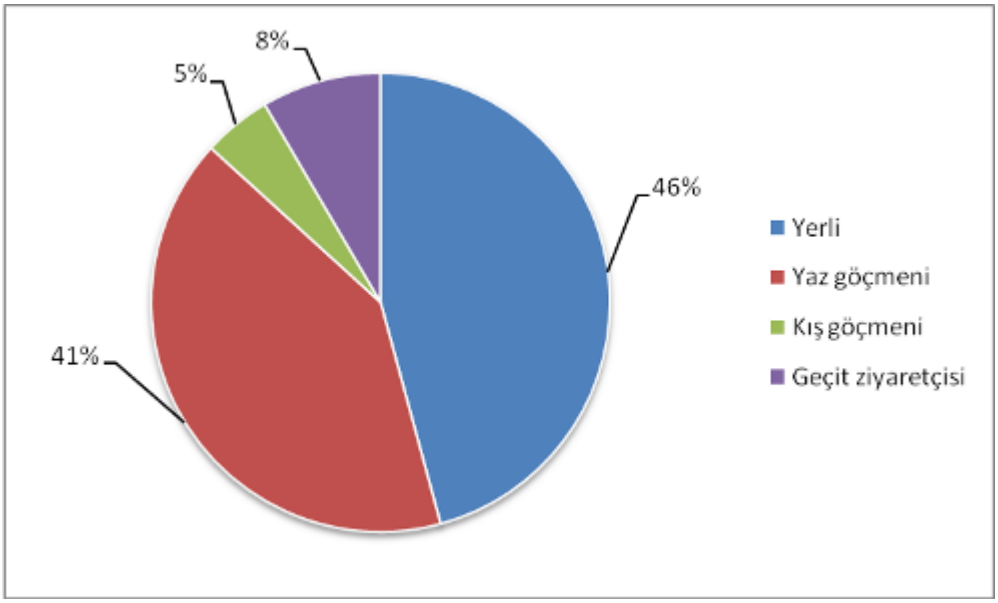


Figure 4.2.13.10 The Birds species widespread in Onur HEPP project site and its vicinity, their rate by immigration status

Figure 4.2.13.11 Of the endangered bird species widespread at the site, Egyptian Vulture Neophron percnopterus

Table 4.2.13.4 . Bird species widely distributed within Onur HEPP project influence zone and their immigration status (PV: passing visitor, WM: winter migrant, N:native, SM: summer migrant) and protection status (Yiğit et al., 2008)

No	Order / Family		Migration Status, Habitat	Bern	IUCN	Central Hunting Commission
	English Name	Scientific Name				
Podicipediformes / Podicipedidae						
1	Little Grebe	*Tachybaptus ruficollis*	N; Water bird, all wetlands in Turkey	Appendix-III	LC	Annex-I
Galliformes / Phasianidae						
2	Common Quail	*Coturnix coturnix*	SM;wetland and desert bird, all Turkey	Appendix-III	LC	
3	Chukar Partridge	*Alectoris chukar*	N;Mountain and steppe bird, all Turkey excluding Thrace	Appendix-III	LC	
Gruiformes / Gruidae						
4	Common Crane	*Grus grus*	SM;wetland and land bird, north coasts of Aegean and all Turkey excluding coasts of Western Black Sea	Appendix-II	LC	Annex-I
Gruiformes / Rallidae						
5	Laysan Crake	*Porzana porzana*	PV;reeds, all Turkey	Appendix-II	LC	Annex-I
6	Coot	*Fulica atra*	N;Water bird, Marmara,Aegean, Aegean and Mediterranean borders of CentralAnatolia, Kızılırmak Basin	Appendix-III	LC	Annex-III
Charadriiformes / Scolopacidae						
7	Lapwing	*Vanellus vanellus*	SM;Marsh bird, Central and East Black Sea, Southeast Anatoliaand all Turkey excluding northwest of Thrace	Appendix-III	LC	Annex-II
Charadriiformes / Scolopacidae						
8	Snipe	*Gallinago gallinago*	WM;Marsh bird, all Turkey	Appendix-III	LC	Annex-III
9	Ruff	*Philomachus pugnax*	PV;Marsh bird, all Turkey	Appendix-III	LC	Annex-II
10	Greenshank	*Tringa nebularia*	PV;Marsh bird, Marmara and Aegeancoasts, Black Sea – Mediterranean gateway	Appendix-III	LC	Annex-II
Charadriiformes / Laridae						
11	Great Black-headed Gull	*Larus ichthyaetus*	WM;Coastal bird, Black Sea – Mediterranean gateway	Appendix-III	LC	Annex-II
Ciconiiformes / Ardeidae						
12	Grey Heron	*Ardea cinerea*	N;Water bird, all wetlands	Appendix-III	LC	Annex-II
13	Bittern	*Botaurus stellaris*	N;Marsh bird, Marmara Sea, Southeast Mediterranean, surroundings of Sinop, Samsun, Tuz Lake and Van Lake	Appendix-II	LC	Annex-I
Ciconiiformes / Ciconiidae						
14	White Stork	*Ciconia ciconia*	SM;Waterand terrestrial birds, all Turkey	Appendix-II	LC	Annex-I

No	Order / Family		Migration Status, Habitat	Bern	IUCN	Central Hunting Commission
	English Name	Scientific Name				
15	Black Stork	*Ciconia nigra*	SM;Water and terrestrial birds, Thrace and Marmara, East Black Sea,CentralAnatolia	Appendix-II	LC	Annex-I
Anseriformes / Anatidae						
16	Eurasian Teal	*Anas crecca*	WM;Water bird, Black Sea-Southeastmigration way, Black Seacoast, Central andWestCentralAnatolia, Marmara,Aegean, Mediterraneancoasts and coasts of Van Lake	Appendix-III	LC	Annex-III
17	Mallard	*Anas platyrhynchos*	N;Water bird, all Turkey	Appendix-III	LC	Annex-III
18	Garganey	*Anas querquedula*	SM;Water bird,Aegean, Marmara, Mediterraneancoasts,Central Anatolia, EastBlack Sea, Black Sea-Southeastmigration way	Appendix-III	LC	Annex-III
19	Ruddy Shelduck	*Tadorna ferruginea*	N;Water bird, all Turkey excluding Black Seacoasts	Appendix-II	LC	Annex-I
Falconiformes / Accipitridae						
20	European Honey Buzzard	*Pernis apivorus*	SM;ForestBird, Marmara, Black Sea,Aegean,CentralAnatolia, east of Mediterranean, Southeastern Anatolia	Appendix-II	LC	Annex-I
21	White-tailed Eagle	*Haliaeetus albicilla*	N;SteppeBird, Marmara, EastBlack Sea,CentralAnatolia,Aegean, Mediterranean	Appendix-II	LC	Annex-I
22	Egyptian Vulture	*Neophron percnopterus*	SM;SteppeBird, All Turkey	Appendix-II	EN A2abcd +3bcd+ 4abcd	Annex-I
23	Black Kite	*Milvus migrans*	SM;SteppeBird, All Turkey	Appendix-II	LC	Annex-I
24	Eurasian Sparrowhawk	*Accipiter nisus*	WM;SteppeBird, All Turkey	Appendix-II	LC	Annex-I
25	Buzzard	*Buteo buteo*	WM;SteppeBird, All Turkey	Appendix-II	LC	Annex-I
26	Long-legged Buzzard	*Buteo rufinus*	N;SteppeBird, All Turkey	Appendix-II	LC	Annex-I
27	Short-toed Snake Eagle	*Circaetus gallicus*	SM;SteppeBirdAll Turkey	Appendix-II	LC	Annex-I
28	Eurasian Marsh Harrier	*Circus aeruginosus*	PV;Reed andSteppeBird, All Turkey	Appendix-II	LC	Annex-I
29	Golden Eagle	*Aquila chrysaetos*	N;Rock andForestBird, all Turkey excluding CentralBlack Sea	Appendix-II	LC	Annex-I
30	Asian Imperial Eagle	*Aquila heliaca*	N;ForestandSteppeBird, all Turkey excluding Mediterraneancoasts	Appendix-II	VU C2a(ii)	Annex-I

No	Order / Family		Migration Status, Habitat	Bern	IUCN	Central Hunting Commission
	English Name	Scientific Name				
31	Lesser Spotted Eagle	*Aquila pomarina*	SM;Forest bird, Marmara,Aegean, WestMediterranean, EastBlack Sea, Black Sea-Southeastmigration way, Thrace- Hatay migration way	Appendix-II	LC	Annex-I
32	Kestrel	*Falco tinnunculus*	N;Steppe bird, All Turkey	Appendix-II	LC	Annex-I
33	Lesser Kestrel	*Falco naumanni*	SM;SteppeBird, All Turkey	Appendix-II	VU A2bce+ 3bce	Annex-I
34	Peregrine	*Falco peregrinus*	WM;All Turkey excluding WesternBlack Sea	Appendix-II	LC	Annex-I
35	Booted Eagle	*Hieraaetus pennatus*	SM;Mountain andForestBird, All Turkey	Appendix-II	LC	Annex-I
Columbiformes / Columbidae						
36	Rock Pigeon	*Columba livia*	N;Rockbird, All Turkey	Appendix-III	LC	Annex-III
37	Stock Pigeon	*Columba oenas*	N;ForestandSteppebird, Black Seacoasts and Aegean and central parts ofMediterranean, northern parts of Thrace	Appendix-III	LC	Annex-II
38	Wood Pigeon	*Columba palumbus*	SM;ForestandSteppebird,All Turkey	Appendix-III	LC	Annex-III
39	Collared Dove	*Streptopelia decaocto*	N;Forestandsteppebird, Marmara, Thrace,AegeanandCentralMediterraneancoastsandCentralBlack Sea	Appendix-III	LC	Annex-II
40	European Turtle Dove	*Streptopelia turtur*	SM;Forestandsteppebird, All Turkey	Appendix-III	LC	Annex-III
Strigiformes / Strigidae						
41	Little Owl	*Athene noctua*	N; Kara bird, all Turkey excluding Black Seacoastline	Appendix-II	LC	Annex-I
42	Eurasian Scops Owl	*Otus scops*	SM;Forestbird, All Turkey	Appendix-II	LC	Annex-I
43	Eurasian Eagle Owl	*Bubo bubo*	N;Forestandsteppebird, northern and central part of CentralAnatolia, Hatay, northern part of EastAnatolia, northern Thrace	Appendix-II	LC	Annex-I
Caprimulgiformes / Caprimulgidae						
44	Eurasian Nightjar	*Caprimulgus europaeus*	SM;Forestand steppebird, All Turkey	Appendix-II	LC	Annex-I
Apodiformes / Apodidae						
45	Swift	*Apus apus*	SM;Rock and wetlandbird, All Turkey	Appendix-III	LC	Annex-I
Coraciiformes / Coraciidae						
46	European Roller	*Coracias garrulus*	SM;Forestbird, all Turkey excluding WesternandEasternBlack Sea	Appendix-II	NT	Annex-I
Coraciiformes / Upupidae						

No	Order / Family		Migration Status, Habitat	Bern	IUCN	Central Hunting Commission
	English Name	Scientific Name				
47	Hoopoe	*Upupa epops*	SM;Woody and rocky areas, All Turkey	Appendix-II	LC	Annex-I
Piciformes / Picidae						
48	Syrian Woodpecker	*Dendrocopos syriacus*	N;Forestbird,CentralAnatolia and all Turkey excludingeast of EasternBlack Sea	Appendix-II	LC	Annex-I
49	Middle Spotted Woodpecker	*Dendrocopos medius*	N;Forestbird, all coasts of Turkey excluding İskenderun Gulf and Marmara	Appendix-II	LC	Annex-I
Passeriformes / Alaudidae						
50	Crested Lark	*Galerida cristata*	N;Steppeand landbird, all Turkey excluding Central and Black Sea coasts	Appendix-III	LC	Annex-II
51	Woodlark	*Lullula arborea*	N;Steppeand landbird, All Turkey	Appendix-III	LC	Annex-II
Passeriformes / Hirundinidae						
52	House Martin	*Delichon urbicum*	SM;Rocky land and wetlandbird, All Turkey	Appendix-II	LC	Annex-I
53	Sand Martin	*Riparia riparia*	SM;Wetland andsteppebird, All Turkey	Appendix-II	LC	Annex-I
54	Crag Martin	*Hirundo rupestris*	SM;Mountainous area, Marmara,all Turkey excluding northeast of Aegean and CentralBlack Sea	Appendix-II	LC	Annex-I
Passeriformes / Motacillidae						
55	Tawny Pipit	*Anthus campestris*	SM;Steppe and rural areabird, All Turkey	Appendix-II	LC	Annex-I
56	Meadow Pipit	*Anthus pratensis*	WM;Bushy and wooden areabird, All Turkey	Appendix-II	LC	Annex-I
57	White Wagtail	*Motacilla alba*	SM;Wetland and meadowbird, All Turkey	Appendix-II	LC	Annex-I
Passeriformes / Troglodytidae						
58	Wren	*Troglodytes troglodytes*	N;Forestbird, Marmara and all coasts	Appendix-II	LC	Annex-I
Passeriformes / Turdidae						
59	European Robin	*Erithacus rubecula*	N;Bushy and forestbird, All Turkey	Appendix-II	LC	Annex-I
60	Redstart	*Phoenicurus phoenicurus*	SM;Forest and bushy areabird, All Turkey	Appendix-II	LC	Annex-I
61	Wheater	*Oenanthe oenanthe*	SM;Steppeand bushy area bird,All Turkey	Appendix-II	LC	Annex-I
62	Lesser Whitethroat	*Turdus merula*	N;Wooden and bushy areabird, All Turkey excluding the central parts	Appendix-III	LC	Annex-III
63	Song Thrush	*Turdus philomelos*	N;Wooden and bushy areabird, Marmara, Black Seaand north of Aegean Region	Appendix-III	LC	Annex-II
Passeriformes / Sylviidae						
64	Lesser Whitethroat	*Sylvia curruca*	SM;Forestbird, All Turkey excluding Southeast AnatoliaRegion	Appendix-II	LC	Annex-I

No	Order / Family		Migration Status, Habitat	Bern	IUCN	Central Hunting Commission
	English Name	Scientific Name				
65	Whitethroat	*Sylvia communis*	SM;Forestbird, All Turkey	Appendix-II	LC	Annex-I
Passeriformes / Paridae						
66	Coal Tit	*Parus ater*	N;Forestbird, All coasts of Turkey	Appendix-II	LC	Annex-I
67	Blue Tit	*Parus caeruleus*	N;Forestbird, All Turkey	Appendix-II	LC	Annex-I
68	Great Tit	*Parus major*	N;Forestbird, All Turkey	Appendix-II	LC	Annex-I
Passeriformes / Sittidiae						
69	Krueper's Nutahatch	*Sitta krueperi*	N;Forestbird, South Marmara,Aegean, Mediterranean, WesternandEasternBlack SeaRegions	Appendix-II	NT	Annex-I
Passeriformes / Laniidae						
70	Red-backed Shrike	*Lanius collurio*	SM;Forest bird	Appendix-II	LC	Annex-I
71	Lanius minor	*Lanius minor*	SM;Forestbird, All Turkey	Appendix-II	LC	Annex-I
Passeriformes / Corvidae						
72	Hooded Crow	*Corvus corone cornix*	N;Steppe and bushy areabird, All Turkey	-	LC	Annex-III
73	Jackdaw	*Corvus monedula*	N;Forestbird, All Turkey	-	LC	Annex-III
74	Raven	*Corvus corax*	N;Desert andSemi-desertbird, All Turkey	Appendix-III	LC	Annex-II
75	Eurasian Jay	*Garrulus glandarius*	N;Forestbird, All Turkey	-	LC	Annex-III
76	Magpie	*Pica pica*	N;Forestbird, All Turkey	-	LC	Annex-III
Passeriformes / Sturnidae						
77	Starling	*Sturnus vulgaris*	N;Landbird, All Turkey	-	LC	Annex-II
Passeriformes / Passeridae						
78	House Sparrow	*Passer domesticus*	N;Fieldand bushy areabird, All Turkey	-	LC	Annex-III
79	Tree Sparrow	*Passer montanus*	N;Field and bushy area bird, All Turkey	Appendix-III	LC	Annex-II
Passeriformes / Fringillidae						
80	Chaffinch	*Fringilla coelebs*	N;Forestand wooden areabird, All Turkey	Appendix-III	LC	Annex-II
81	Brambling	*Fringilla montifringilla*	WM;Forestbird, All Turkey	Appendix-III	LC	Annex-II
Passeriformes / Emberizidae						
82	Ortolan Bunting	*Emberiza hortulana*	SM;Field andSteppebird, All Turkey	Appendix-III	LC	Annex-II
83	Corn Bunting	*Miliaria calandra*	SM;Field and Steppebird, All Turkey	Appendix-III	LC	Annex-II

Mammalia (Mammals)

In Turkey, more than 160 mammal animal species are distributed. The most crowded order of them are rodents with 66 species, and bats follow them with 33 species. 49 mammal species belonging to six orders are seen possible to be distributed in the In HEPP impact zone as being Eulipotyphla (Porcupine and Soricidae; 6 species), Chiroptera (Bats; 19

species), Lagomorpha (Ribbits; 1 species), Rodentia (Rodents; 15 species), Carnivora (Predaceous; 6 species) and Cetartiodactyla (Artiodactyla; 3 species). With regards to the number of the species, Chiroptera, which includes bats, is the most crowded order and represented by 19 species in the region. In addition to the fact that there are not many cliffs and caves in the region, the redundancy of the number of the species is derived from the existence of suitable biotope and wetland areas. The following Rodentia order includes rodent species and 15 species of them have been detected in the area. In the field studies, a cave that is near the line or can be affected directly from the line have not been encountered. HEPP project does not include any applications that restrict the feeding, nesting and range of motion of the mammal species mentioned here.

49 mammal species, which are spread in theproject site and its vicinity are given in the Table with their protection status. Mammal species belong to Eulipotyphla, Chiroptera, Lagomorpha, Rodentia, Carnivora and Artiodactylaorders. 19 of these species are protected within the scope of Bern Contract Appendix-II, and 12 of them by Appendix-III. While most of the species are in LC category according to IUCN; Mediterranean Bat Rhinolophus Euryale, Pug-Nosed Bat Barbastella barbastellus, Long-Winged Bat Miniopterus schreibersii, Anatolian Ground Squirrel Spermophilus xanthoprymnus species are in NT category. Also, Pug-Nosed Bat of Mehelyi Rhinolophus mehelyi is in VU category and Blind Mouse Nannospalax leucodon is in DD category.

Accordingly, totally 4 bat species have endangered categories; 3 species NT and 1 species VU. For the species except bats, there is no determined threat category. With regards to Central Hunting Commission decisions, most of the mammal species are in Appendix List-I and under conservation. Such species as rabbit, fox, jackal, weasel and pig are in Appendix List-III, that is, they are species hunting of which is allowed at certain terms. However, in the borders of Tokat Province which includes the project site, the hunting of fox, weasel and jackal have been banned.

Figure 4.2.13.12 Meles which spread in the site and widespread forest mouse Microtus subterraneus

Table 4.2.13.5. Mammalian species detected at Onur HEPP Project influence zone and their protection status

No	Order, Species and English Name	Habitat	Protection Status Bern & IUCN	Central Hunting Commission
Eulipotyphla– Hedgehogs				
1	*Erinaceusconcolor* Hedgehog	Everywhere, especially forest lands and stream edges	Appendix-III & LC	Annex-I
Eulipotyphla–Soricidae				
2	*Ukrainian Shrew* Sivriburunlu fare	Forest and forest openings, stream edges	Appendix-III & LC	-
3	*Neomys teres* Transcaucasian Water Shrew	Forest and forest openings, stream edges	Appendix-III & LC	-
4	*Crocidurasuaveolens* Lesser White-toothed Shrew	Forest and forest openings, stream edges	Appendix-III & LC	-
5	*Crocidura leucodon* Bicolored Shrew	Forest and forest openings, stream edges	Appendix-III & LC	-
6	*Talpa levantis* Levant Mole	Moist and appropriate areas of soil cover in the forest	- & LC	-
Chiroptera – Bats				
7	*Rhinolophus ferrumequinum* Greater Horseshoe Bat	Flies around streambeds at forested areas and nests at the surrounding caves and abandoned derelict places	Appendix-II& LC	Annex-I
8	*Rhinolophus hipposideros* Lesser Horseshoe Bat	Flies around streambeds at forested areas and nests at the surrounding caves and abandoned derelict places	Appendix-II & LC	Annex-I
9	*Rhinolophus euryale* Mediterranean Horseshoe Bat	Flies around streambeds at forested areas and nests at the surrounding caves and rock cracks	Appendix-II & NT	Annex-I
10	*Rhinolophus mehelyi* Mehely's Horseshoe Bat	Flies around streambeds at forested areas and nests at the surrounding caves and rock cracks	Appendix-II & VU (A4c)	Annex-I
11	*Rhinolophus blasii* Blasius's Horseshoe Bat	Flies around streambeds at forested areas and nests at the surrounding caves	Appendix-II & LC	Annex-I
12	*Myotis myotis* Greater Mouse-eared Bat	Flies around streambeds at forested areas, in summer nests at abandoned places and caves in winter	Appendix-II & LC	Annex-I
13	*Myotis blythii* Greater Mouse-eared Bat	Nests at the surrounding caves and abandoned places	Appendix-II & LC	Annex-I
14	*Myotis emarginatus* Geoffroy's Bat	Nesting areas are caves and abandoned places	Appendix-II & LC	Annex-I
15	*Myotis mystacinus* Whiskered Myotis	Nests at campus and abandoned places, likes moist	Appendix-II & LC	Annex-I
16	*Myotis daubentonii* Daubenton's Bat	Nests at caves near water and abandoned buildings	Appendix-II & LC	Annex-I
17	*Nyctalus leisleri* Lesser Noctule	Prefers trees and wooden buildings to nest	Appendix-II & LC	Annex-I
18	*Eptesicus serotinus* Serotine	Nests at campus areas and wooden buildings	Appendix-II & LC	Annex-I
19	*Hypsugo savii*	Nests partly at rocky areas and	Appendix-II & LC	Annex-I

No	Order, Species and English Name	Habitat	Protection Status Bern & IUCN	Central Hunting Commission
	Savi's Pipistrelle	buildings		
20	*Pipistrellus pipistrellus* Common Pipistrelle	Nests at roof cracks	Appendix-III & LC	-
21	*Pipistrellus kuhlii* Kuhl's Pipistrelle		Appendix-II & LC	Annex-I
23	*Barbastella barbastellus* Barbastelle	A rare species nesting at trees and caves	Appendix-II & NT	Annex-I
24	*Miniopterus schreibersii* Bent-winged Bat	Nests at the caves around forest openings and buildings	Appendix-II & NT	Annex-I
25	*Tadarida teniotis* European Free-tailed Bat	Nests at the cracks of high rocks	Appendix-II & LC	Annex-I
Lagomorpha-Rabbits				
26	*Lepus europaeus* Brown Hare	Found in the forest or open lands	Appendix-III & LC	Annex-III
Rodentia-Rodentia				
27	*Sciurus anomalus* Caucasian Squirrel	Found in the forest and orchards	Appendix-II & LC	Annex-I
28	*Spermophilus xanthoprymnus* Asia Minor Ground Squirrel	Steppe lands	- & NT	Annex-I
29	*Allactaga williamsi* Williams' Jerboa	Steppe lands	- & LC	Annex-I
30	*Cricetulus migratorius* Grey Dwarf Hamster	Steppe slopes	- & LC	-
31	*Mesocricetus brandti* Brandt's Hamster	Steppe lands	- & NT	-
32	*Microtus subterraneus* European Pine Vole	Spread at the edges of stream with abundant herbs	- & LC	-
33	*Microtus rossiaemeridionalis (Microtus levis)* East European Vole	Found at the meadows near abundant grassy water in the forest	- & LC	-
34	*Microtus dogramacii* Dogramaci' Vole	Agricultural lands and steppe areas	- & LC	-
35	*Rattus rattus* Roof Rat	Campuses and streambeds	- & LC	-
36	*Apodemus mystacinus* Broad-toothed Field Mouse	In forest lands and especially at rocky lands	- & LC	-
37	*Apodemus flavicollis* Yellow-necked Field Mouse	Spreads in the forest	- & LC	-
38	*Mus macedonicus* Macedonlan Mouse	Found in the campuses and moist bushy areas	- & LC	-
39	*Meriones tristrami* Tristram's Jird	Steppe lands	- & LC	-
40	*Nannospalax leucodon* Lesser Blind Mole Rat	Steppe and agricultural lands with appropriate soil	- & DD	-
41	*Dryomys nitedula* Forest Dormouse	Found especially at orchards and forests - Hibernates	Appendix-III & LC	Annex-I
Carnivora-Predators				
42	*Mustelanivalis* Least Weasel	Rocky areas and streambeds at the forest and around campuses	Appendix-III & LC	Annex-II
43	*Vulpes vulpes* Corsac Fox	In the forest and around the campuses	- & LC	Annex-III
44	*Canis aureus* Golden Jackal	In the forest and around the campuses	- & LC	Annex-III

No	Order, Species and English Name	Habitat	Protection Status Bern & IUCN	Central Hunting Commission
45	*Canis lupus* Grey Wolf	In the forest and around the campuses	Appendix-II & LC	-
46	*Martes foina* Stone Marten	In the forest and around the campuses	Appendix-III & LC	Annex-III
47	*Meles meles* Eurasian Badger	In the forest and around the campuses	Appendix-III & LC	Annex-II
Artiodactyla-Artiodactyla				
48	*Sus scrofa* Wild Boar	In the forest and especially at secluded streambeds	- & LC	Annex-III
49	*Capreolus capreolus* Roe Deer	In the forest and bushy areas and secluded ares	Appendix-III & LC	Annex-I

Vertebrate Animal Fauna in the Impact Zone and Evaluations and Precautions in terms of Wildlife

The project site is situated on Zinav Stream flowing into Kelkit Stream in Yeşilırmak River Basin in the borders of Reşadiye District,Tokat Province,and the site is essential for wild fauna. Noise, Light, Scent, Dust and Chemical pollutants, anthropogenic factors are main threats for wildlife.

The measurements made display that there is 30-40 dB noise at a distance of 200-300 m to the river, and that is the noise of nature and it does not have any adverse effect on wild fauna. The noise increases till 60 dB closer to the river. Noise, Light, Scent, Dust and Chemical pollutants are not present in the area currently.

Accordingly; especially at the construction phase of HEPP project, considering the criteria mentioned above, the limit value should be careful about not to be surpassed for this criteria. At the management phase of the project, no negation is expected to happen.

Any cave ecosystem do not exist close to the site, therefore at the construction and operation phase, bat population will not be damaged.

By being a wetland area characteristic, the project site has the characteristic of being feeding and breeding area of immigrant water bird.

During the project activity, it should be shown ultimate attention in order not to cut down the trees along the river and in order to be sensitive to the birds using the area. Disturbing practices to the population and potential destruction of nets will be avoided.

The forest site to be stripped along HEPP transmission line will create an area, which is open to erosion. Especially, the lost of the soil under the vegetation, which will be stripped during the transition of sloping lands, should be prevented and the measures will be taken for ensuring the return of vegetation.

It should be shown ultimate attention to avoid noise pollution while using heavy construction equipment during the construction phase of HEPP, and especially in breeding/ovulation season (between February and May) of most of the animals, work will be done more meticulously. Noise and Light pollution will be avoided.

The permanent and indismissible effect of HEPP project to be done on fauna are not expected by giving attention to these measures and considering “improvement of nature conservation strategies in a way that will not hinder economic development and progress”

principle, which is the approach of UNEP (United Nation Environmental Programme), describing United Nations' approach to environmental problems frankly, towards environmental issues.

IV.2.14. Places and Recreation Area With High Landscape Value

The activity area and its vicinity are mostly degraded forest areas.

The activity area can be classified as mountain landscape, degraded oak forest landscape and stream landscape, which are sub-types of natural landscape.The region is in the type of rural landscape because of agricultural areas and village settlements.

Due to the topographical characteristics of the region, any kind of architectural or archaeological means do not exist. During the phase of construction, Tokat Province Directorate of Culture and Tourism will be informed in case of encountering any kind of cultural means. On the routeof the project, geological and geomorphological formations don't exist.

In the vicinity of activity area, whilst there is no place with a high landscape value and recreation areas, Zinav Lake is located at a distance of 1250 m northern of the Power plant site.

Zinav Lake include picnic areas and it is a forest area whose vicinity is under conservation. Additionally, the activity area was announced as a Thermal Tourism Site by 26.07.2010 dated Council of Ministers' decision.

IV.2.15. Mines and Fossil Fuel Resources (reservoir amount, existing and planning operation conditions, annual production and its importance for national and local usage, economic values)

Mineral resources available throughout the Province of Tokat are given below.

ANTIMONY (Sb)

Turhal-Özdemir, Çamlıca Fields
Grade : 4-10 % Sb
Reservoir : 200 000 tons ofobserved +potential, 22 600 tonsof possiblereservoir Deposits have been operated until quite recently.
Turhal Locality Antimony Appearance
Lots of appearances are known to be around the deposits given above.

ASBESTOS (Asb)

Çamlıbel-Dodurga Field
Grade : 5 % asbestos
Reservoir : 500 000 tons ofpossible reservoir
COPPER(Cu)

Niksar-Eryaba zuhuru
Grade : 0.57-1.12 % Cu,
Reservoir : Have the characteristic of small appearance. There is no determined reservoir.

Bula Village Appearance
Grade : 2.78 % Cu
Reservoir : Have the characteristic of small appearance. Also, there are known appearances in Niksar (İbiske) and Gökdere (Karakaya).

BENTONITE (Ben)

Niksar-Yazıcık Bentonit Reservoirs

Quality : Casting bentonite and bleaching soil.
Reservoir : 1 008 828 tonsofpossiblereservoir

Reşadiye-Akdoğmuş Field
Quality : Suitable for Drilling, moulding andto be pellet
Reservoir : 178 585 tonsof possible reservoir

Taşova-Sepetlioba Field
Quality : Suitable for bleaching soil
Reservoir : 200 000 tonsof possible reservoir

Reşadiye-Bereketli-Toklar Deposit
Quality : Suitable for bleaching soil
Reservoir : 6 000 000 tonsof possible reservoir.

Reşadiye-Büşürüm (Akpınar, Karagelin, Çatak) Deposits
Quality : Suitable for bleaching soil
Reservoir : 80 000 tonsof possible reservoir

Reşadiye-Köklü Deposits
Quality : Suitable for bleaching soil
Reservoir : 210 000 tonsof possible reservoir
Reşadiye-Keçiköy and Yolüstü bentonitDeposits
Quality : Molding and drilling bentonit
Reservoir : -

Reşadiye (Köryakup, Doğantepe, İbrahimşeyh) Deposits
Quality : Suitable for drilling and moulding sand
Reservoir : -

CEMENT RAW MATERIALS (Çmh)

Niksar-Kümbetli Village
Quality : Good
Reservoir : Big reserves limsestones

IRON (Fe)

Artova-Karadut Field
Kalite : 50% Fe
Reservoir : 30 000 tons ore have been produced.

CHROMIUM (Cr)

In Yeşilyurt and Artova towns, nearly 30 chromium source, splitting and outcrop have been detected.

Artova Town Salur Source
Tenör : 20% Cr_2O_3
Reservoir : 265 000 tonsof possible reservoir have been accounted.

Besides the mineralization of other appearances do not have an important potential, ore grades alters between 10% and 48% Cr_2O_3

MANGANESE (Mn)

Affusion Tepe-Kat Village Fields
Grade : 32.67% Mn
Reservoir : 3 000 tonsof possible reservoir. The deposit was operated in the past.

VRICK-TILE (TğKi)

Niksar Town
Kalite : Good
Reservoir : 4 500 000 tons geological reservoir.

Table 4.2.15.1. TOKAT Province Lignite (Lin) Reservoir

LOCATION OF THE DEPOSIT	CHEMICAL CHARACTERISTICS (%)				RESERVOIR (1 000 tons)				EXPLANATION
	Water	Ash	Sulphur	LCV Kkal/kg	OBS	POT	POS	GEO	
Artova	23.75	13.75	4.58	3976	500	---	---	---	Old Operation
Zile-Büyükbultu	33.50	35.00	4.88	2245	---	---	---	---	Operable

* LCV: Lower Calorific Value; OBS: Observed; POT: potential; POS: possible.

Table 4.2.15.2. Geothermal Inventory of Tokat Province

GEOTHERMAL ENERGY (Jtm)

PROVINCE: TOKAT

GEOTHERMAL AREA NAME	HOT WATER SPRING NAME	RESOURCE			DRILLING			PURPOSE OF USE	INSTALLED FACILITY	REFERENCE
		Temperature	Flow Rate	Potential	Temperature	Flow Rate	Potential			
		(°C)	(L/s)	(MWt)	(°C)	(L/s.)	(MWt)			
REŞADİYE	Reşadiye	39-49	3.5	0.21	46.5	30	1.44	Spa and heating of the spa and partly of Reşadiye District	The Spa	*,**
SULUSARAY		31.9-44.3	2.56	0.1	27-53	21	1.58	Spa and heating of the spa and partly of Sulusaray District	The Spa	*,**
ERBAA-GÖKBEL ÇERMİĞİ		40.5	0.1	0.002	-	-	-	Spa	The Spa	*
SARIYAZI		32	0.1	-	-	-	-	Spa	The Spa	*

*** Geology Inventory of Turkey-1996**
**** 7th Five Years Development Plan (1995-1999) Special Expertise Commission on Mining Geothermal Energy Working Group of Sub-Commission on Energy Raw Materials**
Note: Potential values of drillings were calculated based on the sum of initial production flow rates.

Coal;Coal is mined in Zile and Artova Towns and is marketed in the province. 1,147.262 tons reservoir exist. Most of the reservoir in Artova Town have been used up.

Antimony; It is mined in Turhal Town and is at a very high quality in the world, too. 437.680 tons reservoir exist.

Marble;The province has rich marble and onyx deposits. In the research carried out by Turkey Mineral Research and Exploration, totally 672.665.100 m³ deposit areas exist. The quality of the diabases peculiar to Tokat are among the kinds searched worldwide. There are three private sectors that manage marble sources.

Chromium; 265.000 tonsreservoir exist in Artova and Sulusaray towns.

Limestone; 50.000.000 tons mineralized calcite limestone reservoir exist in town center.

Bentonite;Available in Reşadiye and Niksar Towns. There is a bentonite factory in Reşadiye District.

Thermal Waters;In Reşadiye District at 46.5°Ctemperature and with 30 L/s flow rate, in Sulusaray Town at 31.9-44 °C temperature and with 31 L/sflow rate thermal water exist and is used for heath and touristic purposes.

Spring Water;Ayvaz Spring water exist in Niksar Town at 26-27 °C temperature and with 1.2-1.5 L/sflow rate.

Mineral Water;In Beşören Village of Central Town 0,036 L/s, in Almus Town 0.023 L/s, in Çiçekdere 0.053 L/s, in Sarılık 0.05 L/sflow rate mineral water exist.

Water for Cure; Water for cure exist in Kat Small Town in Turhal Town with 0.048 L/sflow rate.

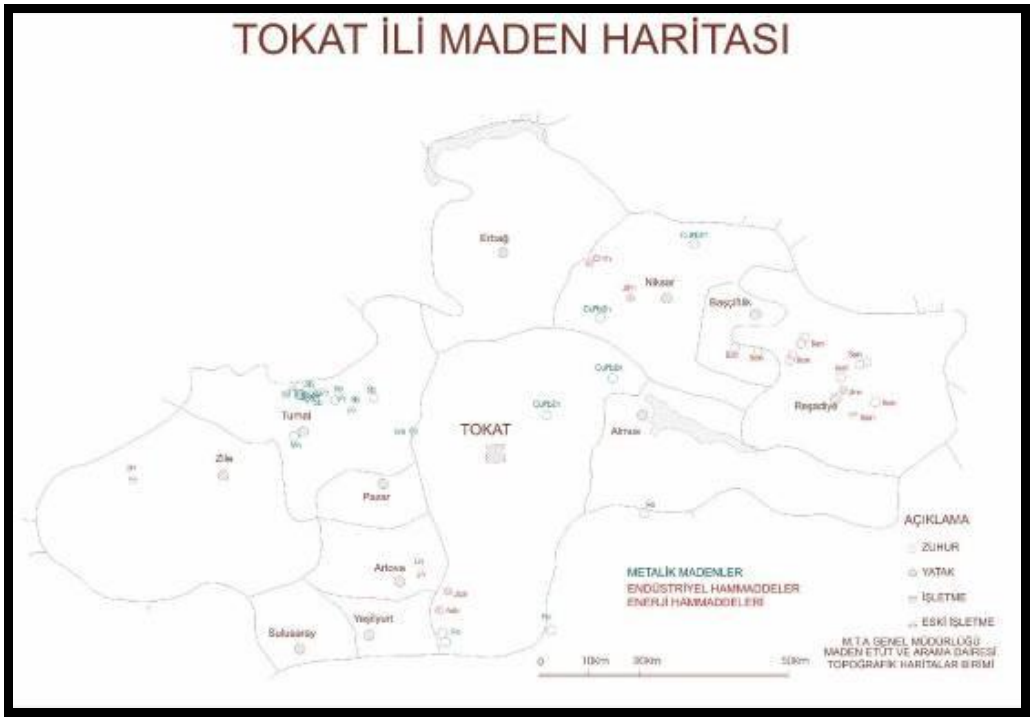


Figure 4.2.15.1. The Mineral Reservoirs Existing in Tokat Province ByGeneral Directorate of MTA

IV.2.16. Stock-Breeding (Species, feeding areas, annual production amount, the place and value of these productions in national economy

Existence of Cattle

The presence of cattle in the province are displayed in **Table 4.2.16.1,** and the number of cattle is 225,737, andthe number of buffalo is 9,197.

When **Figure 4.2.16.1**is analysed,it can be seen that while the rate ofculture range is 17.6%, the rate of mixed breed rage is 43.8%, the rate of local breed rage is 38.6%among all total cattle quantity; this rate is 9.8% for culture rage, 35.4% for mixed breed and 54.8% for local rage in Tokat Province

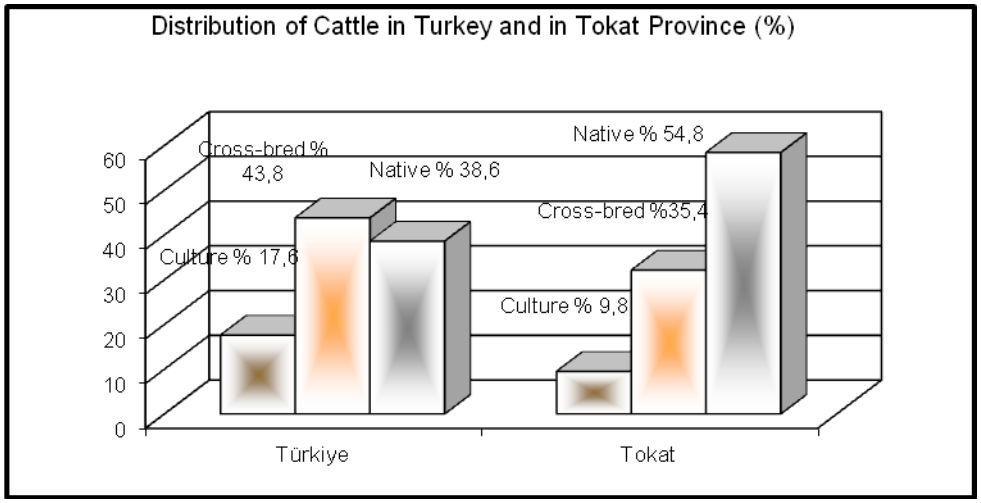


Figure 4.2.16.1. Available Cattle Rate in Turkey and Tokat Province

In Table 4.2.16.1. Changes in the quantity of cattle in Turkey in the eleven-year are displayed. The number of total cattle, which was 11,973,000 in 1991 declined to 10,548,000 in 2001, and decreased in the ratio of 11.9%. On the basis of rages, there was a 47.8% increase in the culture, 14.6% in cross-breed, and 39.1% in native.

Table 4.2.16.1. The Change in Cattle Quantity on Annual Basis in Turkey (1000 animals)

Cattle Rages	YEARS											
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Culture	1,254	1,337	1,442	1,512	1,702	1,795	1,715	1,733	1,782	1,806	1,854	1,860
Cross-Breed	4,033	4,132	4,342	4,543	4,776	4,909	4,690	4,695	4,826	4,738	4,620	4,358
Native	6,686	6,482	6,126	5,846	5,311	5,182	4,780	4,603	4,446	4,217	4,074	3,586
Total	**11,973**	**11,951**	**11,910**	**11,901**	**11,789**	**11,886**	**11,185**	**11,031**	**11,054**	**10,761**	**10,548**	**9,804**

Source: Turkish Statistics Institute, Agricultural Structure (Production, Price, Value) 2002

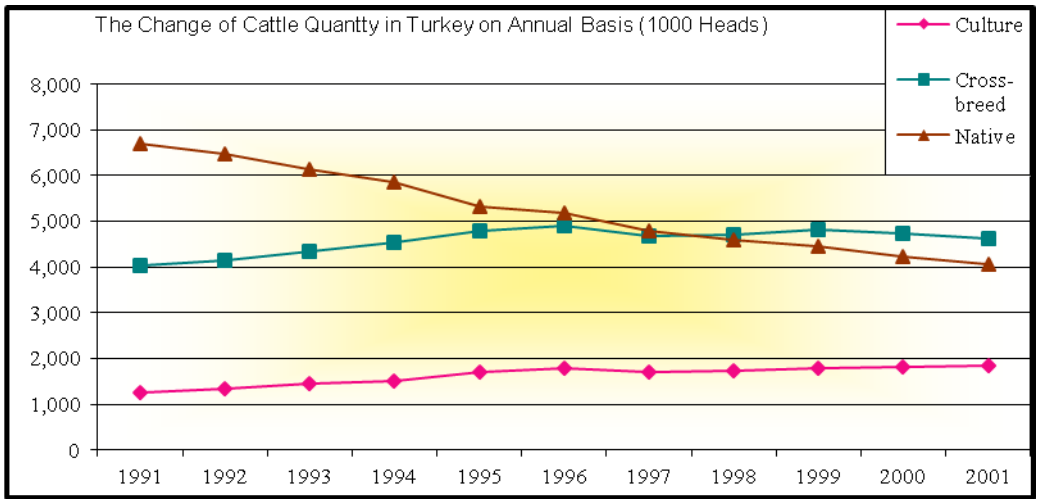


Figure 4.2.16.2. The Change in Cattle Quantity on Annual Basis in Turkey

Table 4.2.16.2. The Change in Cattle Quantity on Annual Basis in Tokat

Years	Native	%	Cross-Breed	%	Culture	%	Total	Buffalo	%	Total Number of Cattle
1991	275,064	79.2	49,811	14.3	22,467	6.5	347,342	39,399	10.2	386,741
1992	252,177	76.1	55,648	16.8	23,398	7.1	331,223	38,511	10.4	369,734
1993	275,462	77.1	57,350	16.1	24,504	6.9	357,316	36,276	9.2	393,592
1994	257,247	73.0	69,312	19.7	25,794	7.3	352,353	36,723	9.4	389,076
1995	231,499	70.3	71,277	21.6	26,567	8.1	329,343	25,290	7.1	354,633
1996	228,146	70.2	68,147	21.0	28,623	8.8	324,916	25,383	7.2	350,299
1997	221,922	68.3	72,165	22.2	30,919	1.0	325,006	25,441	7.3	350,447
1998	199,583	65.3	75,124	24.6	30,786	10.1	305,493	20,273	6.2	325,766
1999	193,792	63.5	80,056	26.2	31,393	10.3	305,241	19,205	5.9	324,446
2000	194,732	64.2	80,937	26.7	27,590	9.1	303,259	15,773	4.9	319,032
2001	163,701	58.4	90,124	32.1	26,546	9.5	280,371	14,660	5.0	295,031
2002	137,699	55.9	85,505	34.7	23,118	9.4	246,322	10,880	4.2	257,202
2003	123,690	54.8	79,963	35.4	22,084	9.8	225,737	9,197	3.9	234,934

(Source: Provincial Directorate of Tokat, 2003)

In **Table 4.2.16.2.,** changes in the quantity of cattle in Tokat Province in the thirteen-year are displayed. The number of total cattle in Tokat, which was 347,342 in 1991 declined to 225,737 in 2003.

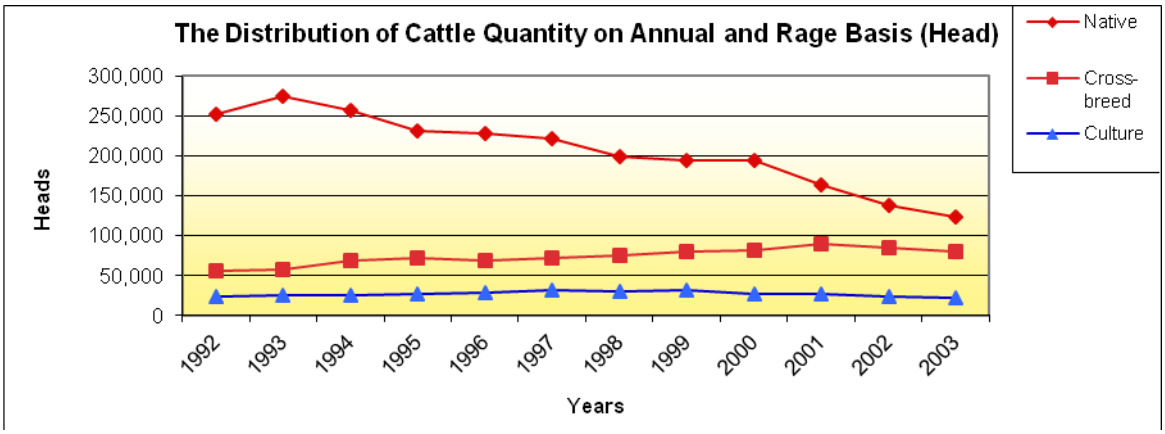


Figure 4.2.16.3. The Distribution of Cattleon Annual and Rage Basis
(Source: Provincial Directorate of Tokat, 2003)

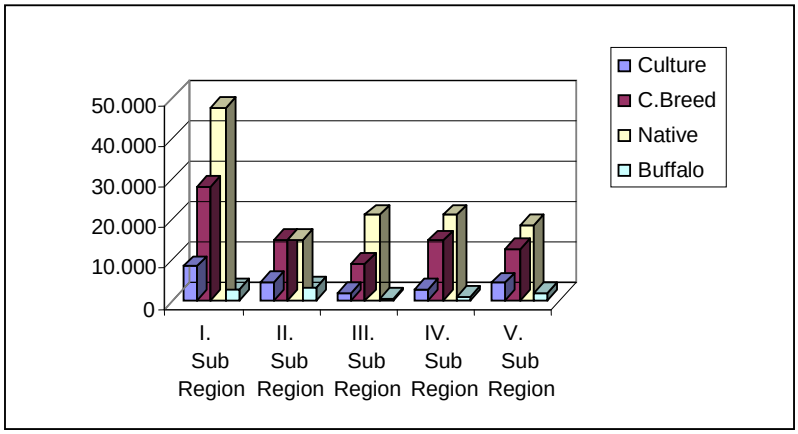


Figure 4.2.16.4. The Distribution of Cattle in Sub-Regions
(Source: Provincial Directorate of Tokat, 2003)

In **Figure 4.2.16.4**the distribution of available cattle on the basis of rages in sub-regions is given. The most cattle number is in 1st Sub-Region with a rate of 37.4%. It is followed by 4th Sub-Region with 17.2%, 5th Sub-Region by 15.7%, 2nd Sub-Region with15.3% and 3rd Sub-Region with 14.3% in order.

The most buffalo number is in 2nd Sub-Region with 33.2%. 1st Sub-Region follows it with 30.9%, 5th Sub-Region with 21.2%, 4th Sub-Region with 9.7%, and 3rd Sub-Region with 4.9%.

Existence of Ovine Animal

Table 4.2.16.3. Change In the Quantity of the Sheep and Goats on Annual Basis in Turkey (1000 Animals)

	YEARS											
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Sheep	40,433	39,416	37,541	35,646	33,791	33,072	30,238	29,435	30,256	28,492	26,972	25,173
Hair goat	9,579	9,440	9,192	8,767	8,397	8,242	7,761	7,523	7,284	6,828	6,676	6,519
TOTAL	**50,012**	**48,856**	**46,733**	**44,413**	**42,188**	**41,314**	**37,999**	**36,958**	**37,540**	**37,540**	**33,648**	**33,694**

Source: Turkish Statistics Institute, Agricultural Structure (Production, Price, Value) 2002

In **Table 4.2.16.3.** the change in the quantity of the sheep and hair goats in Turkey in eleven-year period is displayed.The number of total sheep and hair goats in Turkey, which was 50,012,000 in 1991 declined to 33,648,000 in 2001. So, it decreased at a rate of 32.7%. The quantity of the sheep decreased at a rate of 33.3%, and hair goat's at 30.3%.

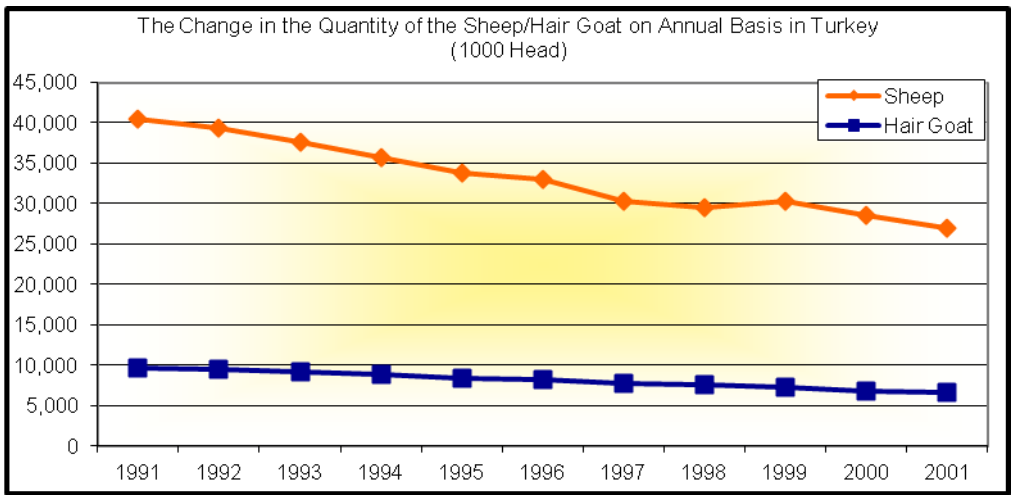


Figure 4.2.16.5. The Change in the Quantity of the Sheep/Goat on Annual Basis in Turkey

In **Table 4.2.16.4**the change in the quantity of the ovine animal in Tokat Province in eleven-year period is displayed. The number of total ovine animals in the province, which was 606,314 in 1991 declined to 213,999 in 2003.

Table 4.2.16.4. The Change in the Quantity of the Ovine Animals on Annual Basis in Tokat

YEARS	Sheep	Hair Goat	Total
1991	549,210	57,104	**606,314**
1992	528,486	51,431	**579,917**
1993	537,653	51,538	**589,191**
1994	529,792	42,588	**572,380**
1995	411,985	26,910	**438,895**
1996	404,445	26,508	**430,953**
1997	341,529	26,125	**367,654**
1998	352,803	28,462	**381,265**
1999	337,094	27,532	**364,626**
2000	292,249	20,775	**313,024**
2001	243,651	25,033	**268,684**
2002	225,575	19,200	**244,775**
2003	196,145	17,854	**213,999**

(Source: Provincial Directorate of Tokat, 2003)

The existence of the ovine animal on the basis of sub-regions, 2nd Sub-region comes first with 61,000 sheep. 1st Sub-region follows it with 57, 911 animals, 4th Sub-region with 42,009 animals, 5th Sub-region with 19,800 animals, and 3rd Sub-region with15.425 in order.

In terms of goat existence,1stSub-region is at the beginning of the rank with 7,760 animals, 2nd Sub-region follows with 6,000 animals, 5th Sub-region with 32,170 animals, 4th sub-region with 1,216 animals and 3rd with 708 animals.

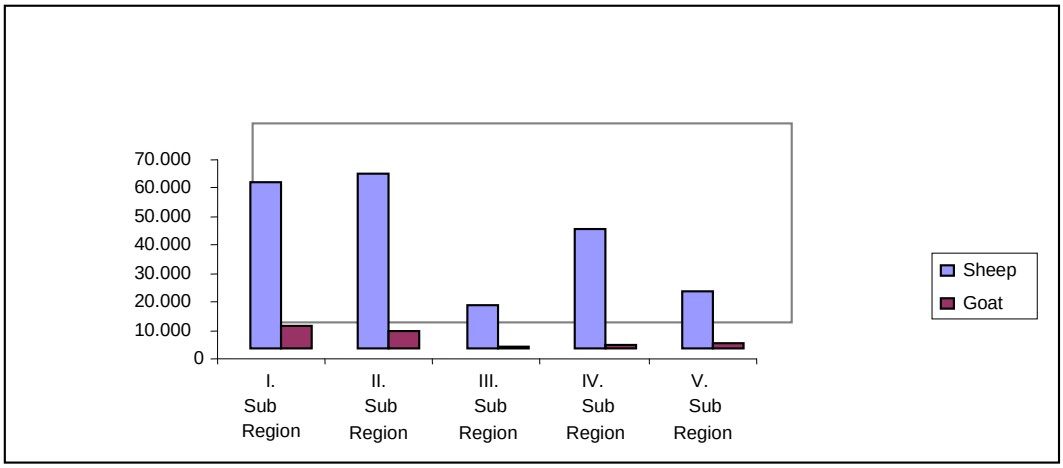


Figure 4.2.16.6. The Quantity of the Ovine Animal on the Basis of Sub-Regions

Existence of Poultry

Poultry industry has achieved a rapid and constant growth in Turkey since the 1960s. As well as the investments which have been made, comparative advantages of the sector have had a role in this growth. Development of poultry by making use of these advantages will provide benefit economically by creating new employment areas, and socially by decreasing the immigration to city from rural areas.

Table 4.2.16.5. The Change in the Quantity of Chicken-Turkey on Annual Basis in Turkey (1000 heads)

	YEARS											
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Chicken	139,207	152,530	178,260	183,684	129,015	152,957	166,273	236,997	239,748	258,168	217,575	245,776
Turkey	3,133	3,333	3,340	3,442	3,291	3,064	5,328	3,805	3,763	3,682	3,254	3,092
Total	**142,340**	**155,863**	**181,600**	**187,126**	**132,306**	**156,021**	**171,601**	**240,802**	**243,511**	**261,850**	**220,829**	250,870

Source: Turkish Statistics Institute, Agricultural Structure (Production, Price, Value) 2002

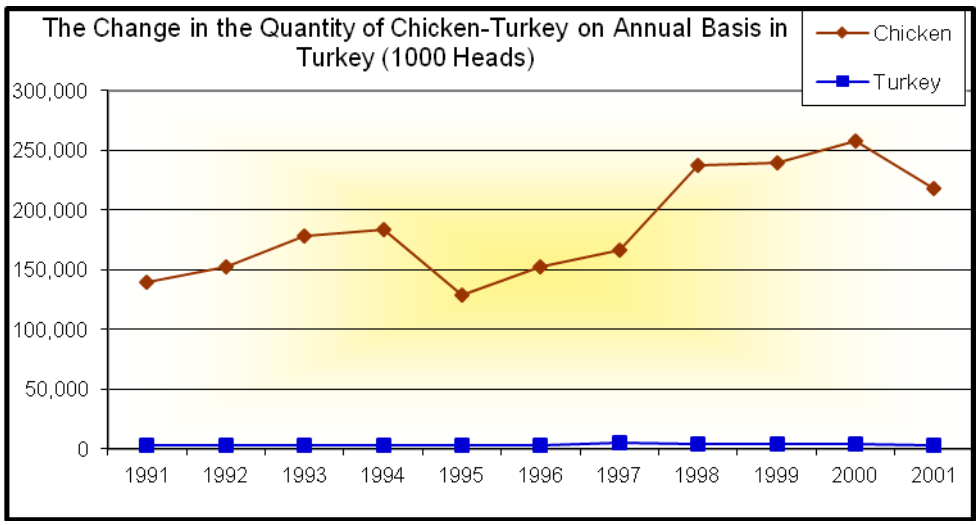


Figure 4.2.16.7. The Change in the Quantity of Chicken-Turkey on Annual Basis in Turkey

While the quantity of chicken was 630,433 and the quantity of turkey was 32,349in Tokat Province in 1991, the number of chicken decreased to 398,061 and turkey's to 19,532 in 2003.

Table 4.2.16.6. The Change In the Quantity of Chicken-Turkey on Annual Basis in Tokat Province (Custom)

YEARS	Chicken	Turkey	Total
1991	630,433	32,349	662,782
1992	640,240	31,815	672,055
1993	669,840	32,140	701,980
1994	559,500	32,210	591,710
1995	651,400	32,310	683,710
1996	684,876	35,645	720,521
1997	674,600	35,520	710,120
1998	522,410	32,090	554,500
1999	500,620	27,190	527,810
2000	501,300	29,070	530,370
2001	457,890	22,860	480,750
2002	440,715	21,925	462,640
2003	398,061	19,532	417,593

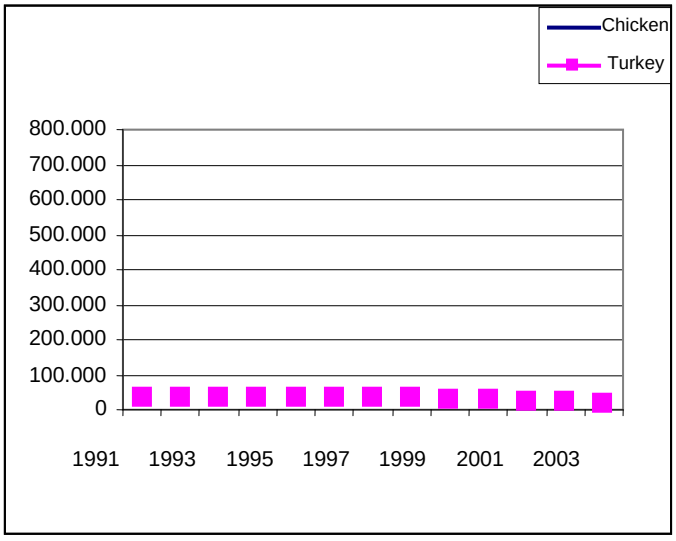


Figure 4.2.16.8. The Change in Quantity of Chicken-Turkey on Annual Basis in Tokat Province

36.2% of the total quantity of poultry is included in the 1st Sub-region, 26.6% in the 5th Sub-region, 16.3% in the 3rd Sub-region, 12.4% in the 2nd Sub-Region, 8.5% in the 4th Sub-region.

161,671 heads of chicken quantity are in the 1st Sub-region, 95,100 in the 5th Sub-region, 57,000 in the 2nd Sub-Region, 46,295 in the 3rd Sub-region, 38,566 in the 4th Sub-region.

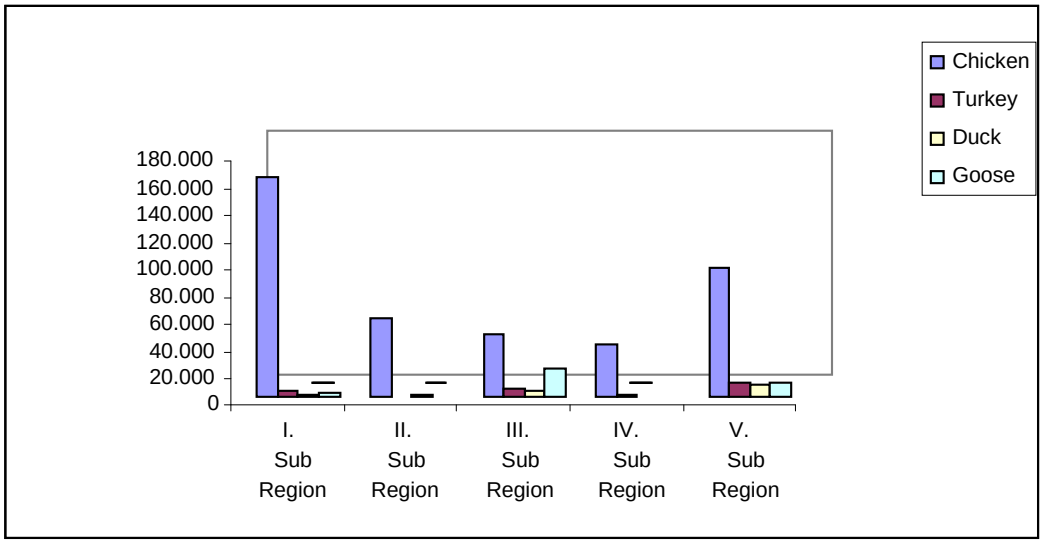


Figure 4.2.16.9. The Poultry Quantities on the Basis of Sub-Regions
(Source: Provincial Directorate of Tokat, 2003)

Beekeeping

Table 4.2.16.7. The Change in the Number of Beehive on Annual Basis

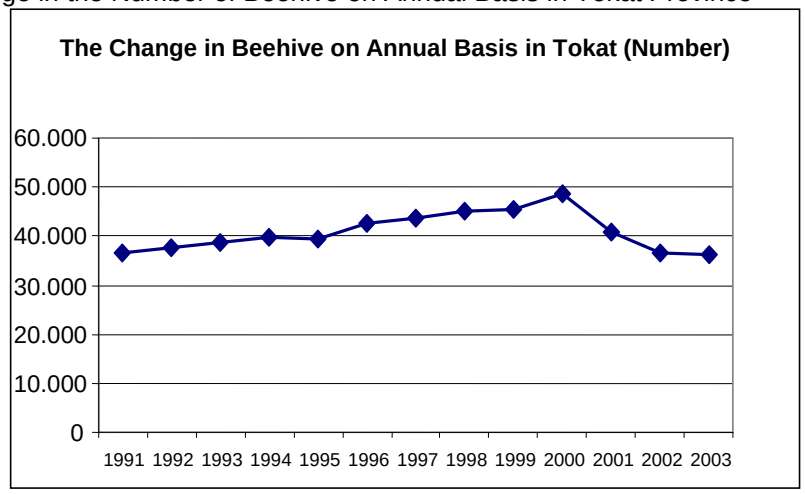
Hive Type	YEARS											
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Old	266.859	250.656	234.692	219.236	214.594	217.140	204.102	193.982	185.915	199.609	184.052	
New	3.161.583	3.289.672	3.450.755	3.567.352	3.701.444	3.747.578	3.798.200	4.005.369	4.135.781	4.067.514	3.931.301	
Total	**3.428.442**	**3.540.328**	**3.685.447**	**3.786.588**	**3.916.038**	**3.964.718**	**4.002.302**	**4.199.351**	**4.321.696**	**4.267.123**	**4.115.353**	**4.160.892**

Source: Turkish Statistics Institute, Agricultural Structure (Production, Price, Value) 2002

In **Table 4.2.16.7**the change in the quantity of beehives in eleven-year period of time. The number of beehives, which was 3,428,442 in 1991, increased to 4,115,353 in 2001, so it rose at a rate of 20%. There was a decrease of 31% on the quantity of old-fashioned beehives, and 24.3% increase in the new types of beehives.

Table 4.2.16.8. The Change in the Number of Beehive on Annual Basis in Tokat Province

Years	Beehive
1991	36,431
1992	37,494
1993	38,831
1994	39,626
1995	39,571
1996	42,491
1997	43,691
1998	45,080
1999	45,617
2000	48,745
2001	40,961
2002	36,544
2003	36,209



(Source: Provincial Directorate of Tokat, 2003)

In **Table 4.2.16.8.,** the eleven-year changes in the quantity of beehives in Tokat province are displayed. The total number of hives, which was 36,431 in 1991, became 36,209 in 2003.

36.8% of the totally 36,209 beehives throughout the province is in the 4th Sub-region,28.9% in the 1st Sub-region, 18.7% in 2nd Sub-region, 9.9% in the 5th Sub-region and 5.7% in the 3rd Sub-region.

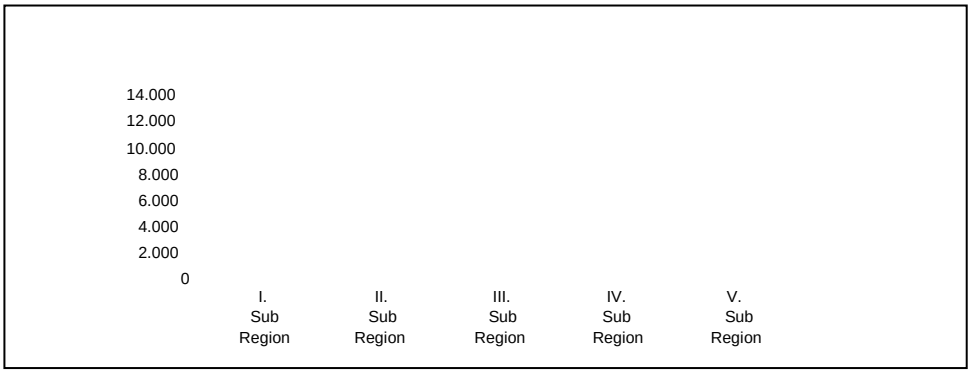


Figure 4.2.16.10. The Quantity of Beehives on the Basis of Sub-Regions
(Source: Provincial Directorate of Tokat, 2003)

Animal Production

Table 4.2.16.9. The Amount of Animal Production in Tokat Province Sub-Regions (2003)

		I.Sub Region	II. Sub Region	III. Sub Region	IV. Sub Region	V. Sub Region	Total
Meat (kg)	Bovine Animal	512,142	261,890	51,254	0	297,554	1.122.840
	Ovine Animal	155,613	165,604	4,633	0	62,596	388.445
Total		**667.755**	**427,494**	**55,887**	**0**	**360,150**	**1,511,286**
Milk (ton)	Bovine Animal	83,166.9	26,246.3	22,804.1	31,935.1	45,187.2	209.339,6
	Ovine Animal	777.4	952.7	197.5	542.2	53.8	2.523,6
Total		**83.944,3**	**27,199.0**	**23,001.6**	**32,477.3**	**45,241.0**	**211,863.2**
Leather (pieces)	Bovine Animal	3,628	2,031	431	0	1,625	7.715
	Ovine Animal	9,615	10,858	239	0	3,541	24.253
Total		**13.243**	**12,889**	**670**	**0**	**5,166**	**31,968**
Wool (kg)	Sheep	65,512	81,604	19,040	49,248	22,200	237.604
	Goat	4,792	3,060	363	593	1,163	9.971
Total		**70.304**	**84,664**	**19,403**	**49,841**	**23,363**	**247,575**
Honey (kg)		**244.275,0**	**107,250.0**	**47,286.0**	**255,400.0**	**67,500.0**	**721,711.0**
Wax (kg)		**9.825,0**	**3,350.0**	**2,687.0**	**11,390.0**	**3,375.0**	**30,627**

Source: Provincial Directorate of Tokat, 2003
Note: Slaughterhouse cuttings are taken into consideration in meat and dermis production

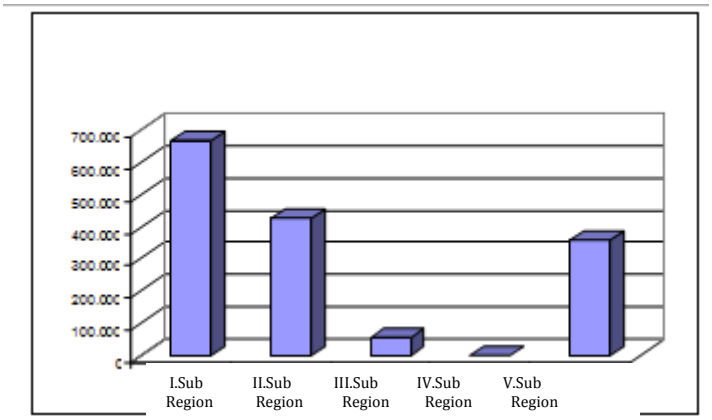


Figure 4.2.16.11. Total Meat Production on the Basis of Sub-Regions
(Source: Provincial Directorate of Tokat, 2003)

When the slaughterhouse cuttings are taken into consideration in the province , it can be seen that 74.3% of the total 1,511,286 kg meat production are obtained frombovine animals, and 25.7% from ovine animals.

The production of bovine animal meat is made at most in the 1st Sub-region with 512.142 kg, and then in the 5th Sub-region with 297,554 kg, 2nd Sub-region with 261,890 kg, and 3rd Sub-region with 51,254 kg.

The production of small cattle (sheep and goats) meat is made at most in the 2nd Sub-region with 165,604 kg, and then in the 1st Sub-region with 155,613 kg, in the 5th Sub-region with 62,596 kg, and in 3rd sub-region with 4,633 kg respectively.

The total milk product is 211,863.2 tons in the province. 98.8% of this is obtained from bovine animals.

The most milk production is made in the 1st Sub-region with 83,944.3 tons, and in the 5th Sub-region with 45,241 tons, in the 4th Sub-region with 32,477 tons, in the 2nd Sub-region with27,199 tons and in the 3rd Sub-region with 23,001 tons respectively.

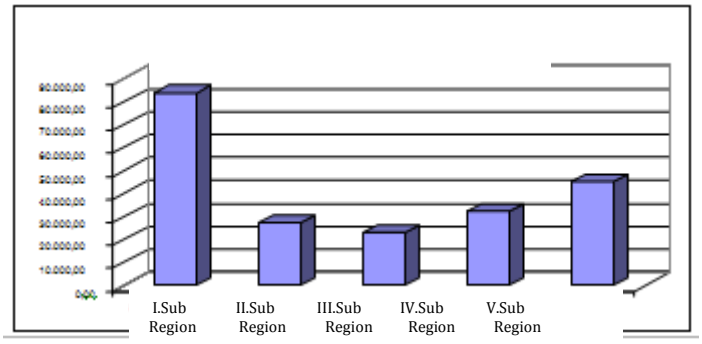


Figure 4.2.16.12. Milk Production on the Basis of Sub-Regions
(Source: Provincial Directorate of Tokat, 2003)

75.9% of the total leather production, which is 31,968 is obtained from small cattle and 24.1% of it from bovine animals. The most leather production is made in the 1st Sub-region with 13,243.

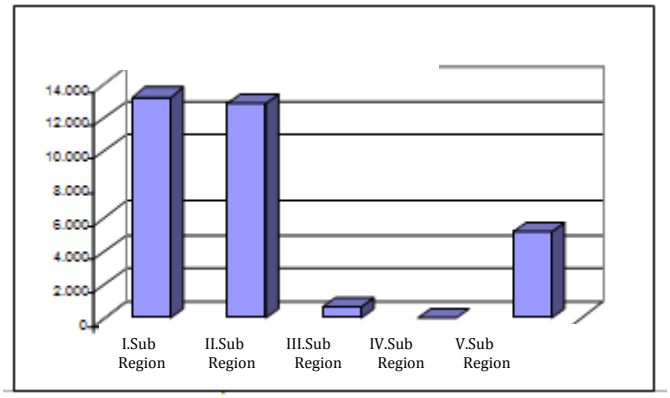


Figure 4.2.16.13. Leather Production on the Basis of Sub-Regions (kg)
(Source: Provincial Directorate of Tokat, 2003)

The total wool production in the province is 247,575 kg and 84,644 of it obtained from the 2nd Sub-region, and the 1st Sub-region with 70,304 kg, the 4th Sub-region with 49,841 kg, the 5th Sub-region with 23,363, and the 3rd with 19,403 kg follow respectively.

The Production of Water Products

In the province there exist Yeşilırmak River, Kelkit, Tozanlı, Çekerek Streams,which are the branches of the river, and plenty of tributaries that flow into all these streams.

In Tokat Province, there are totally 26 operations of trout, 9 of which are in cages and the rest 17 of which are on the land. 97 tons/year production is made in the 1st Sub-region, 13 tons/year in the 2nd Sub-region and 233 tons/year in the 4th Sub-region, so the total production is 343 tons/year.

Carp, catfish and silver fish are present in Almus Hydroelectric Power Plant Dam Lake, which is located in the 4thSub-Region, in addition to the trout breeding carried out in cages.

In the province, total 82,000 kg water product generation(trout, carp, silverfish, gobies, gray mullet, catfish, rudd) is made, 28,391 kg of which by hunting, and 105,000 kg by cultivation.

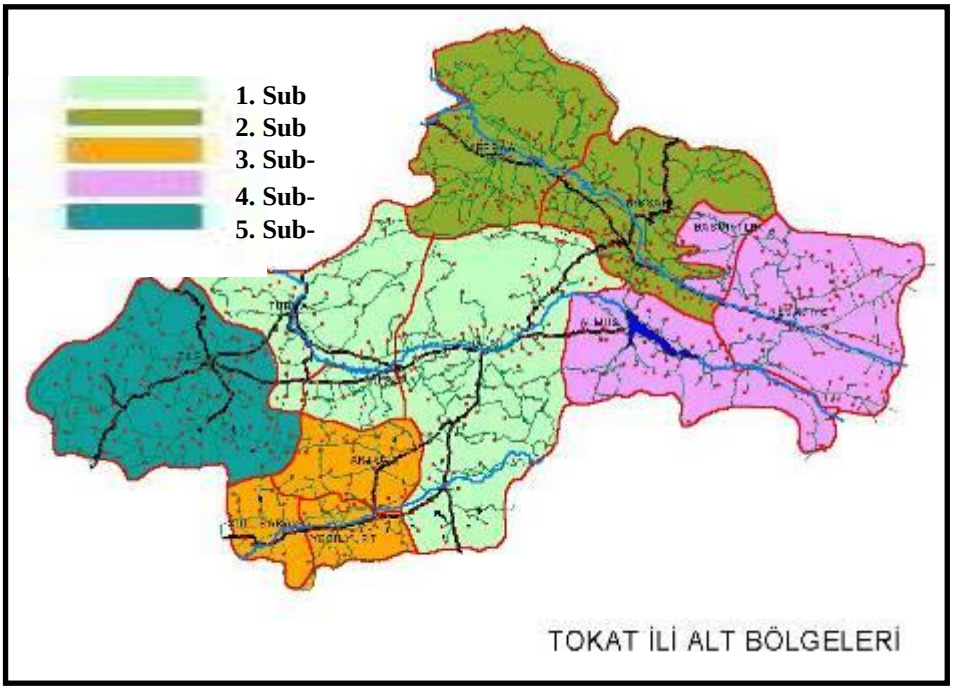


Figure 4.2.16.14. Tokat Province Sub-Regions

The nearest settlement to the activity site is Toklar Village, which is situated at a distance of 1000 km. The source of income is mainly stockbreeding; cultivation and beekeeping are other important sources of income.

IV.2.17. Lands under the provision and seizure of the authorized bodies of the state (Prohibited Military Zones, the areas assigned to public institutions and organizations for certain aims, etc.)

Almost all of the activity area includes forest areas which are under the provision and seizure of the state. The site that was determined to be the construction area are privately owned cultivation areas. The non-agricultural use permissions will be taken for these areas and the other cultivation lands which will lie within the activity area by applying to EMRA. The non-agricultural use permissions for meadow qualified real estates at the regulator area have already been taken. Apart from it, non-agricultural use permission for the access road located in the power plant site.

IV.2.18. The determination of current pollution load in terms of air, water, soil and noise pollution of the project site and its impact area

Tokat is situated between 39°52' - 40°55' north latitude and 35°27' - 37°39' east longitude; in the central part of Black Sea Region and surrounded by Samsun in the north, Ordu in the northeast, Sivas in the south-southeast, Yozgat in the southwest, and Amasya in the east. Project site is at a distance of 399 km to Ankara, 232 km to Samsun, 233 km to Ordu, 108 km to Sivas, 206 km to Yozgat, 114 km to Amasya, and 785 km to Istanbul.

Land transport is made by E80 Highway. The settlements close to the project site are a few houses located on Zinav upland and Toklar Village, about 1000 m away from the regulator (water acquisition system) and .The map that displays the location of the project site in the region is given in Appendix: 1; photos belonging to the project site are given in Appendix: 21,and 1/25,000 scaled topographical map of the project site is given in Appendix: 2.

The facility subject to the project is situated in Tokat Province, on Zinav Stream, which is a branch of Kelkit Stream, in the 15 km northwest of Reşadiye District. The facility site is composed of a 42,312 m^2 area. The facilities to be built on the surface will be on nearly 31,774 m^2 of this area.

The purpose in the Onur hydroelectric power plant is the production of energy in order to meet the demands of the increasing population and developing economy. The total installed power of Onur hydroelectric power plant is 19,568 MWe (20.82 Mwm) and it will produce annual 42,848 GWh energy totally. This value composes a part of the electric energy that our country needs.

BackgroundAir Pollution

In province-wide, coal is used for heating purpose mostly, and besides liquid radiator fuel is also used.

Regarding solid and liquid fuels, the features of fuels to be used relevant to Air Pollution and Control Legislationare determined by Local Council of Environment every year. In the center of province, since 1999, daily sulphur dioxide(SO_2) and smoke(PM) measurements have been carried out periodically in the Public Heath Laboratory.From 2007 onwards, measurements have started to be taken by Air Quality Measurement Station" belonging to Environment and Urban Province Directorate. Additionally, the measurements of CO-CO_2 , originated from motor vehicles in the province,have been carried out by exhaust emission stations. The measurements of CO-CO_2 in homes and industrial facilities can be carried out by means of the stack gas emission measurement device in public Health Laboratories.

Table 4.2.18.1. The Average and Exchange Rate of Sulphur Dioxide (SO_2) and Particulate Material (PM)Between 2003 and 2005 in Tokat Province

Months (2006)	Number of Stations	Number of Measurement Days	Average		Minimum		Maximum		Number of days that short-term limits are exceeded (mg/m^3)	
			SO_2	PM	SO_2	PM	SO_2	PM	SO_2	PM
January	1	31	66	31	42	12	120	79	-	-
February	1	28	65	9	15	4	224	80	-	-
March	1	31	27.7	8.1	17	5	63	27	-	-
April	1	30	21.36	7.27	17	5	40	12	-	-
May	1	31	23	7	19	5	26	7	-	-
June	1	30	18.7	5	17	5	25	7	-	-
July	1	31	17.23	5.32	9	5	18	10	-	-
August	1	31	18	5	17	5	20	5	-	-
September	1	30	17.6	8	17	5	18	26	-	-
October	1	29	19.9	10	17	5	35	31	-	-
November	1	30	104	14	34	5	202	45	-	-
December	1	27	99.19	35.70	55	5	130	122	-	-

(Environmental Status Report of Tokat Province, 2006)

Table 4.2.18.2. Annual SO_2Values

Months	2002	2003	2004	2005	2006
January	139.9	111	0	79	66
February	77.7	101	0	92	65
March	43.25	78	0	60.9	27.7
April	33.16	48	0	41	21.36
May	17.09	0	0	21	23
June	17.2	0	0	19	18.7
July	16.6	0	0	19	17.23
August	16	0	21	20	18
September	19	0	20	24.7	17.6
October	37	0	27	30.39	19.9
November	84	0	59	63	104
December	102.8	0	122	66	99.19
AVERAGE	50.31	28.17	20.75		

(Environmental Status Report of Tokat Province, 2006)

Table 4.2.18.3. Annual PM Concentration

Months	2002	2003	2004	2005	2006
January	101.3	113	-	30	31
February	38.03	75	-	39	9
March	28.03	69	-	12.38	8.1
April	22.63	29	-	30	7.27
May	8.87	-	-	5	7
June	6.46	-	-	6	5
July	5.48	-	-	5	5.32
August	6	-	5.4	6	5
September	7.5	-	6	9.4	8
October	29	-	19	10.74	10
November	104	-	15	8	14
December	013	-	49	31	35.7
AVERAGE	38.36	71.50	18.88		

(Environmental Status Report of Tokat Province, 2006)

Background Soil Pollution:

The most essential sources that cause pollution of soil chemically in Tokat Province are the release of domestic and industrial drain water to the receiving environment and/or use of it in agricultural irrigation. Additionally, pesticides, excessive use of fertilizers, waste disposed without compliance with the legislation(dangerous waste, medical waste, radioactive waste etc.) and metal pollution that is cause by the vehicles travelling on the reads cause.

Within the borders of the province, no analysis has been carried out in order to determine the pesticide accumulation in soil. No study on whether there happened any deformation as a result of misuse of commercial fertilizers have been carried out yet.

Background Water Pollution:

Any source of pollutant that pollutes the available groundwater sources within the borders of Tokat Province has not been detected.

As any agricultural land, industrial region or settlement causing water pollution do not exist in the region where the project area is located , there is not any significant pollution in Zinav Stream. Water analysis results which were carried out with the aim of exhibiting background pollution load are given in **Appendix: 20.**

As only energy production is planned by evaluating water potential of Zinav Stream, any kind of descent will not be seen in the quality of water which is used in the hydroelectric power plant to produce energy. There is no problem in the current water quality in terms of energy production, as well.

IV.2.19. Other Characteristics

There exist no issues to be assessed under this section.

IV.3. The Characteristics of Socio-Economic Environment

IV.3.1.Economic Characteristics (the main sectors that compose the economy structure of the locality, the distribution of local workforce in these sectors, in place and importance of the goods and service production in the sectors in the local and national economy, other information)

Industry, agriculture, stockbreeding sectors have an essential role in the economic structure of Tokat. Primarily food industry, industries based on rock and soil, forestry products industry and nowadays the garment with textile fabric industry have formed the most important part of Tokat economy. Sugar beet, tobacco, raw vegetable and fruits, and other industrial agriculture products, wheat and other cereal products are used in the public and private institutions present in the province. The private sectors that make use of brick and forestry products carry on their business in Erbaa Town, and they are dominating the market of neighbour provinces and East Anatolia.

With the foundation of Turhal sugar and Machine Factory, which is one of the first sugar factories of Turkey, in the 1930s, the first industrialization attempt in Tokat was started by public who met the first industrial institution. However, except a few small facilities belonging to Almus Dam and Hydroelectric Power Plant,which were built in the 1960s, and the Tobacco Factory,which got started running in 1983, there has been no developments in the industry.

With the encouragement measures carried out subsequent to 1985, there has been an increase in the soil based industries such as brick-tile industry, flour-seed industry, hardwood-timber industry and manufacture of agricultural machinery. So, the weight of industry started to be felt bit by bit.

As for today, Tokat reached to a luckier and and advantageous condition point compared to many other provinces in Turkey due to the its economic potential and the activities in the economic sector which makes use of this potential. A transition has been seen from workshops based on labor to production industries with high-technology.

Another distinctive characteristics of Tokat province from other provinces is that it grows together with its towns. Especially, Erbaa, Turhal, Zile and Niksar towns are included in the first 300 towns among 910 towns nationwide.

In order to do agriculture with more modern techniques and to put agricultural products to a better use, vine cultivation (make use of grape leaves), greenhouse cultivation, seedling cultivation, growing stick tomatoes etc. projects carry on.

Tokat has a higher potential with regards to the neighbour provinces in the field of livestock breeding. Milk and meat livestock, ovine breeding and bovine breeding, beekeeping and poultry husbandry are carried out. Besides, a project was begin by the governorship so as to improve beekeeping.

Constant developments have been seen recently in the tourism sector in Tokat. In Pazar town, Ballıca Cave, which is defined as the 8th World Wonder by the authorities, has been visited by loads of local and foreign visitors every day since it was opened. In Sulusaray and Reşadiye Districts gain importance in thermal tourism with their thermal water. Also, Reşadiye, Almus and Niksar towns gain importance by means of tableland tourism, which becomes more widespread day by day.

Tokat, which was previously as the pilot area forhandcrafts, vocational courses for handcrafts such as carpet business, knitting, silver thread, Siirt blanket business and traditional scarf business have been opened.

In Toklar village, which is the nearest settlement to activity area subject to the project,ovine and bovine breeding are done intensively. Besides, barley, wheat and vetch cultivation are carried out within the scope of agricultural activities. Moreover, alfalfa and sainfoin cultivation is carried out with the support of Provincial Directorate of Tokat. Furthermore,it is aimed to contribute to the national economy by cultivating vegetables(such as beans, tomatoes, etc.) at a small scale in the small gardens of village residents.

IV.3.2. Population (the urban and rural population in the locality, population movements; immigration, population growth rate, average household population, other information)

According to the results of General Census in 2000, Tokat Province General Population is 828,027. 401,762 people of this population live in the city, and 426,265 of them live in villages. As central town total population is 174,700, 113,100 of them live in city center, and 61,600 in the villages. According to the Directorate of Province Population and Citizenship data, rural and urban population in 2000 on the basis of towns are displayed in **Table 4.3.2.1** and in **Table 4.3.2.2.**

Table 4.3.2.1 Tokat Province Rural and Urban Population

Population of the City	Population of the Village	Total Population	Number of Districts	Number of Towns/Municipalities	Number of Villages
401,762	426,265	828,027	12	77	609

Table 4.3.2.2 Total Urban and Rural population on the Basis of Towns

DISTRICT CODE	DISTRICTS	POPULATION ACCORDING TO RESIDENCE				
		TOTAL POPULATION	POPULATION OF THE CITY	%	POPULATION OF THE VILLAGE	%
1	CENTER	174,700	113,100	64.7	61,600	35.3
2	ALMUS	43,470	6,197	14.3	37,273	85.7
3	ARTOVA	16,246	5,610	34.5	10,636	65.5
4	BAŞÇİFTLİK	13,321	5,971	44.8	7,350	55.2
5	ERBAA	100,586	45,595	45.3	54,991	54.7
6	NİKSAR	90,672	44,808	49.4	45,864	50.6
7	PAZAR	20,295	5,301	26.1	14,994	73.9
8	REŞADİYE	101,900	16,389	16.1	85,511	83.9
9	SULUSARAY	11,202	4,160	37.1	7,042	62.9
10	TURHAL	130,985	95,536	72.9	35,449	27.1
11	YEŞİLYURT	14,511	6,455	44.5	8,056	55.5
12	ZİLE	110,139	52,640	47.8	57,499	52.2
TOTAL		828,027	401,762	48.52	426,265	51.48

The incident of immigration can be designed as internal immigration and emigration. Internal immigration are the ones that are done from villages and districts to the center of provinces. The farmers who cannot earn a sufficient income, tend to other business and immigrate to Towns, Provinces and big city centers. Therefore, the age of people who work in agricultural activities is rising more and more.

Emigration is done from one province to the other provinces. The main reason of emigration is economic trouble and unemployment. Due to these emigrations, a decrease in the population of the province happens. This affects the progress and development of a province adversely.

Annual population growth rate between the census in Tokat Province was - 0,1% in 1952. This rate, which has shown rise and fall since that year, was 11.50% by 1985. Although Tokat was a province that has emigration, it has shown a population growth at the beginning of the 2000s. The main reason of the population growth is that fertility rate is high there. Literacy rate is high and the number of the faculty and college graduates increases.

According to the results of 1990 and 2000 General Population Census of SHW (State Hydraulic Works), population growth rate is 14.15% (Urban 26.24%, rural 3.95%). Considering the 2000 population rate, Tokat is ranked as the 26th.

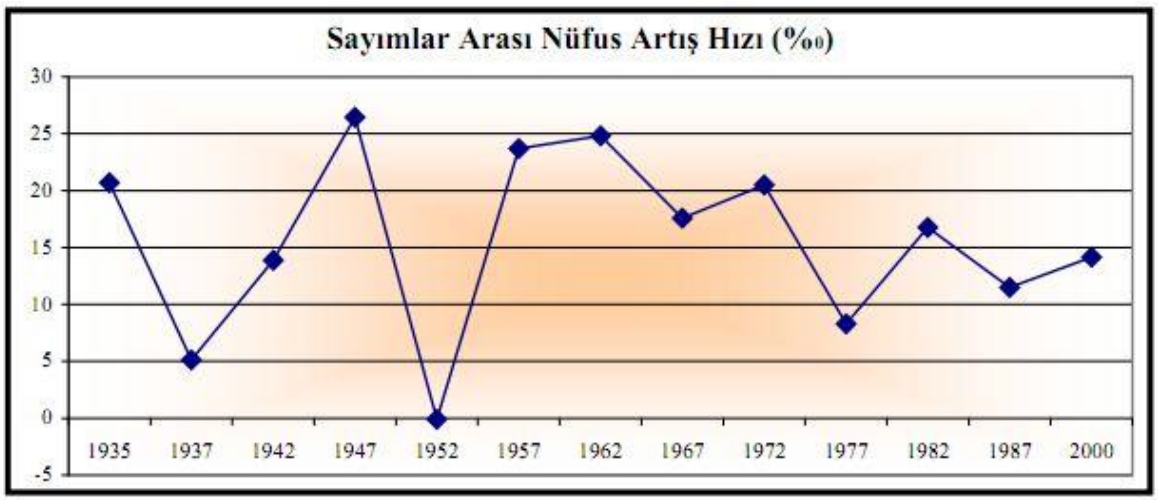


Figure 4.3.2.1. Population Increase between Censuses

According to the results of Address-Based Population Census System, the population of Tokat and Reşadiye in in 2010 decreased with regards to the one in 2000. This result is a sign of the fact that the province emigrate constantly. Emigration data of Tokat province on annual basis are given in Table 4.3.2.3.

Table 4.3.2.3. 2010 Population Data of Address-Based Population Census System of Reşadiye District

	Total	**Male**	**Female**
Population of Tokat Province	617,802	310,193	307,609
Population of Tokat Province and Districts	363,944	184,543	179,401
Population of the Towns and Villages of Tokat	253,858	125,650	128,208

Reşadiye				
Center	Bağdatlı	34	17	17
	Büşürüm	1821	918	903
	Çevrecik	1.963	1.003	960
	Güvendik	128	66	62
	Karataş	100	48	52
	Yenituraç	17	11	6
Bereketli	Bereketli	2.545	1.267	1.278
	Bozçalı	3.065	1.522	1.543
	Çakraz	259	133	126
	Elmacık	307	148	159
	Güzeldere	129	68	61
	Hebüllü	218	102	116
	Keteniği	209	102	107
	Taşlıca	608	307	301
	Toklar	78	34	44

Table 4.3.2.4 Tokat Province Migration Data

	Total Population			**Migration In**			**Migration Out**		
	2007-2008	**2008-2009**	**2009-2010**	**2007-2008**	**2008-2009**	**2009-2010**	**2007-2008**	**2008-2009**	**2009-2010**
	617,158	624,439	617,802	29,593	32,655	25,430	35,892	34,213	40,995
Tokat	**2007-2008**	**2008-2009**	**2009-2010**	**2007-2008**	**2008-2009**	**2009-2010**			
	-6,299	-1,558	-15,565	-10.15	-2.49	-24.88			
	Net Migration			**Net Migration Rate (%)**					
	2007-2008	**2008-2009**	**2009-2010**	**2007-2008**	**2008-2009**	**2009-2010**			
	-6,299	-1,558	-15,565	-10.15	-2.49	-24.88			

IV.3.3. Income (the distribution of income to business in the locality, maximum, minimum and average per capita income regarding businesses)

Industry, agriculture, stockbreeding sectors have an essential role in the economic structure of Tokat province. Primarily food industry, industries based on rock and soil, forestry products industry and nowadays the garment with textile fabric industry have formed the most important part of Tokat economy. Sugar beet, tobacco, raw vegetable and fruits, and other industrial agriculture products, wheat and other cereal products are used in the public and private institutions present in the province. The private sectors that make use of brick and forestry products carry on their business in Erbaa Town, and they are dominating the market of neighbour provinces and East Anatolia.

In Toklar Village, which is the nearest settlement to activity area subject to the project, ovine and bovine breeding are done intensively. Besides, barley, wheat and vetch cultivation are carried out within the scope of agricultural activities. Moreover, alfalfa and sainfoin cultivation is carried out with the support of Provincial Directorate of Tokat. Furthermore, it is aimed to contribute to the national economy by cultivating vegetables(such as beans, tomatoes, etc.) at a small scale in the small gardens of village residents.

In a survey made by Forum Magazine which is published by Union of Chambers and Commodity Exchanges, Tokat is ranked as the 8th province nationwide in food industry. In The Local Economy Improvement Program conducted by the technical support of World Bank and with the coordination of The State Planning Organization, Undersecretary of Treasury, Small and Medium Industry Development Organization and Labor-Employment Exchange Agency, the suggestion of making use of greenhouse production, textiles and garments, vine leaves was chosen as the second best suggestion.

Table 4.3.3.1. Pay-Roll Data

EMPLOYMENT INDICATORS	Unit	TOKAT	BLACK SEA	TURKEY
Agriculture	(%)	74.03	66.10	48.38
Industry	(%)	4.91	7.29	13.35
Trading	(%)	4.38	5.97	9.67
Financial Institutions	(%)	1.03	1.45	3.11
Employees	(%)	20.52	27.48	43.52
Female Employees	(%)	2.62	4.44	8.81
Proportion of Employers to Total Employment	(%)	0.95	1.46	2.61

Table 4.3.3.2. Financial Indicators

Financial Indicators	Unit	TOKAT	BLACK SEA	TURKEY
Share of GDP	(%)	0.74	9.46	100
GDP per capita	TL	1.107	1.396	1.837
Municipal expenditures per capita	TL	52	55	82
General budget revenues per capita	TL	51	111	464
Amount of export per capita	$	95	662	2.249
Amount of import per capita	$	176	809	3.967

Source: State Planning Organization, Socio-Economical Development Status of Provinces and Regions,2003

IV.3.4. Unemployment (the rate of unemployed population to active population in the locality)

As totally 218 facilities are operating throughout the province,11 of them are in public sector, 200 of them have the characteristicsof SME, and the rest 7 facilities employ more than 150 workers. A large majority of the industrial enterprises are located in the Center, Erba and Niksar Towns. Food, textile, garment and leather industries, and industries based on rock and soil hold an importance place in these establishments. Total 8,988 employee (3039 of them in public establishments) work in these industrial enterprises.

An average of 4,985 people work annually in total 56 workplaces (4 belonging to governmental and 52 to private sectors) which are involved in manufacturing industry.

The population working in the agriculture sector is really high. Though 53.66% of Turkey's total population work in agriculture, forestry and fishery sector, thisrate is 75.57% in Tokat province. However, disguised and open unemployment in rural areas are rather widespread. Approximately 1/3 of the population working in farming is surplus labor.

According to 2005-2006 data of Tokat Provincial Directorate of Turkish Employment Agency, 7465 people in 2005 and 8544 people in 2006 were recorded unemployed number. 592 people in 2005 and 499 in 2006 people were employed. Unemployment rate of Tokat Province regarding the data in 2004 is given in **Table 4.3.4.1.**

Table 4.3.4.1 Unemployment Rate of Tokat Province Regarding the Data in 2004

Towns	Unemployment Rate (%)
Center	7.6
Almus	1.86
Atrova	4.74
Başçiftlik	7.08
Erbaa	5.27
Niksar	5.30
Pazar	2.85
Reşadiye	2.69
Sulusaray	3.71
Turhal	15.53
Yeşilyurt	5.74
Zile	5.36

IV.3.5. Social Basis Services in the Locality (education, heath care, cultural services and the condition of making use of them)

Education:

The schooling rates in Tokat (2005-2006)are 0.4 at pre-school (o.4 girls and 0.4 boys); 72 at primary school (72 girls, 70 boys); and 48 at high school (girls 40, boys 56).

Within the body of Gaziosmanpaşa University,it has 5 faculties, 3 colleges, 4 graduate schools,9 vocational schools, 6 departments, 3 research centers and 1 center. 16 professors, 16 doctors, 48 assistant professor, 11 academician, 37 instructors, 14 experts and 99 research assistants work at this university, where 8,028 students are educated.

Table 4.3.5.1. Tokat Province School/Classroom/Students/Teachers Data

School Type	**Number of Classrooms**	**Number of Students**	**Number of Teachers**
Primary Education	4146	92487	3808
High School	909	26766	1498
Total	5055	119253	5306

Table 4.3.5.2. Education Indicators of Tokat Province

Education Indicators	**Tokat (%)**	**Turkey(%)**
Literacy Population Rate	85.67	87.30
Primary Education Schooling Rate	79.20	80.62
High School Schooling Rate	26.03	36.92

Source: Environmental Status Report of Tokat Province, 2006

Health Care

In Tokat Province, hospitals and health care institutions are planned to be accessed easily. New plans are being madefor the health care facilities that started their operation but haven't been able to meet the needs sufficiently.

According to the data of Tokat Provincial Healthcare Directorate, 13 hospitals, one of which is university hospital, 110 town and village clinics, 264 sanatoriums, and 6 tuberculosis control dispensaries are available. Total number of healthcare personnel is 2,776. The number of patients per doctor is 1,517. The rate of birth is 12.63% and the rate of death is 3.15%.

The total number of the beds in inpatient treatment institutions throughout the province is 1640. The problems within the scope of healthcare that are being experienced throughout Turkey are also experienced in Tokat.

The population per healthcare personnel will decrease when the number of the personnel who are working is primarily increased.

Table 4.3.5.3. Healthcare Institutions in Tokat Province

Institutions	Quantity
Public Hospital	11
Maternity and Child Care Homes	1
Tuberculosis Control Dispensaries	6
Village Clinics	110
Heath Care Home	246
Public Health Laboratories	3
Maternal and ChildHealth and FamilyPlanning Center	1
112EmergencyAid Station	14
Faculty of Medicine	1

IV.3.6. Urban and Rural Land Use (the distribution of settlement areas, available and planning areas of usage, industrial enterprises within this scope, residence, touristic attractions etc.)

Any industrial enterprise doesn't exist in the project area and its vicinity. There are scattering settled villages in the region. As there is not an urban settlement area, rural land use is widespread in the area

Agricultural areas compose 31.9% of Tokat provincial acreage, meadow-pasture lands compose 13.2%, forestry and scrub lands compose 38.7%, empty arable lands compose 5.3%, and other lands compose 16.2%.

Though the lands are rough except some major lowlands, agriculture is done intensively.

Ballıca Cave: it is situated at the 8th km of the road that lies towards to Akdağ Hill from Pazar Town in Tokat. The height of the cave, which is at 1080 m altitude, is 680 m and its elevation is 94 m. With the stalactites, stalagmites, columns, walls and lattice stalactites, cave roses and needles, stalactite pools, onion stalactites in it, the cave is considered as one of the richest and most beautiful caves in the world. The temperature in the cave, a part of which is still not open to be visited, is 18-19 ^{o}C throughout the winter and summer.

Topçam Upland: At a distance of 15. km. to the center of Tokat Province and altitude of 1600 m, Topçam Upland has an extraordinary beauty with its fresh air and lush forests.

Batmantaş Upland: At a distance of 28 km. to the center of Tokat Province and altitude of 1850 m, Batmantaş upland is waiting to serve for upland tourism with its dense forests, pristine mountain air, and ice-cold water.

Selemen Upland: It is the upload where our historical, cultural and natural richness reaches its peak. Yavuz Sultan Selim who campaigned for Çaldıran excursion settled here with his army.

Akbelen (Bizeri) Upland: It is at a distance of 29km. to the center of Tokat Province and altitude of 1740 m. It is covered with wide rıral area suitable for grass skiing, forests composed of pine and fagus trees.

Dumanlı Upland: OnDumanlı upland, which is at a distance of 70 km. to the center of Tokat Province and altitude of 2578 m, magical colorful scene of upland flowers arises a joy of life.

Zinav Lake: It is a t a distance of 3 km to Yol Üstü Village of Reşadiye District. Its water is fresh. The lakeshore has a 1.5 km² area and it is a forest land. A fresh water fish called rudd lives there. Zinav Lake is a B type picnic area.

Besides, the place where the activity area is situated has been announced as Thermal Tourism Area by the Decision of Council of Ministers.

IV.3.7. Other issues

There exists no issue to be assessed under this section.

CHAPTER V: IMPACT OF THE PROJECT ON THE SITE DEFINED IN CHAPTER IV AND PRECAUTIONS TO BE TAKEN:

(Description of the impacts on physical and biological environment, and explanation of the details of the legal, administrative, and technical measures to be taken to prevent, to minimize or to remediate these impacts for the headings V.I and V.2, separately.)

V.1. Site preparation, projects at construction and installation phase, its impacts on physical and biological environment and the measures to be taken (Regulator, HEPP, Transmission line, (including the Quarry, Concrete Plant, Crushing and Screening Plant, etc. to be used for Tunnel and/or channel (closed system or pipe system) Penstock and access roads) all the works to be performed, (the impacts at the construction phase shall be discussed for each regulator, HEPP, and their transmission facilities and other structures separately.)

V.1.1. Within the scope of the work that begins with site preparation until the opening of the units: the location and the amount of land to be excavated (including the vegetable soil), the amount of excavation, the materials to be used during excavation and their properties, the properties of temporary storage area, explosives, the area where excess excavated soil, stone, sand, etc. are to be moved, stored and their purpose of use, commitment to not discarding the excavation to river bed, the materials to be used during excavation, commitment to conducting appropriate and proper disposal and storage, and plotting the excavation and waste material dumping site on 1/25000 scaled land use map and giving their coordinates, (plotting the excavation storage area on 1/1000 scaled map in case it is on the border of a stream), the property status of excavation area, fill area and restoration plan

During construction phase of the activity, the vegetable soil will be grazed and excavated for preparation of the site and construction of the facility. The locations of these activities and the amount of excavation to be produced within this scope are given in **Table 5.1.1.1**.

Table 5.1.1.1 The Locations and the Amount of Excavation

Units	Areas to be excavated	Amount of excavation (m^3)	Amount of excavation (tons)
Regulator, Gravel Gateway and Sedimentation Pool	All kinds of ground excavation excluding rock and muddy soil	20,000	32,000
	Excavation of rock	14,000	39,200
Transmission tunnel	Excavation of the tunnel	59,795	167,930
Regulator Bridge	Excavation at loose ground	154	246.4
	All kinds of ground excavation excluding rock and muddy soil	462	739.2
	Excavation of rock	859	2,405.2
Powerhouse	Excavation of rock	8,580	24,024
	Excavation of soft rock	8,580	24,024
	All kinds of ground excavation excluding rock and muddy soil	17,160	27,456
Power Plant Intercepting Channel	All kinds of ground excavation excluding rock and muddy soil	1,750	2,800
	Excavation of soft rock	375	1,050
	Excavation of rock	375	1,050
Penstock and Supports	All kinds of ground excavation excluding rock and muddy soil	1,000	1,600

	Excavation of rock	250	700
		TOTAL	**325,224,8 tons**

(Density is taken as 2.8 tons/m^3 for the excavation of rock and 1.6 tons/m^3 for the other excavation activities.)

As can be seen from **Table 5.1.1.1**, totally 325,224.8 tons of excavation material will be produced during the project. Approximately 5% of this amount is expected to be vegetable soil and this shows about 16,261 tons of vegetable soil will be produced.

16,261 tons of vegetable soil to be produced during the project will be used separate from other excess excavation material for landscaping and rehabilitation of the areas where construction activities are completed. In addition, within the scope of the project, usable part of the excess excavation material will be used as the basic lower and upper construction material for roads instead of regulator and power plant. The rest of the material will be stored at excavation storage areas. Excess excavation material will definitely not be left at river bed. A detailed and approved report, which shows how to store the excavation material and specifies the necessary measures for prevention of the stored material to drag into the river bed and be an obstacle, will be prepared by the owner of the activity. DSİ's positive opinion about the subject is given in **Appendix: 16-b**, and 1/25,000 scaled map showing the areas of excess excavation material is given below. 1/2,500 scaled map and the coordinates of the areas of excess excavation material is presented in **Appendix: 12**. Therefore, no alternatives were assessed for excess excavation material storage areas, since the areas in concern are poor in soil, stony, rocky. Cutting of trees in these areas shall be avoided wherever possible. Storage of excess excavation material, produced during the construction of facilities that are subject to permission, and disposal of waste, waste or any other material produced due to the facilities that are not subject to permission will definitely be avoided at the areas that are considered as forested areas.

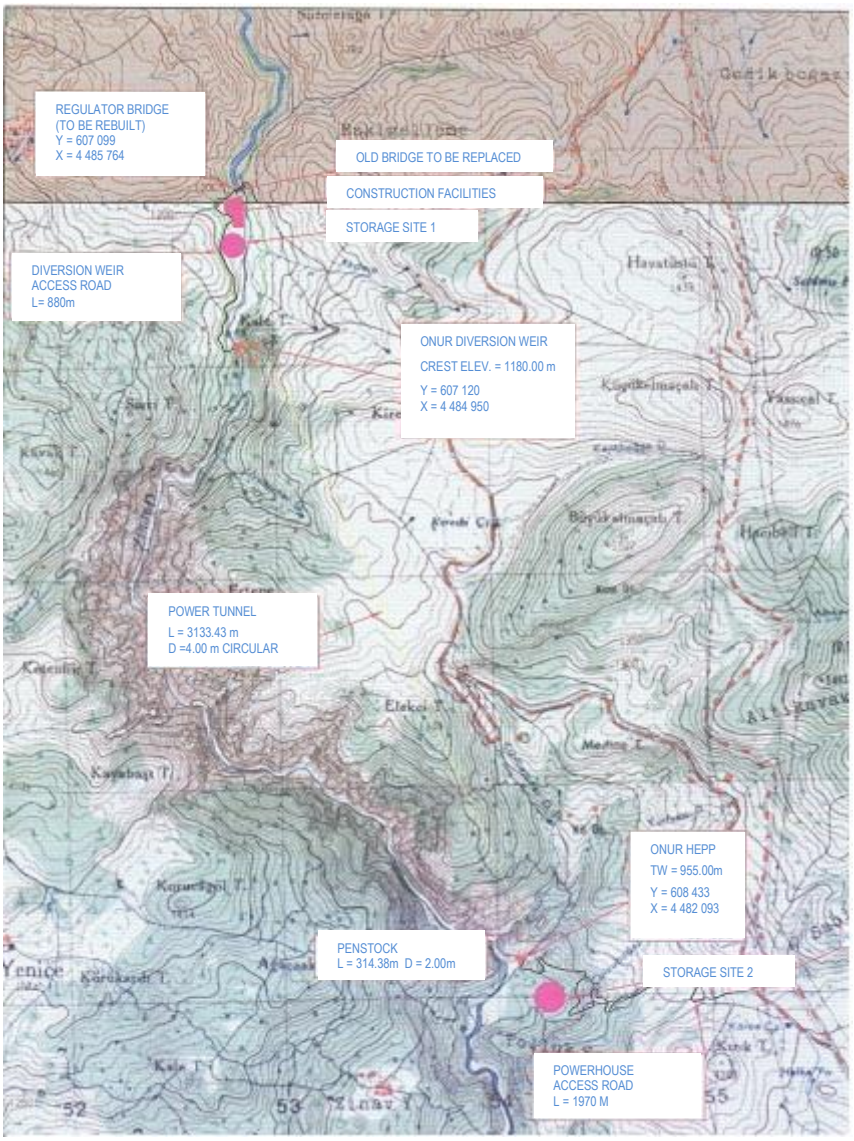


Figure 5.1.1.1 Excavation Site Storage Areas

The number and property of the construction equipment to be used during excavation are given in the following table.

Table 5.1.1.2 The Equipment to be used

	Regulator Site	Transmission Tunnel	HEPP Site
Equipment	**Number**	**Number**	**Number**
Crawler Loader	1	1	1
Truck	3	2	3
Excavator	2	2	2
Concrete Pump	1	1	1
Mixer	1	1	1
Rock Drill	1	1	1
Tractor	1	1	1
Compressor	--	2	2
Total	10	11	11

Within the scope of the project, it is planned to build regulator, transmission tunnel, penstock, and HEPP site.

As can be seen from **Table 5.1.1.1,** it is planned to make 71,000 tons of excavation for the regulator site. Landscaping will be accomplished in this area following the completion of construction activities.

The transmission tunnel to be built during the project will be 3133.43 m in length. During the construction phase, for loosening blasting at the transmission tunnel only necessary amounts of explosive will be supplied and no storage of explosives will be performed. Open air blasting will be carried out at the entrance and exit of the transmission tunnel, whereas enclosed blasting will be performed to open the transmission tunnel. During open air blasting; rock drilling machine, anfo explosives, powergel magnum feeder, exel capsule igniter, explosion fuse, flow measurement device, and igniter magneto will be used; and for the tunnel blasting rock drilling machine, tripod hand drilling machine, powergel magnum explosive, exel capsule igniter, explosion fuse, flow measurement device, and igniter magneto will be used. Use and transportation of explosives to be used during the construction will be in responsibility of the business owner and be performed in compliance with the “Bylaw Concerning Precautions to be taken in Work Places Operating with Flammable, Explosive, Dangerous and Hazardous Substances” and “Bylaw Concerning the Methods and Principles for Production, Importation, Transportation, Keeping, Storage, Sale, Use, Disposal, Audit of Explosives and Hunting Materials that are Un-monopolized”, published in the Official Gazette dated 29.09.1987 and numbered 19589.

Penstock begins at the 2824.85m of the transmission tunnel. Total length of the penstock is 324.06 m. Penstock will be constructed such that 308.58 m of its length to be located inside the transmission tunnel and 15.48 m of it at the outside of the tunnel. For this reason, no restoration work will be carried out for the part passing through the tunnel. Excavation will only be carried out for the 15.48 m part that is located outside the tunnel to pass underground. Trees located at this area will be cut down, however; following the completion of construction works, these areas will be reforested within the scope of restoration works. Power plant, the last unit of the project, will be founded at an area of 549 m^2. This building will be constructed with reinforced concrete and its surroundings will be afforested.

Approximately 10 ha of the project site is composed of forest area, and 14 ha of it is composed of non-forest area. The lands determined as the construction site are agricultural lands of private property. For these lands and the other agricultural lands found within the project site, permission for non-agricultural land use will be taken according to the application of EMRA (Energy Market Regulatory Authority). For the meadow property land around the regulator, non-agricultural land use permission was taken before. Other than this, non-agricultural land use permission was also taken for the access roads found in the power plant area.

V.1.2. Transportation, storage and use of flammable, explosive, dangerous, toxic and chemical substances to be used during the preparation of land and construction of the units; if blasting is to be performed, detailed information about blasting, assessment of blasting for groundwater, amount and type of explosives to be used, tools and machines to be used for land preparation works, (if blasting is to be performed, not to perform blasting activities during breeding and spawning period of aquatic fauna living in the stream)

During the excavation process to be performed in land preparation and construction phase, it is planned to use main tools and construction equipment, such as dozer, crawler and rubber-wheeled loaders, excavator (including crusher excavator), grader, cylinder, dump trucks, air compressor, tunnel drill gun, tunnel ventilation fan, in addition to ANFO and dynamite (Powergel Magnum).

Blasting activities to be performed during excavation work will be done both in open and closed area. At the entrance and exit of transmission tunnel, open air blasting will be performed; whereas enclosed blasting will be performed to open the transmission tunnel.

During the construction phase, for loosening blasting at the transmission tunnel only necessary amounts of explosive will be supplied and no storage of explosives will be performed. No flammable, explosive, toxic and hazardous chemical other than anfo will be used at the project site.

During open air blasting; rock drilling machine, anfo explosives, powergel magnum feeder, exel capsule igniter, explosion fuse, flow measurement device, and igniter magneto will be used; and for the tunnel blasting rock drilling machine, tripod hand drilling machine, powergel magnum explosive, exel capsule igniter, explosion fuse, flow measurement device, and igniter magneto will be used.

ANFO to be used for blasting is an explosive substance obtained by mixing ammonium nitrate and fuel oil (or diesel oil) at a ratio of 6%. Due to its cheapness and safety, it is the most consumed explosive mixture used worldwide and Turkey as well. Its detonation speed reaches up to 4,400 m/s at a blasting drill of 250 mm in diameter. Therefore, ANFO cannot reach a constant detonation speed at the holes that are smaller than 25 mm in diameter. Ideally, ANFO reaches to the maximum blasting speed at holes with medium and large (75-250 mm) diameter. In order to detonate ANFO, it is necessary to ignite it with a higher primer (dynamite, etc.).

For construction of the transmission tunnel, 2 blasting will be carried out at each entrance that makes 4 blasting/day. Inside the tunnel, blasting will only be done for the rocks that cannot be crushed or excavated by machines. Blasting activities will not be performed simultaneously. Blasting will be done with small shots and delayed detonator will be used. During the project, gallery blasting method will not be carried out, and blasting will not be performed during breeding and sprawling period of the aquatic fauna living in the stream. Blasting design of the transmission tunnel and information related to blasting are given below:

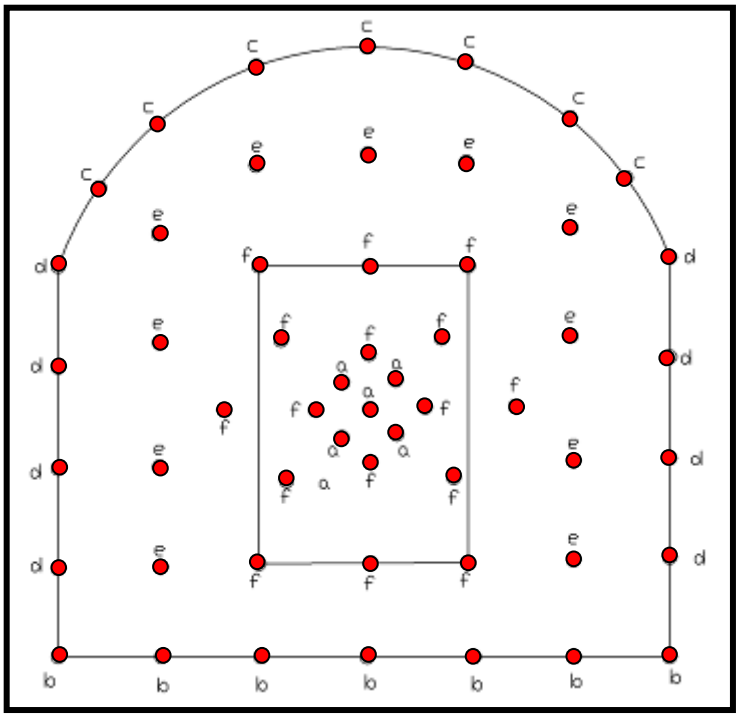


Figure 5.1.2.1. Blasting Pattern for the Transmission Tunnel

4 holes (5 of which will be empty) will be drilled **per blasting**;

a- 5 loosening hole (a) : No explosives will be put
b- 7 basement hole (b) : Explosives exist
c- 7 ceiling hole (c) : Explosives exist
d- 8 side-wall hole (d) : Explosives exist
e- 11 production hole (e) : Explosives exist
f- 16 central hole (f) : Explosives exist

Length of hole : 3.5 m (2.5 m will be compressed with anfo and the rest 1m with clay)
Diameter of hole: 32 mm
Surface area : ~18.1 m^2
Density of Anfo : 0.82 gr/cm^3

Accordingly the amount of explosive to be used;

Volume of hole= л. r^2.h= 3.14 X $(3.2 / 2)^2$ x 350 cm = **2,813.4 cm^3**
Density of anfo: 0.82 gr/cm^3

Amount of anfo in 1 hole = 2,813.4 cm^3x 0.82 gr/cm^3
= 2,307 gr = **2.31 kg (maximum instant charge)**

Totally 54 holes will be drilled and 5 of them will be loosening holes, thus the number of holes to be filled with explosives is 49. Therefore, total anfo amount per blasting is;

49 holes x 2.31 kg/blasting = **113.19 kg**

The area of the tunnel to be opened within the scope of the project is located in steep slop topography that is composed of Nebişeyh limestone units whose lower and upper strata are unbedded or very thick-bedded, whereas its middle strata are thick-bedded, brittle and fractured Zinav limestone unit, and uniform patterned and thin-middle bedded, partly sandy, fractured in various directions, fractures are calcite and silica-filled, fine-crystallized, rough patterned, brittle structured, clastic and rarely interbedded with marn.

The limestone formations found in this area do not have aquifer property due to abovementioned properties. Small quantities of water retained within their structure are emptied at upper elevations as small resources. In this region, groundwater is only found at the permeable alluvial formed at downstream of streams.

Therefore, geological formations to be used for tunnel drilling do not contain groundwater. Tunnel route is located well above the groundwater level. Blasting will only be held in case needed and being in small-scale will not affect groundwater adversely.

According to the ecosystem report, breeding period of the aquatic organisms is between April-July. Hence, no blasting activity will be performed in this period.

V.1.3. Transportation infrastructure plan within the project scope, actions related with construction of infrastructure, properties of the roads to be constructed, materials to be used, chemical substances, tools, machines, dust emitting mechanical activities such as crushing, screening, transportation, storage, dust and noise calculations, traffic load, new roads to be constructed, improvement of village roads, in case project units have connection with highways, its affects on the highway and precautions to be taken

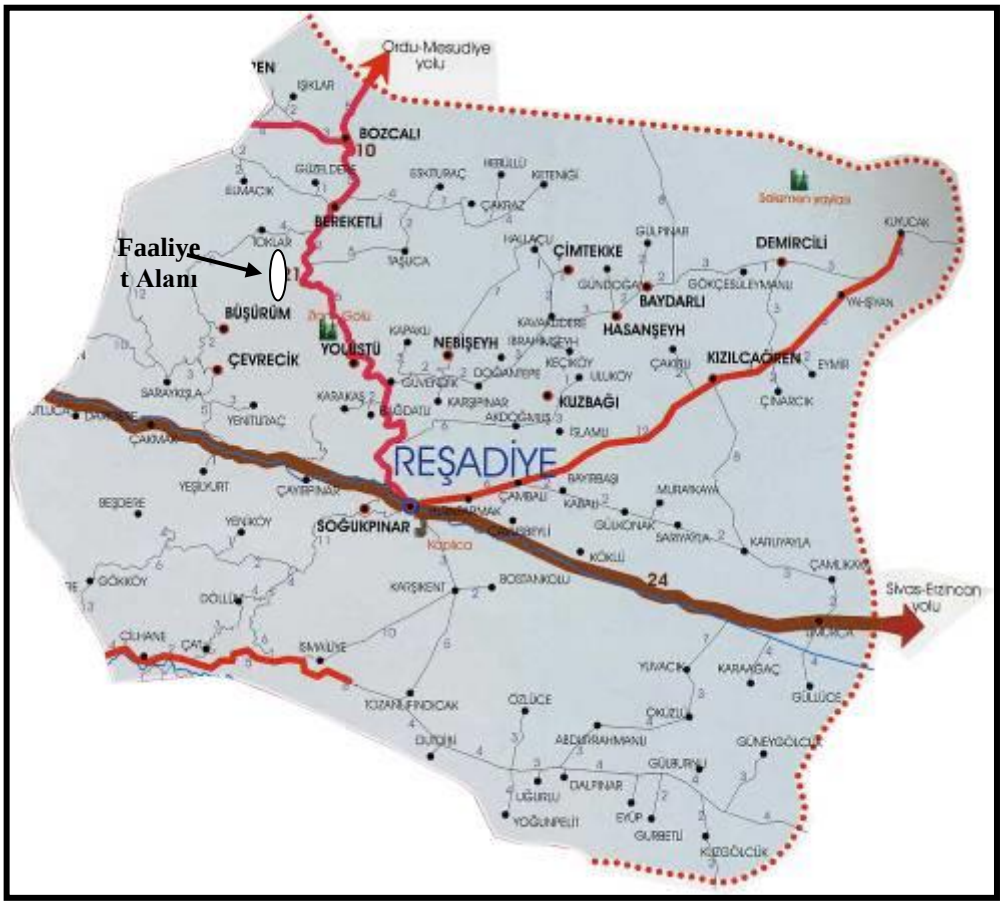


Figure 5.1.3.1. Map of Reşadiye District

As can be seen from Figure 5.1.3.1, in which the map of Reşadiye District is given, it is possible to reach next to the project site by using the existing state and village roads. However, 880 m of road to provide access to the regulator area and 2,003 m of road to provide access the powerhouse, which totally makes 2,883 m, will be constructed. In this context, required permissions will be taken from the authorized bodies and the roads to be constructed at appropriate areas of the project site and the existing village roads to be expanded and renewed will be used as access roads.

For the access roads to be constructed and village roads to be expanded, various construction equipment (dozer, grader, truck, etc.) will be used. The required material will be supplied by the large and small material that are gathered during tunnel opening process, and crushing-screening plant will not be founded. It is not considered to use any chemical substance during road construction. In case of unavailability of appropriate material by excavation, materials will be supplied from the licensed stone quarries found at the region.

Amount of Dust to be produced during Road Construction

For road construction, large and small material provided from tunnel excavation will be used. In case of inappropriateness of these material, material to be supplied from licensed stone quarry will be used without storing it. In this context, dust will be produced during transportation and deployment of material on the site. In the project, it is planned to construct 2,883 m of road and approximately 1,500 tons of material is planned to be used. In this context, maximum 3 km of soil-stabilized road will be used for transportation of materials. It is planned to complete road construction activities in 2 months.

Total amount of material	: 1,500 tons
Number of days to work	: 60 days (2 months)
Daily working hours	: 10 hours
Amount of excavation	: 2.5 ton/hour

Considering that a truck has 20 tons of carrying capacity, 2 trips will be made per day. The emission factor for transportation is 0.7 kg/km-trip. Accordingly, the amount of dust to be generated is as follows;

Dust to be generated during transportation = 0.7 kg/km-trip x 2 trip/10 h x 3 km
= **0.42 kg/h**

Emission to be produced during unloading = 0.01 kg/ton x 3 tons/h
= **0.03 kg/h**

Thus, totally 0.45 kg/h of dust will be generated during road construction. This value is below the emission rate for normal operation conditions and for operation hours of weekly working days (>1.0 kg/h) (excluding point sources), given in Table 2.1 of Appendix-2 of the “Regulation on Industrial Air Pollution Control”. For this reason, air dispersion modeling is not required. Therefore, adverse effects of dust to be generated due to road construction on the surrounding settlements is out of question.

Noise to be generated during Road Construction

For construction of access roads and expansion of existing village roads, various construction equipment (dozer, grader, truck, etc.) will be used.

The following calculations were performed to estimate noise to be generated by construction equipment that will work at road construction.

Related with the noise to be generated during construction activities and during operation of tools, equipment and machines, the issues mentioned in Regulation on Machine Safety (98/37/AT) that is prepared by the Ministry of Science, Industry and Technology and published in the Official Gazette dated 5/6/2002 and numbered 24776 shall be complied with.

Noise levels of potential sources are found by using the equations given with respect to the engine power levels defined in table given under 5th article of Regulation on Environmental Noise Emission Generated by Equipment used at Open Air Area that is prepared by Science, Industry and Technology and published in the Official Gazette dated 22/01/2003 and numbered 25001. From the machine-equipment list given in the table under 5th article, equipment types to be used at site and equations corresponding to their engine power are given in Chapter V, Table 5.1.24.2.

Noise level to be generated at the site depends on power of engine, thus equations given in the table will be used to calculate noise levels of equipment. Quantity and engine powers of the construction equipment to be used during road construction are given in Table 5.1.3.1.

Table 5.1.3.1 Types and Quantities of Equipment to be used for Road Construction

Phase	Equipment to be used	Engine Power (HP)	Engine Power (kW)	Quantity
Road Construction	**Truck**	110	82.06	3
	Grader	170	126.82	1
	Dozer	170	126.82	1
	Sprinkler	110	82.06	1

Calculation of Noise Level of Construction Equipment

Noise level of each equipment is calculated below by using the equations given in Chapter V, Table 5.1.24.1.

Truck:

Engine power of the truck to be used at the project site is 110 HP = 82.06 kW. According to the evaluation given in Table 5.1.24.1; since P = 82.06 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw = 82 + 11 Log 82.06
Lw = **103.1 dB**

Grader:

Engine power of the grader to be used at the project site is 170 HP = 126.82 kW. According to the evaluation given in Table 5.1.24.1; since P = 126.82 kW > 55 kW, Lw=82 + 11 Log P equation was used.

Lw= 82 + 11 Log 126.82
Lw= **105.13 dB**

Dozer:

Engine power of the dozer to be used at the project site is 170 HP = 126.82 kW. According to the evaluation given in Table 5.1.24.1; since P = 126.82 kW > 55 kW, Lw=82 + 11 Log P equation was used.

Lw= 82 + 11 Log 126.82
Lw= **105.13 dB**

Sprinkler:

Engine power of the sprinkler to be used at the project site is 110 HP = 82.06 kW. According to the evaluation given in Table 5.1.24.1; since P = 82.06 kW > 55 kW, Lw=82 + 11 Log P equation was used.

Lw= 82 + 11 Log 82.06
Lw= **103.1 dB**

Noise levels of the equipment to be used in construction is as follows:

Table 5.1.3.2. Noise Level of the Equipment to be used during Road Construction

Noise Sources	Quantity	Noise Levels (dB)
Truck	3	103.10
Grader	1	105.13
Dozer	1	105.13
Sprinkler	1	103.10

Distribution of total sound power level of all noise sources given in the table above to 4 octave bands between 500-4,000 Hz is presented below. For this purpose, sound power level in each octave band is calculated by taking reverse summation of decibels.

Table 5.1.3.3. Distribution of Sound Power Level of the Equipment to be used during Road Construction to Octave Bands

Noise Sources	Sound Power Level			
	50 Hz	1000 Hz	2000 Hz	4000 Hz
Truck	97.1	97.1	97.1	97.1
Grader	99.1	99.1	99.1	99.1
Dozer	99.1	99.1	99.1	99.1
Sprinkler	97.1	97.1	97.1	97.1

Sound power level of each noise source in 4 octave bands is calculated by use of the following equation and the results are given in the table below.

$$\mathbf{Lp = L_w + 10\ Log\ (Q/\ 4\ \pi\ r^2)}$$

where;

Lw : Sound power level of source (dB)
Q : Directivity coefficient (taken as 1 for mobile sources)
R : Distance from source (meter)

Table 5.1.3.4. Sound Pressure Level of the Equipment to be used during Road Construction

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Truck	50	55.14	55.14	55.14	55.14
	100	49.12	49.12	49.12	49.12
	250	41.16	41.16	41.16	41.16
	500	35.14	35.14	35.14	35.14
	1000	29.12	29.12	29.12	29.12
	2000	23.10	23.10	23.10	23.10
	3000	19.58	19.58	19.58	19.58
Grader	50	57.18	57.18	57.18	57.18
	100	51.16	51.16	51.16	51.16
	250	43.20	43.20	43.20	43.20
	500	37.18	37.18	37.18	37.18
	1000	31.16	31.16	31.16	31.16
	2000	25.14	25.14	25.14	25.14
	3000	21.62	21.62	21.62	21.62
Dozer	50	57.14	57.14	57.14	57.14
	100	51.12	51.12	51.12	51.12
	250	43.16	43.16	43.16	43.16
	500	37.14	37.14	37.14	37.14
	1000	31.12	31.12	31.12	31.12
	2000	25.10	25.10	25.10	25.10
	3000	21.58	21.58	21.58	21.58
Sprinkler	50	55.14	55.14	55.14	55.14
	100	49.12	49.12	49.12	49.12
	250	41.16	41.16	41.16	41.16
	500	35.14	35.14	35.14	35.14
	1000	29.12	29.12	29.12	29.12
	2000	23.10	23.10	23.10	23.10
	3000	19.58	19.58	19.58	19.58

Atmospheric absorption values are calculated for each frequency by using the following equation and relative humidity (Φ) is taken as 62.23%.

$$\mathbf{A_{atm} = 6.2 \times 10^{-8} (f^2 r / \Phi)}$$

where;

F : Frequency of noise source
r : Distance
Φ **:** Relative humidity

After subtracting the atmospheric absorption levels given in **Chapter V, Table 5.1.24.6**, final sound pressure level of each source at 4 octave bands is calculated with respect to the following equation and the results are given in **Table 5.1.3.5**.

$$\mathbf{L_p = L_p - A_{atm}}$$

Table 5.1.3.5. Final Sound Pressure Levels to occur during Road Construction

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Truck	50	55.12	55.07	54.87	54.06
	100	49.09	48.98	48.58	46.95
	250	41.08	40.82	39.81	35.74
	500	34.97	34.46	32.43	24.30
	1000	28.78	27.77	23.70	7.44
	2000	22.42	20.39	12.26	-20.27
	3000	18.56	15.51	3.31	-45.48
Grader	50	57.16	57.11	56.91	56.10
	100	51.13	51.02	50.62	48.99
	250	43.12	42.86	41.85	37.78
	500	37.01	36.50	34.47	26.34
	1000	30.82	29.81	25.74	9.48
	2000	24.46	22.43	14.30	-18.23
	3000	20.60	17.55	5.35	-43.44
Dozer	50	57.12	57.07	56.87	56.06
	100	51.09	50.98	50.58	48.95
	250	43.08	42.82	41.81	37.74
	500	36.97	36.46	34.43	26.30
	1000	30.78	29.77	25.70	9.44
	2000	24.42	22.39	14.26	-18.27
	3000	20.56	17.51	5.31	-43.48
Sprinkler	50	55.12	55.07	54.87	54.06
	100	49.09	48.98	48.58	46.95
	250	41.08	40.82	39.81	35.74
	500	34.97	34.46	32.43	24.30
	1000	28.78	27.77	23.70	7.44
	2000	22.42	20.39	12.26	-20.27
	3000	18.56	15.51	3.31	-45.48

To calculate A-weighted noise levels, correction factors given in **Chapter V, Table 5.1.24.8** are used.

The results of noise level calculation for each noise sources for 4 octave bands by using the correction factors given in **Chapter V, Table 5.1.24.8** and total noise levels calculated by using the equation given below are presented in **Table 5.1.3.6**.

$$L_T = 10 \log \Sigma 10^{Li/10}$$

where;

Lt: Total noise level
Li: Noise source corrected noise level

Table 5.1.3.6. Total Noise Level in Road Construction Phase

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
Truck	50	51.92	55.07	56.07	55.06	60.80
	100	45.89	48.98	49.78	47.95	54.40
	250	37.88	40.82	41.01	36.74	45.51
	500	31.77	34.46	33.63	25.30	38.42
	1000	25.58	27.77	24.90	8.44	31.06
	2000	19.22	20.39	13.46	0.00	23.35
	3000	15.36	15.51	4.51	0.00	18.68
Grader	50	53.96	57.11	58.11	57.10	62.84
	100	47.93	51.02	51.82	49.99	56.44
	250	39.92	42.86	43.05	38.78	47.55
	500	33.81	36.50	35.67	27.34	40.46
	1000	27.62	29.81	26.94	10.48	33.10
	2000	21.26	22.43	15.50	0.00	25.38
	3000	17.40	17.55	6.55	0.00	20.70
Dozer	50	53.92	57.07	58.07	57.06	62.80
	100	47.89	50.98	51.78	49.95	56.40
	250	39.88	42.82	43.01	38.74	47.51
	500	33.77	36.46	35.63	27.30	40.42
	1000	27.58	29.77	26.90	10.44	33.06
	2000	21.22	22.39	15.46	0.00	25.34
	3000	17.36	17.51	6.51	0.00	20.66
Sprinkler	50	51.92	55.07	56.07	55.06	60.80
	100	45.89	48.98	49.78	47.95	54.40
	250	37.88	40.82	41.01	36.74	45.51
	500	31.77	34.46	33.63	25.30	38.42
	1000	25.58	27.77	24.90	8.44	31.06
	2000	19.22	20.39	13.46	0.00	23.35
	3000	15.36	15.51	4.51	0.00	18.68

Considering the worst case scenario, equivalent noise levels for the case that all noise sources operate simultaneously are calculated and given in the following table. For this purpose, the following equation is used and calculations are performed considering the number of equipment.

L_{day} noise levels **(**L_{day} **=** L_{eq}**)** are calculated by use of the following equation and given in **Table 5.1.3.7**.

$$L_{eq}=10\ log\Sigma 10^{\,LT(i)}/10$$

Table 5.1.3.7. L_{day} Levels to occur during Road Construction

Distance	L_{day} (dBA)
50	67.95
100	61.55
250	52.66
500	45.56
1000	38.21
2000	30.52
3000	25.89

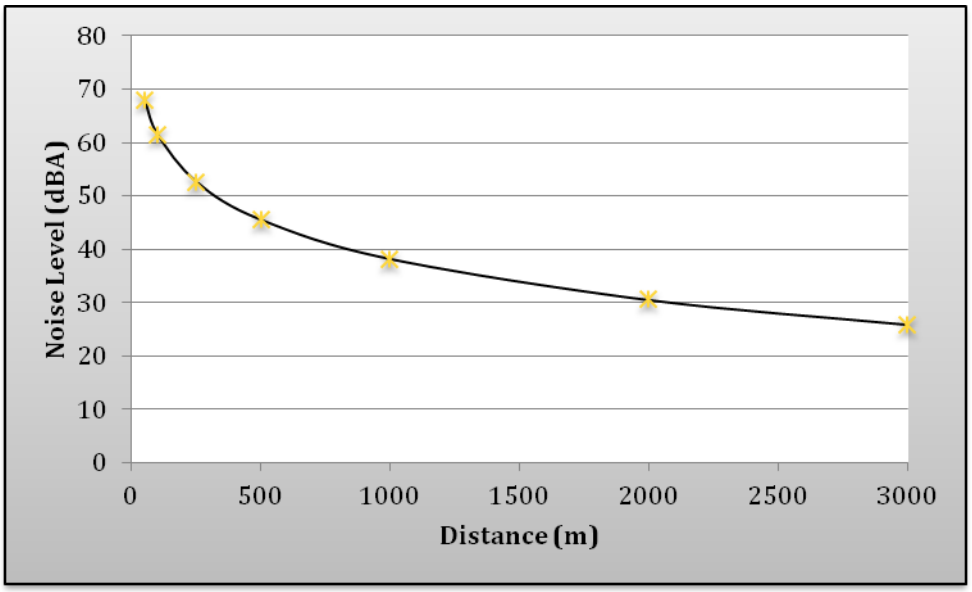


Figure 5.1.3.2. Distribution of Noise to occur during Construction Phase

Calculations are done by considering that all construction equipment to work at the same location. However, these vehicles and equipment will be working at different locations. Besides, all of these equipment will not work simultaneously. Hence, noise level at the nearest settlement will be lower.

In the (a) item of 22nd article of the relevant regulation, it is mentioned that "Noise level generated by an facility or plant should not exceed the standards given in Table-4 of Appendix-VIII of this regulation". Environmental Noise Level Standards for construction sites are given in **Chapter V, Table 5.1.24.11**. The nearest settlement to the project site is Tokatlar Village that is 1 km far away from the project site. As can be seen from **Table 5.1.3.7,** daily noise level at a distance of 50 m from the project site will be lower than 70 dBA. Therefore, noise to generated at the project site will not affect the nearest settlement.

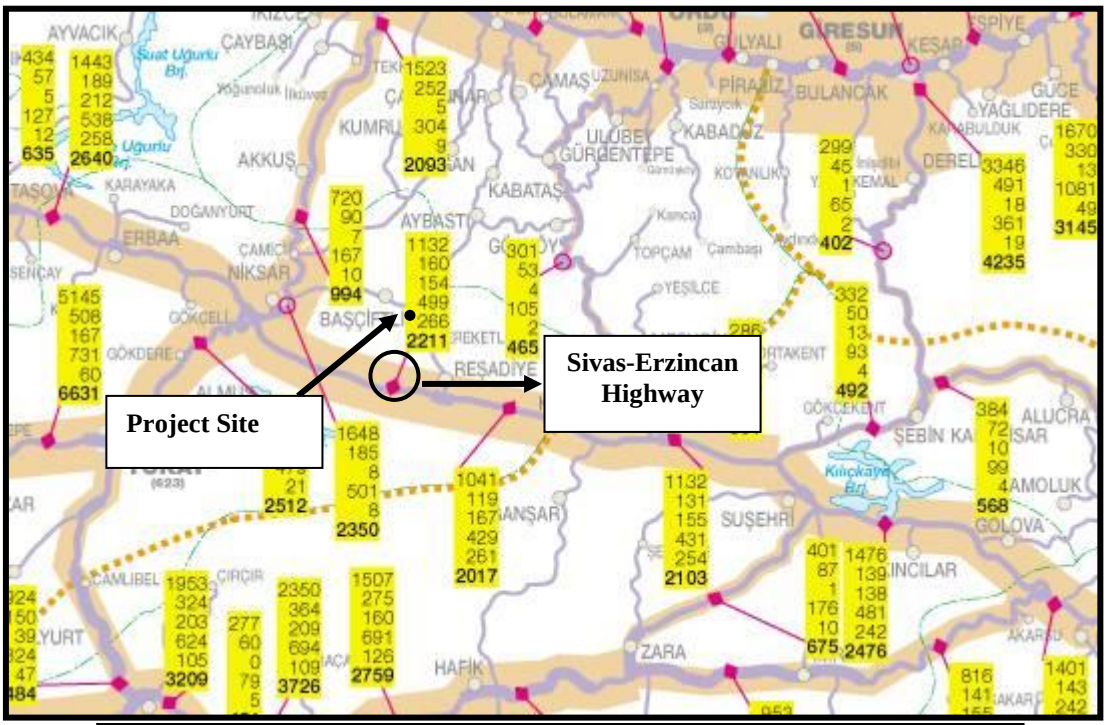
In addition, necessary measures will be taken by the investing company to control the noise to be generated due to project activities.

In relation to noise, necessary measures shall be taken in accordance with "Regulation on Occupational Health and Safety" published in the Official Gazette dated 09/12/2003 and numbered 25311. As stated in the regulation employees working at the project site shall use the provided headphones to compensate for the noise, and the other provisions of the regulation shall be complied with.

Besides, all the issues stated in "Regulation on Assessment and Management of Environmental Noise" published in the Official Gazette dated 04.06.2010 and numbered 27601 shall be complied with during the project activities.

Traffic Load

During the construction phase of the project, since necessary materials for the road construction will be transported via state, village and stabilized access roads, no significant dust emission will be generated.



LEGEND

1120	Car	47782	Light Vehicle
276	Medium Loaded Commercial Vehicle	2110	Heavy Vehicle
100	Bus	59892	Total
547	Truck		
24	Truck+Trailer, Hauler + Semi-Trailer		
1791	Total		

Annual Average Daily Traffic Load

Figure 5.1.3.3. Map of Traffic Load

Expansion of village roads and stabilized access roads to be constructed at the project site will be clarified by final design projects. Considering that the expansion and renovation of the existing roads, and construction of new stabilized roads will take place at a maximum distance of 10 km and by assuming the road width as 5m and the thickness as 30 cm, total road construction material required is calculated as follows:

2,883 m x 5 m x 0.3 m = 4,324.5 m^3 = 4,324.5 m^3 x 2.8 ton/m^3 = 12,108.6 tons

Assuming that road construction works last for 6 months, the amount of material to be used is;

12,108.6 tons / 6 months = 2,018.1 tons/month
= (2,018.1 tons/month) / (25 day/month) = 80.7 ton/day

Assuming that a truck capacity of 15 tons and each truck makes 1 trip per day;

(80.7 ton/day) / (15 ton/day) = 5.38

thus approximately 6 trucks per day will use these highways.

Traffic load of the region is given in **Figure 5.1.3.3**. The highway that is nearest to the project site and that has the highest traffic load is Sivas-Erzincan Highway passing through Reşadiye District. Daily traffic load of this highway is 2211 vehicle, 765 of which is truck and the rest is heavy vehicles.

The percentage of heavy vehicles is calculated as follows:

= (Existing Heavy Vehicles + Vehicles to Work at Project Site) / Existing Vehicles x 100
= (765 + 6) / 2211 x 100
= 34.87 %

The percentage of heavy vehicles excluding the traffic load due to the project activities:

= (Existing Heavy Vehicles / Existing Vehicles) x 100
= (765/2211) x 100
= 34.59 %

According to this, existing heavy vehicle load on the highway will increase by 0.28% (34.87% – 34.59% = 0.28 %) due to the project construction works. It means that trucks working for transportation of materials for road construction will not have a substantial burden on the existing traffic load.

During road construction, only appropriate sizes of the materials to be provided from tunnel excavation will be used. Quarry or crushing-screening plant will not be installed within the scope of the project, and no chemical will be used during road construction.

The machines and equipment to be used in the project are wheel loader, truck, excavator, wheel dipper, concrete pump, dozer, concrete mixer, mobile crane, and sprinkler to avoid dust generation and road irrigation.

V.1.4. Actions for soil safety and avoiding water spill from regulator and canal structures

The regulator is the most important structure of the project. Soil excavation will not be done by blasting, hydraulic grips will be used for hard surface excavations. Especially the subgrade will not be remolded. Potential weak subgrades will be discharged and these parts will be filled with concrete. During cross-sectional excavations, angle of repose will be defined with consideration of soil stability and sensitivity of the dominating soil. During cut excavations, intercepting ditches will be designed with respect to the slope of soil and by calculating the flow rate of running water at the time of maximum precipitation. Downstream of these will be connected to the streambed. Creep of concrete will be avoided by constructing filtered drainage pipes underneath the approach plate. These drainages will be drained behind edge walls and connected to the streambed. Concrete aggregates of the regulator will not include porous material. Cement to be used for concrete manufacturing will be resistant to alkaline and have high fineness modulus. Back of the regulator walls will be filled with granular material, so that water running from the slopes will be discharged.

Channel excavation will be made according to the excavation plans sectioned with respect to the caliber of pipes. Padstone will be placed carefully, and appropriate sand-gravel material will be supplied. Likewise, fill material will be firmly compressed around the pipe by manpower.

Starting from the upstream, all penstocks throughout the route will be mounted by welding and each connection will be examined with x-ray. Pipe cover fills will be compressed such as to avoid water leakage to the basement of pipes.

In order to meet axial water load in the penstock line project, it will be attached to soil from various parts of the line by anchorage concretes.

To prevent slipping of excavation material to be stored at temporary excess excavation material storage areas of inclined surface, retaining walls will be installed as required.

V.1.5. Actions for flood prevention and drainage,

There exists no gauging station on Zinav Stream where the project is taking place. For flood calculations of the project, instant maximum flood data of the surrounding gauging stations were taken into consideration. To calculate flood flows of the proposed facilities taking place within the scope of Onur Regulator and HEPP project

- Synthetic methods and
- Gauged flows were used.

Flood recurrence calculations are accomplished by use of gauged flows, Point and Regional Frequency Analysis in addition to Synthetic methods by considering size of the drainage area, and by using Superimposed Mockus Method.

For Onur Regulator, safe and freeboard flood flow that is for 100-year recurrence is calculated as 146.40 m^3/s and for 500-year recurrence is calculated as 193.50 m^3/s, which could pass through full spillway without freeboard.

However, possible floods will be avoided due to the controlled water discharge from the regulator. During cut excavations, intercepting ditches will be designed with respect to the slope of soil and by calculating the flow rate of running water at the time of maximum precipitation. Downstream of these will be connected to the streambed. Creep of concrete will be avoided by constructing filtered drainage pipes underneath the approach plate. These drainages will be drained behind edge walls and connected to the streambed. The regulator to be constructed will partially serve to delay flood. Moreover, Zinav Stream that take place at the project site has a wild nature and flows along deep valleys. Due to these properties, the stream does not pose flood risk to the surrounding environment.

Besides, in the course of regulator construction, it will be protected against floods through diversion channel and cofferdam. The stream will be directed to the diversion channel to be installed at the bank through the cofferdam to be constructed at the upstream of the regulator, and thus the regulator area will remain dry throughout the construction. In addition to that, drainage ditches will be made at the edge of the roads to be constructed in the course of the project to avoid water accumulation. Furthermore, all kinds of measures will be taken by the company to avoid flood.

The spillway, which is planned to avoid flood and to discharge water in the regulator reservoir as soon as possible in case of emergency, is designed in consideration with flood flow of 100-year recurrence. The spillway elevation is 1180.00 m and net width is 34.00 m. Flip bucket will be installed in downstream of the spillway. Thus, flood will flow to downstream without any damage.

V.1.6. Amounts of rock, sand, gravel and similar materials to be extracted from the water media that is found within the project area through processes such as excavation, bottom scraping, etc., the place where these materials to be transported or their purpose of use, effects of activities to be performed in the streambed (turbidity, flow rate, etc.)

Within the scope of the project, only the regulator construction will take place in water medium, where regulator, gravel pass, and water intake structure are to be constructed. For this reason, diversion channel and cofferdam will be used to retain the medium dry in the course of construction.

The alluvial thickness at the regulator area is not more than 2-3 meters. During construction activities, this alluvial cover will be removed and the regulator structure will be settled to hard rock. The materials to be extracted during this process will be used as permeable filling material.

Totally 35,475 m^3 of excavation, 20,616 m^3 of which is soft soil excavation and 14,859 m^3 is hard rock excavation, will be held at the regulator area. The density of hard rock is about 2.8 ton/ m^3, whereas soft soil excavation density is 1.5 ton/ m^3. Thus, total amount of excavation is;

20,616 m^3 x 1.5 ton/m^3= 30,924 tons
14,859 m^3 x 2.8 ton/m^3≅ 41,606 tons
Total = 30,924 ton + 41,606 ton = **72,530 tons**

The material to be excavated during construction is planned to be used again in the construction as much as possible. The material that is not used will be transported to the excess excavation material site-1 which is located in the 750 m north of the regulator. The determined excess excavation material sites are shown on the map given in the attachments (**Appendix: 12**). Total amount of excavation also includes vegetable soil to be scrapped. Vegetable soil will be stored at excess excavation material storage site as appropriate, but separate from excavation material, and after completion of construction works, it will be used for reinstatement of the site. Excess excavation material will definitely not be left to streambeds.

V.1.7. Throughout the construction works, possible effects on living species (terrestrial and aquatic flora-fauna) present at the streambed and the project site, the measures to protect sensitive species, transition structures to be installed on surface water resources (appropriate way to sustain continuity of ecological structure)

The vegetation types taking place within influence area of the project are Degraded Forest Vegetation, Riparian Vegetation, and Steppe Vegetation. During construction phase, Riparian Vegetation will be affected the most.

IUCN danger categories of the plant species that are endemic, rare and under threat of extinction, which may exist around Zinav Stream that flows into Kelkit Creek within Yeşilırmak River Basin within the boundary of Reşadiye District of Tokat Province, in the Central Black Sea Region, are given below.

According to this, 20 species and taxa, 19 of which takes place in LR (lc) and 1 in LR (cd) category, has been identified in the region.

No species were identified in the region that is found in high risk category (CR and EN) and needs special protection.

One species (Hieracium reductum Freyn & Sint.) that is found in LR (cd - conservation dependent) category were identified in the region. Since the channel system of the planned HEPP project is tunnel, it poses no threat on this species.

Onur Regulator and Onur HEPP Project is placed on Zinav Stream that flows into Kelkit Creek within Yeşilırmak River Basin, within the boundary of Reşadiye District of Tokat Province and it lies in the vicinity of Kelkit Valley that is “Mediterranean Enclave”. Therefore, it is a place where “floristic diversity” is abundant. Glacial movements occurring at different geologic periods has contributed to the biological diversity of Anatolia. Anatolia has influenced by plant and animal migrations that have occurred during glacial and interglacial periods. Kelkit Valley is important as being a Tethys (former Mediterranean) residue.

Due to floristic significance of the region, it is important to accomplish any activity at site with special care and to take necessary measures in order to protect floristic diversity.

Protecting floristic diversity and integrity of habitat at the project site and its surroundings is significant due to its proximity to Kelkit Valley that is Mediterranean Enclave.

The construction works of the project will totally last for a period of 32 months, 30 months of which will be construction period and 2 months will be testing period. During this period, 16,261 tons of vegetable soil to be produced during soil excavation will be stored separate from excess excavation material and used for landscaping and rehabilitation works. Excess excavation material will definitely not be left to streambeds.

It is assumed that performing restoration of the areas, which may be affected due to construction works, in compliance with the principles of “Ecological Restoration” and taking other measures will minimize adverse effects on floristic diversity.

Important ecosystems for terrestrial ecosystems that take place within the project influence zone are aquatic ecosystem, ecosystem with steppe characteristics and agricultural lands, and deciduous forest ecosystem. During construction phase, aquatic ecosystem will be the ecosystem to be affected the most.

Noise, light, odor, dust and chemical pollutants are the main anthropogenic factors threatening wildlife.

The performed measurements show that noise level at a distance of 200-300 m far away from the stream is between 30-40 dB which is the natural noise having no adverse effect on fauna. The noise level increases up to 60 dB as approaching to the stream. For now, there exists no noise, light, odor, dust or chemical pollution source at the site.

Accordingly;

Throughout or prior to construction phase, the seeds of above-mentioned endemic, rare or endangered species, especially Hieracium reductum Freyn & Sint. Species shall be ensured to be collected. Some of these seeds shall be delivered to the Seed Gene Banks. In addition, creation of new populations of these species shall be ensured at ex-situ habitats of similar ecological properties through seeds or seedlings.

Especially during the construction phase of the project, the abovementioned criteria should be taken into consideration and attention should be paid not to exceed the limit values for these criteria. During the operation phase of the project, no adverse effect is expected to happen.

There exists no cave ecosystem in the vicinity of the project site, thus bat population will not be harmed during the construction and operation phases.

Due to wetland nature of the project site, it is kind of feeding and breeding area for many migratory water-bird. Maximum care shall be taken not to cut trees along the stream during construction. The birds that utilize the area to during the works will be sensitive to, the practices disturbing the population, and possible destruction of nests shall be avoided.

Imperial eagle has a small population on global scale, and their number is decreasing day by day. For this reason, it has been taken to VU category by IUCN. Especially during breeding period of this endangered species, special attention shall be paid not to disturb their individuals, their nests possibly found in the project site, and the surroundings of the nests, not to make noise, not to destroy their feeding areas, and habitats of the mammalian animal and bird species that they feed on.

Due to sudden drop in their population, small vulture has been taken into EN category. They begin spawning about in the middle of April in Turkey and they usually make incubation two times during their reproduction period, and the fledging hatches in 42 days on average. After reproduction period, these birds migrate to their wintering grounds until the mid of October. For these reasons, especially in reproduction periods, the individuals and their nests shall not be disturbed and noise in the vicinity of the nests shall be avoided.

In the population of lesser kestrel, a rapid decline has been observed worldwide, especially in Europe 46% of decrease since 1950 and in South Africa 25% of decrease since 1971, and thus it has been taken to VU category. One of the reasons for the decline in their number is hunting and the other one is their capture due to the aim of raising them as a cage bird or a pet. Towards the end of April, they lay their eggs (about 2-8 eggs), and in late September they migrate to South Africa, their wintering grounds. For protection of this species, it is essential to support their reproduction by not disturbing their nesting areas during reproduction periods and not hunting or capturing as pets.

The forest land to be clear-cut along HEPP transmission line will create an area that is susceptible to erosion. Loss of soil beneath the vegetation to be clear-cut especially at sloping land should be avoided, the measures shall be taken to ensure regeneration of vegetation.

During construction phase of HEPP, special attention shall be paid to avoid noise pollution due to the use of construction equipment and construction works shall be performed more rigorously especially between February-May that corresponds to breeding/spawning period of most of the animals. Noise and light pollution will be avoided.

No permanent or unrecoverable effect of HEPP project, which will be carried out in regard of the abovementioned precautions and “development of strategies for conservation of nature that do not hinder economical development” principle of the UNEP (United Nation Environmental Programme) that defines the United Nation’s approach to environmental concerns clearly, is expected on the fauna.

Aquatic ecosystems consist of; phytoplanktonic organisms as producers (algae living as free or attached); primary and secondary consumers feeding on these, called zooplanktonic and benthic organisms; and fish, called tertiary consumers, feeding on phytoplanktonic organisms, zooplanktonic, and benthic organisms, or small fish based on their food preference. In this regard, algae (attached and free forms - phytoplanktonic organisms), zooplanktonic organisms, benthic organisms and fish are the basic rings of the food chain of the aquatic ecosystem. Any change occurring at the aquatic systems may lead to changes in these organisms.

Hydroelectric power plants may have positive and negative effects on fish population and fish diversity generally due to the alterations in water flow, quality of surface and groundwater, and change in vegetative structure. Conversion of draining habitat into a stagnant habitat (as a result of dam construction) is effective on the growth of fish rather than the composition of fish species.

Although adverse effects of regulators on fish growth and breeding is less than dams, it may cause decrease in population as it hinders reproduction behavior of some species living and breeding in rivers.

The most important criteria in regulator installation is the amount of stream water and/or side channel water released. In order to minimize the effects of regulator, the following suggestions should be considered.

To prevent adverse effects on the existing species, necessary measures shall be taken during construction and operation phase of the regulator. In this context, stream water shall not be polluted with regard of the biological and ecological properties of fish, or water flow shall not be interrupted especially during breeding period (between April-July that is the breeding period of the existing fish species) of the identified species.

Necessary physical conditions (minimum values for species in Cyprinidae family: 15 cm of water depth, 0.20 m/s of flow) (Cows and Welcomme, 1998) shall be established for the species that exist in water to be released after reservoir.

Since regulator construction will result in alteration of flow regime, certain habitat changes will occur. Considering in terms of aquatic organisms;

Reduction of the existing habitat of algae, among aquatic organisms, means formation of a new habitat. As a result of lake and pond formation, phytoplanktonic forms (free forms) will be observed as dominant instead of algae species living in attached form. In stagnant areas, forms living as attached to sediment, rock and plants will keep existing. Increased phytoplanktonic organisms (algae capable of moving freely) in the lake area will be a source of food for zooplanktonic organisms. In general, any adverse condition to affect fresh water algae flora of the region will be out of question. Because fresh water algae will maintain their conditions in lake system as well.

Stagnant water to be formed at the regulator site will create a suitable living environment for zooplanktonic organisms. The increase in phytoplanktonic organisms at the regulator site will result positively in terms of zooplankton and an increase will occur both in density and diversity of species. Zooplanktonic organisms, which have low species diversity and population density in creek and river systems of the region, will be represented by more species and density after formation of the regulator lake. As a result, optimum conditions will be satisfied for zooplanktonic organisms after realization of the project.

A part of benthic organisms may move away from the regulator site. These are the species that prefer to live in flowing environments. Conversely, other benthic organisms will come to the fore at the stagnant area. These species prefer to live in deep mediums consist of heavy silt and sediment.

Increase of planktonic species forming the nutrients for fish at the regulator site will affect fish population positively.

Another factor affecting the biological diversity of the region is the flowing mediums and the stagnant water habitat to occur after construction of the regulator. Because the composition of species living in these habitats is different.

During construction phase of the regulator, where body construction is handled, some devastating effects may occur. Because this condition is not permanent, the system will recover itself as soon as possible. In addition to this, it will be ensured to release minimum amount of water to the downstream during the operation phase of the regulator.

In general, fish living in creek, river and/or stream migrate in certain periods from downstream to upstream for breeding, feeding, and wintering. It is planned to make fish pass at the regulator and HEPP not to hinder breeding of endemic fish species existing at site.

V.1.8. Where, how and what amounts of material to be used for construction of the facilities (regulators, HEPP, transmission channel, tunnel and service roads) within the project scope

It is not planned to open material quarry during the project. The material to be used for the project will be provided from the licensed stone quarry located at İnlikaya that is about 2.5 km east of the project site. In case rock with appropriate specifications and amounts cannot be found, EIA application will also be done to get license for stone quarries.

V.1.9. Number of material quarries, such as stone quarry, sand quarry, or clay quarry, size of quarries, their capacity and coordinates, annual production amounts, production methods to be applied, step heights, width, slope angle, number of steps, display of the quarries' initial and final situations on production maps

It is not planned to open material quarry (sand, clay, and stone quarry) within the scope of the project. The required material will be provided from licensed stone quarries located at the region.

However, the rock material to be obtained during tunnel excavation will be used if it is found suitable. Procurement of material from Zinav streambed is also out of question. But, small amount of coarse-grained sediments of the streambed to be obtained during foundation excavation of the regulator may be used in accordance with the results of analysis to be conducted.

V.1.10. Specification of whether the material quarry will be opened or not, explanation of how blasting will be made, blasting pattern, the amount of explosives to be used per blasting, their transport, storage, and use, assessment of their impacts by making air shock and rock jumping calculations

It is not planned to open material quarry within the scope of the project.

V.1.11. Upon opening of material quarries, production quantities, duration of work (day-month-year), transportation routes, transportation infrastructure plan, actions in relation to construction of infrastructure, the nearest settlement areas around quarry, production map and cross-section of the quarry, location map showing its vicinity, machinery equipment to be used

It is not planned to open material quarry within the scope of the project.

V.1.12. Specification of whether the crushing-screening plant will be installed or not, in case of installation, its technology, production quantities, duration of work (day-month-year), transportation infrastructure plan, actions in relation to construction of infrastructure, coordinates of the site, size of the area, capacity of the plant, the nearest settlement areas around quarry, (measures to be taken to prevent dust, noise, etc.), process flowchart of the plant, present use and ownership of the plant area, display of the plant area in 1/25,000 scaled map, machinery equipment to be used

It is not planned to open material quarry within the scope of the project.

The material to be obtained from the transmission is expected to be large and small as a result of blasting. The suitable materials to be obtained from here will be used as construction material for regulator and power plant access roads.

V.1.13. Specification of whether the concrete plant will be founded or not, in case of foundation, its capacity, duration of work (day-month-year), transportation infrastructure plan, actions in relation to construction of infrastructure, machinery equipment to be used

The main phases of the activity to be carried out at the concrete plant can be summarized as follows: aggregates to be transported via trucks from the quarry site for production of ready-mixed concrete will be unloaded to the bunker at construction site and from here it will be delivered to the mixer at the concrete plant by a belt system. The concrete to be transferred from cement factory by trucks will be unloaded to the silos at the construction site and will be delivered to the mixer at the concrete plant by use of helical tube.

Water will be transferred to the mixer of the concrete plant by use of submersible pumps and water, cement, and aggregate will be mixed here, concrete grout will be produced in this way. Ready-mixed concrete obtained from concrete plant will be used at construction site by loading the mixers. The process flowchart, showing the general operation of the plant, is given below.

The capacity of the concrete plan is planned as 160 m^3/h (max. 320 m^3/day). The plant will operate 12 months per year, 25 days per month. C25 type concrete will be produced at the plant, and a total of 50,000 m^3 of concrete is required to complete the project. The machinery and equipment to be used within the scope of concrete plant is listed in the following table.

Table 5.1.13.1. List of Machinery and Equipment to be used within the scope of Concrete Plant

Equipment		Quantity	Approximate Capacity
Silos	Sand Silo	1	100 tons
	Gravel Silo	1	100 tons
	Coarse Gravel Silo	1	100 tons
	Cement Silo	1	70 tons
Mixer		1	320 m^3/day
Water Storage Tank		1	2 m^3

Concrete plant, given in Appendix:9, will be located within the construction site and it is planned to construct a road of 880 m to provide access to the site. The map showing the access roads is givein in **Appendix: 15**.

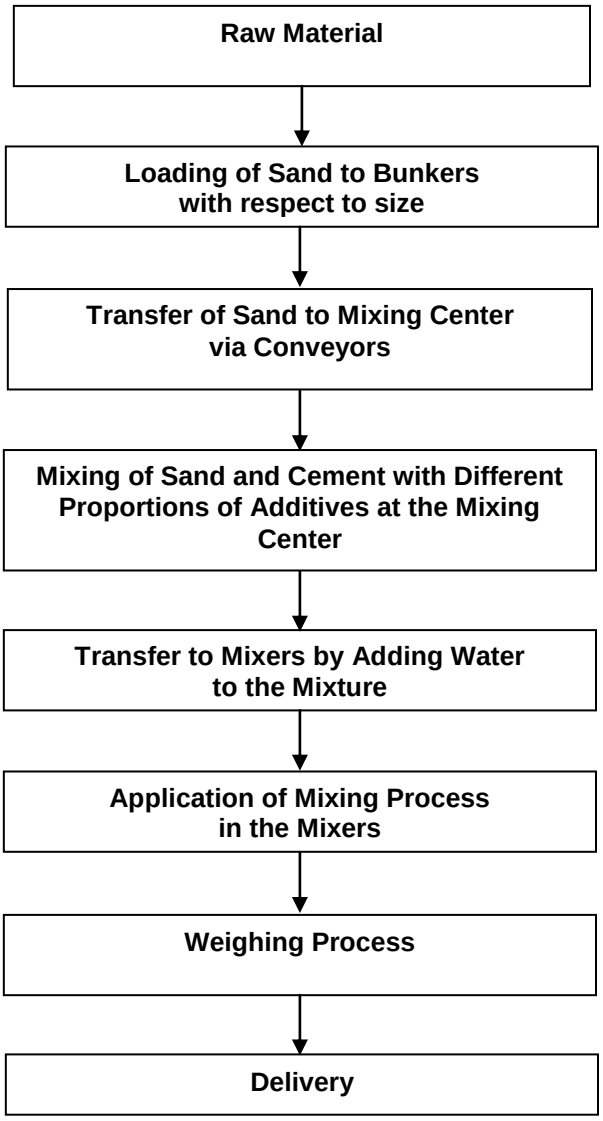


Figure 5.1.13.1. Process Flowchart

As the sand to be used at the concrete plant will be supplied from the outside, sand washing process will not be carried out at the site. Therefore, wastewater will not be produced in this context. In addition, water to be used for making concrete will be transferred from Toklar Village by tanker. As the water to be used for making concrete remains in the produced concrete, no liquid waste will be produced in this context. Concrete plant will be uninstalled in the end of the construction period.

V.1.14. Dust generating activities such as crushing, grinding, washing-screening, transportation, and storage, cumulative values

Material quarry will not be opened within the scope of the project. For this reason, activities such as crushing, grinding, washing-screening will not take place. Therefore, dust emissions due to these activities is out of question.

Within the scope of the project, dust will be generated due to activities, such as excavation, loading and unloading of the materials to be obtained from excavation, storage, transportation, movement of construction equipment at the site, and blasting to be performed at transmission tunnel.

As the facilities are located at different areas, dust generation calculations are performed separately for;

a. Regulator Site
b. Transmission Tunnel
c. HEPP Site

Table 5.1.14.1. Emission Factors given in Table 12.6 of Appendix:12 of Regulation on Industrial Air Pollution Control

Dust Generating Activities	Emission Factors (kg/ton)	
	Uncontrolled	Controlled
Blasting	0.08	--
Dismantling	0.025	0.0125
Dust due to Roads	0.70	0.35
Loading	0.01	0.005
Storage	5.8	2.9
Unloading	0.01	0.005

a) Regulator Site

Construction of regulator, gravel pass, water acquisition structure will be accomplished according to the working schedule. Totally 35,475 m^3 of excavation, 20,616 m^3 of which is soft soil excavation and 14,859 m^3 is hard rock excavation, will be held at the regulator area. The density of hard rock is about 2.8 ton/ m^3, whereas soft soil excavation density is 1.5 ton/ m^3. Thus, total amount of excavation is;

Units	Areas to be excavated	Excavation Amount (m^3)	Excavation Amount (tons)
Regulator, Gravel Pass, and Sedimentation Pool	All kinds of ground excavation excluding rock and muddy soil	20,000	32,000
	Excavation of rock	14,000	39,200
Regulator Bridge	Excavation at loose ground	154	246.4
	All kinds of ground excavation excluding rock and muddy soil	462	739.2
	Excavation of rock	859	2,405.2
TOTAL		35,475	74,590.8

In the scope of regulator site, totally 74,590.9 tons of excavation will be performed. Dust calculation for the regulator site is given below.

Total amount of excavation : 74,590.8 tons
Number of days to work : 450 day (15 month)
Daily working hours : 10 hour
Amount of excavation : 16.5 ton/h

Excavation

In the course of excavation for regulator construction, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission = 16.5 ton/h x 0.025 kg/ton = **0.41 kg/h**
Controlled dust emission = 16.5 ton/h x 0.0125 kg/ton = **0.205 kg/h**

Loading

In the course of loading of excess excavation material to trucks, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission = 16.5 ton/h x 0.01 kg/ton = **0.165 kg/h**
Controlled dust emission = 16.5 ton/h x 0.005 kg/ton = **0.082 kg/h**

Transportation

The materials to be loaded to trucks will be transferred to the storage site placed in the vicinity of regulator site. Transportation distance is taken as 550 m on average. Daily excavation amount is 165 ton/day, and capacities of the trucks are 15 tons. Accordingly, number of trips to be performed is taken as 8 trips/day.

Distance of each trip :1.4 km/trip (round trip)
Uncontrolled dust emission :0.7 kg/km x 1.1 km/trip x 11 trip/day=8.47 kg/day
:8.47 kg/day x 1day/10hr =**0.8 kg/h**

Controlled dust emission :0.35 kg/km x1.1 km/trip x10 trip/day=3.85 kg/day
:3.85 kg/day x 1day/10hr =**0.385 kg/h**

Unloading

In the course of unloading of excavation material to storage area, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission :16.5 ton/h x 0.01 kg/ton = **0.165 kg/h**
Controlled dust emission :16.5 ton/h x 0.005 kg/ton = **0.008 kg/h**

Storage

If it is assumed that excess excavation material is stored at a height of 3 meters, surface area of daily stored material (52 m^3) will be 17.33 m^2/day. Dust to be generated in the course of storage is;

Uncontrolled dust emission: 5.8kg/ha-day x 17.33 m^2/day x 1 ha/10.000 m^2 x 1day/24h
= **0.0004 kg/h**

Controlled dust emission: 2.9 kg/ha-day x 17.33 m^2/day x 1 ha/10.000 m^2 x 1day/24h
= **0.0002 kg/h**

Dust to be generated due to movement of construction equipment at the site,

Due to movement of construction equipment at the site, a little amount of dust emission will occur. In order to prevent dust, water spraying will be performed at the site in respect to season and evaporation rate.

Table 5.1.14.2. Total Dust Emission to be produced at Onur Regulator Site

	Uncontrolled Dust Emission (kg/h)	**Controlled Dust Emission (kg/h)**
Excavation	0.41	0.205
Loading	0.165	0.082
Transportation	0.8	0.385
Unloading	0.165	0.08
Storage	0.0004	0.0002
Total	**1.54**	**0.75**

Uncontrolled dust emission that may occur at the regulator site is calculated as **1.54 kg/h**, whereas the controlled dust emission is **0.75 kg/h**. Necessary measures (spraying of roads with water, canvasing the trucks loaded with material, etc.) will be taken to avoid dust emission to be generated due to excavation activities of the project. As the controlled dust emissions given in **Table 5.1.14.2** is taken into consideration, the calculated value is below the emission rate for normal operation conditions and for operation hours of weekly working days (>1.0 kg/h) (excluding point sources), given in Table 2.1 of Appendix-2 of the "Regulation on Industrial Air Pollution Control" **published in the Official Gazette dated 03.07.2009 and numbered 27277**. For this reason, air dispersion modeling is not required. However, in order to assess distribution of the uncontrolled dust emission at project site topography, dispersion modeling was performed below.

Calculation of Uh Value

Uh=UR(h/Za)M equation is used.

*The following values are used for M.

Stability Categories	**M**
A(very unstable)	0.09
*B(unstable)	0.20
C/I(Neutral)	0.22
C/II(Neutral)	0.28
D(stable)	0.37
E(very stable)	0.42

* Value used in calculations.

Height of anemometer, Za = 10 m, dust emission release height due to the movement of construction equipment (found by observation) h = 2 m.

Table 5.1.14.3. Classification of Wind Records

DIRECTION	**Stability Class**	**UA(m/s)**	**UR(m/s)**	**UH(m/s)**
N	B	1.3	1	1.0
NNE	B	1.7	1.5	1.5
NE	B	1.6	1.5	1.5
ENE	B	2	2	2.0
E	B	2	2	2.0
ESE	B	2	2	2.0
SE	B	1.9	2	2.0
SSE	B	2.2	2	2.0
S	B	2.1	2	2.0
SSW	B	2.2	2	2.0

SW	B	2	2	2.0
WSW	B	2.2	2	2.0
W	B	1.9	2	2.0
WNW	B	1.7	1.5	1.5
NW	B	1.3	1	1.0
NNW	B	1.5	1.5	1.5

As a result of calculations, the stability category of B is calculated with respect to the cloudiness ratio of 5/8.

Equation II of Environmental Legislation was used for dispersion modeling of dust.

$$C_i(x,y,z) = \frac{10^6}{3600 \times 2 \times \pi} \times \frac{Q_i}{U_h \times \sigma_y \times \sigma_z} \times \exp\left[-\frac{y^2}{2 \times \sigma^2{}_y}\right] \times \left[\exp\left[\frac{-(z-h)^2}{2 \times \sigma^2{}_z}\right] + \exp\left[\frac{-(z+h)^2}{2 \times \sigma^2{}_z}\right]\right] \times \exp\left[-\sqrt{\frac{2}{\pi}} \times \frac{Vdi}{Uh} \times \int_0^x \frac{1}{\sigma_z(\xi)} \times \exp\left[\frac{-h^2}{2\sigma_z{}^2(\xi)}\right] \delta\xi\right]$$

Calculation of Settleable Dust Amount

$$d(x,y) = 3600 \sum_{i=1}^{4} V_{di} \times Ci(x,y,0)$$ *(Environmental Legislation - Equation III)*

Particulates greater than 10μ constitutes 80% (with respect to experience) of dust generated during operation.

Q = 1.54 kg/h (Total dust amount generated due to operation)

For the Amount of Particulates Suspended in Air, C(x,y,z);

Q = 0.3 kg/h (for particulates smaller than 10μ)

h = 10 m (with respect to experience)

z = 2 m is assumed.

Vdi = 0.01 m/s

Table 5.1.14.4. Dispersion of Particulates Suspended in Air (μg/m^3)

DIRECTION	C=100 m	C=200 m	C=300 m	C=400 m	C=500 m	C=600 m	C=700 m	C=800 m	C=900 m	C=1000 m
N	35.10	10.10	4.69	2.70	1.76	1.24	0.92	0.71	0.57	0.46
NNE	23.41	6.74	3.13	1.80	1.17	0.83	0.61	0.47	0.38	0.31
NE	23.41	6.74	3.13	1.80	1.17	0.83	0.61	0.47	0.38	0.31
ENE	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
E	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
ESE	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
SE	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
SSE	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
S	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
SSW	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
SW	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
WSW	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
W	17.56	5.05	2.35	1.35	0.88	0.62	0.46	0.36	0.28	0.23
WNW	23.41	6.74	3.13	1.80	1.17	0.83	0.61	0.47	0.38	0.31
NW	35.10	10.10	4.69	2.70	1.76	1.24	0.92	0.71	0.57	0.46
NNW	23.41	6.74	3.13	1.80	1.17	0.83	0.61	0.47	0.38	0.31

For the Amount of Settleable Dust (di);

Q= 1.23 kg/h (for particulates larger than 10μ)

h=10 m

z=0 is assumed.

Vdi=0.07 m/s

Table 5.1.14.5. Dispersion of Settleable Dust (mg/m^2.day)

DIRECTION	d=100 m	d=200 m	d=300 m	d=400 m	d=500 m	d=600 m	d=700 m	d=800 m	d=900 m	d=1000 m
N	403.72	116.12	53.91	31.10	20.26	14.27	10.60	8.20	6.53	5.33
NNE	269.72	77.52	35.98	20.75	13.52	9.52	7.07	5.47	4.36	3.56
NE	269.72	77.52	35.98	20.75	13.52	9.52	7.07	5.47	4.36	3.56
ENE	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
E	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
ESE	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
SE	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
SSE	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
S	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
SSW	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
SW	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
WSW	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
W	202.50	58.17	27.00	15.57	10.14	7.14	5.31	4.10	3.27	2.67
WNW	269.72	77.52	35.98	20.75	13.52	9.52	7.07	5.47	4.36	3.56
NW	403.72	116.12	53.91	31.10	20.26	14.27	10.60	8.20	6.53	5.33
NNW	269.72	58.17	35.98	20.75	13.52	9.52	7.07	5.47	4.36	3.56

The amount of dust emissions due to project activities and their dispersion with respect to meteorological conditions are calculated by using the corresponding equations given above. However, in these calculations, it is assumed that dust eliminating practices (e.g., moisturizing roads by spraying) were not performed. The calculated emission concentrations are evaluated with respect to short and long term limit values of Air Pollution Control Regulation.

Table 5.1.14.6. Limit Values of Industrial Air Pollution Control Regulation

Parameter	2011	2012	2013
PM	96 μg/m^3	78 μg/m^3	60 μg/m^3
Settleable Dust	266 mg/m^2.day	238 mg/m^2.day	210 mg/m^2.day

The nearest settlement area to the regulator site is Toklar Village located in 1 km north-west of the site. Considering the tables given above, as PM and settleable dust concentrations at 1 km distance are below the limit values given in Table 5.1.14.6, Toklar Village will not be affected due to the emissions to be released from project site.

b) Transmission Tunnel

Totally 59,795 m^3 of excavation will be performed during construction of the transmission tunnel. It is foreseen in the work schedule that the transmission tunnel works will be completed in 20 months period on average.

During construction of the transmission tunnel, it is planned to move by making small-scale blasting operations. For the transmission tunnel, 2 tunnel face, one of which will be located at the entrance and one at the exit, will be opened. Blasting will be performed at the entrance and exit of the tunnel, and inside the tunnel and dust to be generated inside the

tunnel will be vacuumed out by using compressor and passed through dust filters. For this reason, calculation were not performed for blasting inside the tunnel. Dust emission calculations for blasting to be performed at the entrance and exit of the tunnel is given below. In addition to this, dust emissions will occur in the course of loading of excavation material to trucks, its transportation and unloading to storage site. Calculations for dust emissions to be generated during transmission tunnel works is given below.

Blasting

Blasting will be performed at the entrance and exit of the tunnel, and inside the tunnel and dust to be generated inside the tunnel will be vacuumed out by using compressor and passed through dust filters.

In order to reduce dust emissions to be generated during blasting, by moisturizing the front of tunnel face with use of sprinkler, adherence of fine-grained particulates to each other is ensured, and thus the amount of dust emission to be generated becomes 40-50 % lower compared to uncontrolled blasting 40-50%. For this reason, the front of the tunnel face will be water sprayed to minimize the dust to be generated.

In the course of blasting, it is not possible to perform any other activity at the project site. Since all other activities will be stopped during blasting, dust calculations for tunnel construction is considered separate from other calculations.

For construction of the transmission tunnel, totally 4 blasting, 2 of which will be done at the entrance and 2 at the exit, will be performed. These blasting will not be performed simultaneously. Totally 54 holes will be drilled for each blasting activity, 49 of these holes will be filled with explosives, whereas the remaining 5 holes will be empty. For ach hole 2.31 kg of ANFO, which totally makes 113.19 kg of ANFO, will be used. The diameter and the depth of the holes to be drilled with rock drill will be 3.2 cm and 3.5 m, respectively. As the area of the tunnel face to be opened is about 15 m^2 and the hole depth is 3.5 m, the amount of material to be obtained per blasting is;

15 m^2 x 3.5 m = **52.5 m^3 = 147 tons**

In this way, the amount of dust emission will be;

Emission factor for drilling-blasting = 0.08 kg/ton
Total amount of dust to be generated per blasting = 147 X 0.08= **11.76 kg**

Since 167,930 tons of material to be excavated from the transmission tunnel;

167,930 ton / 147 blasting/ton ≅ 1,142 blasting will be performed. In this regard, totally 13,429 kg (1,142 blasting x 11.76 kg/blasting = 13,429 kg) of dust emission will be generated throughout the tunnel. As the work will be performed for 20 months, 30 days per month, 10 hours per day, the hourly dust emission will be 2.23 kg/h.

In addition, the calculations for the dust emissions to be generated during loading, transportation, unloading, and storage are given below.

Total amount of excavation : 59,795 m^3 (167,930 ton)
Number of days to work : 600 day (20 month)
Daily working hours : 10 hour
Amount of excavation : 27.99 ton/h

Loading

In the course of loading of excess excavation material to trucks, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission : 27.99 ton/h x 0.01 kg/ton = **0.28 kg/h**
Controlled dust emission : 27.99 ton/h x 0.05 kg/ton = **0.14 kg/h**

Transportation

A part of the materials loaded to trucks will be transported to the storage area located in the vicinity of the regulator site (**Appendix: 12** - Excess material storage area 1), and the other part to the storage area in the vicinity of the tunnel exit (**Appendix: 12** - Excess material storage area 2). The distance of excess material storage area 1 to the entrance of the transmission tunnel is 750 m, while the distance of excess material storage area 2 to the exit of the transmission tunnel is 250 m. For this reason, the farthest distance, which is 750 m, is taken into consideration.

The materials loaded to the trucks will be transported to the storage area that is 700 m away on average. The daily excavation amount is 279.9 ton and the capacity of the trucks is 15 ton. Accordingly, the number trips is taken as 11 trip/day.

Distance of each trip : 1.4 km/trip (round trip)
Uncontrolled dust emission = 0.7 kg/km x 1.5 km/trip x 19 trip/day x 1day/10h
= 1.9 kg/day
Controlled dust emission = 0.35 kg/km x 1.5 km/trip x 19 trip/day x 1day/10h
= 0.9 kg/day

Unloading

In the course of unloading of excavation material to storage area, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission : 27.99 ton/h x 0.01 kg/ton = **0.28 kg/h**
Controlled dust emission : 27.99 ton/h x 0.05 kg/ton = **0.14 kg/h**

Storage

If it is assumed that excess excavation material is stored at a height of 3 meters, surface area of daily stored material (106.89 m^3) will be 35.63 m^2/day. Dust to be generated in the course of storage is;

Uncontrolled dust emission :5.8kg/ha-day x 35.63 m^2/day x 1 ha/10.000 m^2 x 1 day/24h
= **0.0008 kg/h**
Controlled dust emission :2.9 kg/ha-day x 35.63 m^2/day x 1 ha/10.000 m^2 x 1 day/24 h
= **0.0004 kg/h**

Total dust emission due to all these operations to be performed during transmission tunnel works is given in the following table.

Table 5.1.14.7. Dust Emission Flow Rate due to Transmission Tunnel

	Uncontrolled Dust Emission (kg/h)	**Controlled Dust Emission (kg/h)**
Blasting	2.23	-
Loading	0.28	0.14
Transportation	1.9	0.9
Unloading	0.28	0.14
Storage	0.0008	0.0004
Total	**4.6**	**1.18**

As the controlled dust emissions given in **Table 5.1.14.7** is taken into consideration, the calculated value is above the emission rate for normal operation conditions and for operation hours of weekly working days (>1.0 kg/h) (excluding point sources), given in Table 2.1 of Appendix-2 of the "Regulation on Industrial Air Pollution Control" **published in the Official Gazette dated 03.07.2009 and numbered 27277**. For this reason, air dispersion modeling is required.

Calculation of Uh Value

Uh=UR(h/Za)M equation is used.

*The following values are used for M.

Stability Category	**M**
A(Very unstable)	0.09
*B(unstable)	0.20
C/I(Neutral)	0.22
C/II(Neutral)	0.28
D(stable)	0.37
E(very stable)	0.42

* Value used in calculations

Height of anemometer, Za = 10 m, dust emission release height due to the movement of construction equipment (found by observation) h = 2 m.

Table 5.1.14.8. Classification of Wind Records

DIRECTION	STABILITY	UA(m/s)	UR(m/s)	UH(m/s)
N	B	1.3	1	1.0
NNE	B	1.7	1.5	1.5
NE	B	1.6	1.5	1.5
ENE	B	2	2	2.0
E	B	2	2	2.0
ESE	B	2	2	2.0
SE	B	1.9	2	2.0
SSE	B	2.2	2	2.0
S	B	2.1	2	2.0
SSW	B	2.2	2	2.0
SW	B	2	2	2.0
WSW	B	2.2	2	2.0
W	B	1.9	2	2.0
WNW	B	1.7	1.5	1.5
NW	B	1.3	1	1.0
NNW	B	1.5	1.5	1.5

As a result of calculations, the stability category of B is calculated with respect to the cloudiness ratio of 5/8.

Equation II of Environmental Legislation was used for dispersion modeling of dust.

$$C_i(x,y,z) = \frac{10^6}{3600 \times 2 \times \pi} \times \frac{Q_i}{U_h \times \sigma_y \times \sigma_z} \times \exp\left[-\frac{y^2}{2 \times \sigma^2{}_y}\right] \times \left[\exp\left[\frac{-(z-h)^2}{2 \times \sigma^2{}_z}\right] + \exp\left[\frac{-(z+h)^2}{2 \times \sigma^2{}_z}\right]\right] \times \exp\left[-\sqrt{\frac{2}{\pi}} \times \frac{Vdi}{Uh} \times \int_0^x \frac{1}{\sigma_z(\xi)} \times \exp\left[\frac{-h^2}{2\sigma_z{}^2(\xi)}\right] \delta\xi\right]$$

Calculation of Settleable Dust Amount

$$d(x,y) = 3600 \sum_{i=1}^{4} V_{di} \times Ci(x,y,0)$$ *(Environmental Legislation - Equation III)*

Particulates greater than 10μ constitutes 80% (with respect to experience) of dust generated during operation.

Q = 4.6 kg/h (Total dust amount generated due to operation)

For the Amount of Particulates Suspended in Air C(x,y,z);

Q = 0.92 kg/h (for particulates smaller than 10μ)
h = 10 m (with respect to experience)
z = 2 m is assumed.
Vdi = 0.01 m/s

Table 5.1.14.9. Dispersion of Particulates Suspended in Air ($\mu g/m^3$)

DIRECTION	C=100 m	C=200 m	C=300 m	C=400 m	C=500 m	C=600 m	C=700 m	C=800 m	C=900 m	C=1000 m
N	90.17	25.95	12.05	6.95	4.52	3.19	2.37	1.83	1.46	1.19
NNE	60.14	17.31	8.03	4.63	3.02	2.12	1.58	1.22	0.97	0.79
NE	60.14	17.31	8.03	4.63	3.02	2.12	1.58	1.22	0.97	0.79
ENE	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
E	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
ESE	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
SE	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
SSE	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
S	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
SSW	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
SW	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
WSW	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
W	45.11	12.98	6.02	3.47	2.26	1.59	1.18	0.92	0.73	0.60
WNW	60.14	17.31	8.03	4.63	3.02	2.12	1.58	1.22	0.97	0.79
NW	90.17	25.95	12.05	6.95	4.52	3.19	2.37	1.83	1.46	1.19
NNW	60.14	17.31	8.03	4.63	3.02	2.12	1.58	1.22	0.97	0.79

For the Amount of Settleable Dust (di);

Q = 3.7 kg/h (for particulates larger than 10μ)

h = 10 m

z = 0 is assumed.

Vdi = 0.07 m/s

Table 5.1.14.10. Dispersion of Settleable Dust (mg/m^2.day)

DIRECTION	d=100 m	d=200 m	d=300 m	d=400 m	d=500 m	d=600 m	d=700 m	d=800 m	d=900 m	d=1000 m
N	1037.18	298.32	138.51	79.90	52.05	36.66	27.24	21.06	16.78	13.70
NNE	692.92	199.14	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13
NE	692.92	199.14	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13
ENE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
E	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
ESE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SSE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
S	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SSW	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SW	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
WSW	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
W	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
WNW	692.92	199.14	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13
NW	1037.18	298.32	138.51	79.90	52.05	36.66	27.24	21.06	16.78	13.70
NNW	692.92	149.45	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13

The amount of dust emissions due to project activities and their dispersion with respect to meteorological conditions are calculated by using the corresponding equations given above. However, in these calculations, it is assumed that dust eliminating practices (e.g., moisturizing roads by spraying) were not performed. The calculated emission concentrations are evaluated with respect to short and long term limit values of Air Pollution Control Regulation.

Table 5.1.14.11. Limit Values of Industrial Air Pollution Control Regulation

Parameter	2011	2012	2013
PM	96 μg/m^3	78 μg/m^3	60 μg/m^3
Settleable Dust	266 mg/m^2.day	238 mg/m^2.day	210 mg/m^2.day

The nearest settlement area to the entrance of transmission tunnel is Toklar Village located in 1 km north-west of the site, the nearest settlement area to the tunnel exit is Zinav Plateau located in 870 m southwest. According to the tables given above, PM and settleable dust emissions do not have adverse effects on Toklar Village and Zinav Plateau.

c) HEPP Site

Powerhouse and penstock construction works will take place at HEPP site. Total excavation amount at tha HEPP site will be 73, 462 m3 due to these works. Totally 51,302 m^3 of rock excavation will be held at the HEPP site, where hard rock density is 2.8 ton/m^3 and soil density is 1.5 ton/m^3. Accordingly, total excavation amount is;

Table 5.1.14.12. Excavation Amounts

Units	Areas to be excavated	Amount of excavation (m^3)	Amount of excavation (tons)
Powerhouse	Excavation of rock	8,580	24,024
	Excavation of soft rock	8,580	24,024
	All kinds of ground excavation excluding rock and muddy soil	17,160	27,456
Power Plant Intercepting Channel	All kinds of ground excavation excluding rock and muddy soil	1,750	2,800
	Excavation of soft rock	375	1,050
	Excavation of rock	375	1,050
Penstock and Supports	All kinds of ground excavation excluding rock and muddy soil	1,000	1,600
	Excavation of rock	250	700
TOTAL		**38,070**	**82,704**

Totally 82,704 ton of excavation will be done. According to working schedule, it is expected to accomplish the excavation work to be held at these sites in 15 months period and dust emission calculations are given below.

Total amount of excavation : 82,704 ton
Number of days to work : 450 day
Daily working hours : 10 hour
Amount of excavation : 18.37 ton/h

Excavation

In the course of excavation for construction of the facilities at HEPP site, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission = 18.37 ton/h x 0.025 kg/ton = **0.45 kg/h**
Controlled dust emission = 18.37 ton/h x 0.0125 kg/ton = **0.225 kg/h**

Loading

In the course of loading of excess excavation material to trucks, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission = 18.37 ton/h x 0.01 kg/ton = **0.18 kg/h**
Controlled dust emission = 18.37 ton/h x 0.005 kg/ton = **0.09 kg/h**

Transportation

As a result of HEPP excavation works, totally 183.7 ton/day of excavation will be produced. Excess excavation material will be transported to the temporary storage site located at a distance of 250 m (Appendix: 12 – Excess excavation material storage area 2). The capacity of the trucks is 20 ton. Accordingly, number of trips to be performed is taken as 10 trip/day.

Distance of each trip : 0.5 km/trip (round trip)

Uncontrolled dust emission: 0.7 kg/km x 0.5 km/trip x 10 trip/day x 1day/10h= 0.35 kg/h
Controlled dust emission: 0.35 kg/km x 0.5 km/trip x 10 trip/day x 1day/10h = 0.17 kg/h

Unloading

In the course of unloading of excavation material to temporary storage area, dust may generate. The amount of dust that may generate is calculated as follows:

Uncontrolled dust emission : 18.37 ton/h x 0.01 kg/ton = 0.42 kg/h

Controlled dust emission : 18.37 ton/h x 0.005 kg/ton = 0.21 kg/h

Storage

If it is assumed that excess excavation material is stored at a height of 3 meters, surface area of daily stored material (139.9 m^3) will be 46.63 m^2/day. Dust to be generated in the course of storage is;

Uncontrolled dust emission: 5.8 kg/ha-day x 0.0047 ha x 1 day/24 hour = 0.001 kg/h

Controlled dust emission: 5.8 kg/ha-day x 0.0047 ha x 1 day/24 hour = 0.0005 kg/h

Total Dust Emission to be generated at HEPP Site:

As a result of these operations to be performed at HEPP site, total dust emission to be generated is;

Table 5.1.14.13. Dust Emission Flow Rate to occur at HEPP Site

	Uncontrolled Dust Emission (kg/h)	**Controlled Dust Emission (kg/h)**
Excavation	0.45	0.225
Loading	0.18	0.09
Transportation	0.35	0.17
Unloading	0.42	0.21
Storage	0.001	0.0005
Total	**1.41**	**0.7**

Uncontrolled dust emission that may occur at the HEPP site is calculated as **1.41 kg/h**, whereas the controlled dust emission is **0.7 kg/h**. Since excavation works at the project site will be done with application of necessary mitigation measures (e.g., loading-unloading without blowing soil, spraying roads, etc.), controlled dust emission rate, 0.7 kg/h, is taken into consideration. In this regard, 0.7 kg/h value is below the emission rate for normal operation conditions and for operation hours of weekly working days (>1.0 kg/h) (excluding point sources), given in Table 2.1 of Appendix-2 of the "Regulation on Industrial Air Pollution Control" **published in the Official Gazette dated 03.07.2009 and numbered 27277**. For this reason, air dispersion modeling is not required. However, in order to assess distribution of the uncontrolled dust emission at project site topography, dispersion modeling was performed below.

Calculation of Uh Value

Uh=UR(h/Za)M equation is used.

*The following values are used for M.

Stability Category	**M**
A(Very unstable)	0.09
*B(unstable)	0.20
C/I(Neutral)	0.22
C/II(Neutral)	0.28
D(stable)	0.37
E(very stable)	0.42

* Value used in calculations

Height of anemometer, Za = 10 m, dust emission release height due to the movement of construction equipment (found by observation) h = 2 m.

Table 5.1.14.14. Classification of Wind Records

DIRECTION	STABILITY	UA(m/s)	UR(m/s)	UH(m/s)
N	B	1.3	1	1.0
NNE	B	1.7	1.5	1.5
NE	B	1.6	1.5	1.5
ENE	B	2	2	2.0
E	B	2	2	2.0
ESE	B	2	2	2.0
SE	B	1.9	2	2.0
SSE	B	2.2	2	2.0
S	B	2.1	2	2.0
SSW	B	2.2	2	2.0
SW	B	2	2	2.0
WSW	B	2.2	2	2.0
W	B	1.9	2	2.0
WNW	B	1.7	1.5	1.5
NW	B	1.3	1	1.0
NNW	B	1.5	1.5	1.5

As a result of calculations, the stability category of B is calculated with respect to the cloudiness ratio of 5/8.

Equation II of Environmental Legislation was used for dispersion modeling of dust.

$$C_i(x,y,z) = \frac{10^6}{3600 \times 2 \times \pi} \times \frac{Q_i}{U_h \times \sigma_y \times \sigma_z} \times \exp\left[-\frac{y^2}{2\times\sigma^2{}_y}\right] \times \left[\exp\left[\frac{-(z-h)^2}{2\times\sigma^2{}_z}\right] + \exp\left[\frac{-(z+h)^2}{2\times\sigma^2{}_z}\right]\right] \times \exp\left[-\sqrt{\frac{2}{\pi}} \times \frac{Vdi}{Uh} \times \int_0^x \frac{1}{\sigma_z(\xi)} \times \exp\left[\frac{-h^2}{2\sigma_z{}^2(\xi)}\right] \delta\xi\right]$$

Calculation of Settleable Dust Amount

$$d(x,y) = 3600 \sum_{i=1}^{4} V_{di} \times Ci(x,y,0)$$ *(Environmental Legislation - Equation III)*

Particulates greater than 10μ constitutes 80% (with respect to experience) of dust generated during operation.

Q = 1.41 kg/h (Total dust amount generated due to operation)

For the Amount of Particulates Suspended in Air C(x,y,z);

Q = 0.28 kg/h (for particulates smaller than 10μ)

h = 10 m (with respect to experience)

z = 2 m is assumed.

Vdi = 0.01 m/s

Table 5.1.14.15. Dispersion of Particulates Suspended in Air ($\mu g/m^3$)

DIRECTION	C=100 m	C=200 m	C=300 m	C=400 m	C=500 m	C=600 m	C=700 m	C=800 m	C=900 m	C=1000 m
N	66.51	19.14	8.89	5.12	3.34	2.35	1.75	1.35	1.08	0.88
NNE	44.36	12.77	5.92	3.42	2.23	1.57	1.16	0.90	0.72	0.59
NE	44.36	12.77	5.92	3.42	2.23	1.57	1.16	0.90	0.72	0.59
ENE	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
E	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
ESE	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
SE	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
SSE	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
S	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
SSW	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
SW	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
WSW	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
W	33.28	9.58	4.44	2.56	1.67	1.18	0.87	0.68	0.54	0.44
WNW	44.36	12.77	5.92	3.42	2.23	1.57	1.16	0.90	0.72	0.59
NW	66.51	19.14	8.89	5.12	3.34	2.35	1.75	1.35	1.08	0.88
NNW	44.36	12.77	5.92	3.42	2.23	1.57	1.16	0.90	0.72	0.59

For the Amount of Settleable Dust (di);

Q = 1.12 kg/h (for particulates larger than 10μ)

h = 10 m

z = 0 is assumed.

Vdi = 0.07 m/s

Table 5.1.14.16. Dispersion of Settleable Dust (mg/m^2.day)

DIRECTION	d=100 m	d=200 m	d=300 m	d=400 m	d=500 m	d=600 m	d=700 m	d=800 m	d=900 m	d=1000 m
N	1037.18	298.32	138.51	79.90	52.05	36.66	27.24	21.06	16.78	13.70
NNE	692.92	199.14	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13
NE	692.92	199.14	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13
ENE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
E	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
ESE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SSE	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
S	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SSW	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
SW	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
WSW	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
W	520.24	149.45	69.35	39.99	26.05	18.34	13.63	10.54	8.40	6.85
WNW	692.92	199.14	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13
NW	1037.18	298.32	138.51	79.90	52.05	36.66	27.24	21.06	16.78	13.70
NNW	692.92	149.45	92.43	53.30	34.72	24.45	18.17	14.05	11.19	9.13

The amount of dust emissions due to project activities and their dispersion with respect to meteorological conditions are calculated by using the corresponding equations given above. However, in these calculations, it is assumed that dust eliminating practices (e.g., moisturizing roads by spraying) were not performed. The calculated emission concentrations are evaluated with respect to short and long term limit values of Air Pollution Control Regulation.

Table 5.1.14.17. Limit Values of Industrial Air Pollution Control Regulation

Parameter	2011	2012	2013
PM	96 $\mu g/m^3$	78 $\mu g/m^3$	60 $\mu g/m^3$
Settleable Dust	266 mg/m^2.day	238 mg/m^2.day	210 mg/m^2.day

The nearest settlement area to the power plant that is planned to be built is Zinav Plateau. According to the tables given above, PM and settleable dust emissions do not have adverse effect on Zinav Plateau that is located 870 m far away from the plant.

V.1.15. All kinds of filling to be made in river basin for the aim of diversion (changing the river route temporarily to keep the regulator construction area dry) or any other reasons, construction on piles and similar operations, and what and how much area they will occupy and materials to be used, equipment and machine

In the course of the construction of regulator site to be built during the project, in order not to manage foundation excavation of the units (sedimentation pool, water acquisition structure, spillway, etc.) to be built in this area in water environment, the streambed will be dried by diversion channel and construction operation will start after that.

By building up a cofferdam and diversion channel at upstream of the regulator to be built, it will be ensured to reroute stream water to diversion channel. In this way, the regulator site will be kept dry throughout the construction.

During construction of the regulator, as the water of Zinav Stream will flow to downstream through diversion channel, no alteration will occur in the flow rate of the stream.

V.1.16. Measures to be taken for possible landslides

Throughout the project, excavation and earthwork activities will not be performed randomly. By performing gradual (stepped) excavation, depending on the terrain topography, landslide risk will be lowered.

Besides, by considering that the streambed might destroy excess excavation storage areas due to flood or to landslide or to the ground conditions to occur during the periods of heavy rain, necessary precautions will be taken.

Moreover, against the risk of rock fall or slip, mesh-reinforced shotcrete will be used at the entrance and exit of the tunnel. Within the route of the roads planned to be built, retaining walls will be constructed at necessary sections of the road where landslide risk is possible.

V.1.17. Impacts on groundwater

The area of the tunnel to be openned within the scope of the project lis located in steep slop topography that is composed of Nebişeyh limestone units whose lower and upper stata are unbedded or very thick-bedded, whereas its middle strata are thick-bedded, brittle and fractured Zinav limestone unit, and uniform patterned and thin-middle bedded, partly sandy, fractured in various directions, fractures are calcite and silica-filled, fine-crystallized, rough patterned, brittle structured, clastic and rarely interbedded with marn.

The limestone formations found in this area do not have aquifer property due to the abovementioned properties. Small quantities of water retained within their structure are emptied at upper elevations as small resources. In this region, groundwater is only found at the permeable alluvial formed at downstream of streams.

Therefore, geological formations to be used for tunnel drilling do not contain groundwater. Tunnel route is located well above the groundwater level. Blasting will only be held in case needed and being in small-scale will not affect groundwater adversely.

V.1.18. Assessment under the Circular 2006/27 of the Prime Ministry (published in 09/09/2006 dated and 26284 numbered Official Gazette)

Excess excavation material to be produced due to the project will be stored at the excess excavation material storage area displayed in Appendix:12, and excavation wastes will not be disposed to river or dried river beds in accordance with the provisions of the Circular 2006/27 of the Prime Ministry published in Official Gazette dated 09.09.2006 and numbered 26284.

V.1.19. Size of the agricultural land to be used for supplying the land needed for land preparation and construction, their land use capability and agricultural product types

For the area of concern, EIA Assessment and Evaluation Form has been taken from Regional Directory of Forestry of Amasya (**Appendix:16-a**). According to Assessment and Evaluation Form based on EIA certificate, 10.06 ha of the site is composed of forest area, and 14.51 ha of it is composed of non-forest area.

The land determined as the construction site is agricultural land with private property. For these lands and the other agricultural lands to lie within project site, non-agricultural land use permission will be taken in accordance with the application of EMRA. For the meadow property land around the regulator, non-agricultural land use permission was taken before. Other than this, non-agricultural land use permission was also taken for the access roads found in the power plant area.

V.1.20. Types and number of trees to be cut for supplying the land needed for land preparation and construction, stand type, stand density, effect of trees to be cut on the forestry ecosystem and erosion, natural plant types possibly be destroyed and the size of the area where these activities take place

For the area of concern, EIA Assessment and Evaluation Form has been taken from Regional Directory of Forestry of Amasya (**Appendix:16-a**). According to Assessment and Evaluation Form based on EIA certificate, 10.06 ha of the site is composed of forest area, and 14.51 ha of it is composed of non-forest area. The project site is not covered by fire-damaged lands. Its stand type is

- Agricultural land (Z)
- Degraded oak coppice (ÇBMBt)

Reşadiye series stand map, on which the project site is displayed, is given in **Chapter IV.II.10, Figure 4.2.10.1**. Most of the project site is stony and the remaining rocky part is degraded oak coppice. In the region where project site takes place, generally Quercus sp. (oak) trees are found, and these plants are in bushy form and its density has been fell below 10 %. Before starting the construction works, all kinds of permissions will be taken from the General Directorate of Forestry. Construction works will be begin after taking these permissions.

It is planned to construct 3133.43 m of transmission tunnel within the scope of the project. Penstock begins at the 2824.85m of the transmission tunnel. Total length of the penstock is 324.06 m. Penstock will be constructed such that 308.58 m of its length to be located inside the transmission tunnel and 15.48 m of it at the outside of the tunnel. In this regard, since a tunnel of 3133.43 m is to be constructed, the land property at the surface will not be destroyed. For the remaining part of the penstock with 15.48 m length and for the other structures, a little amount of cutting and stripping work will be held. The stand type in these areas are degraded oak coppice (ÇBMBt). As the density of pure degraded oak coppice has been fell below 10%, the number of trees per hectare is about 60-70 (according to site observation). Therefore, it is planned to cut 70 trees within the scope of the project.

The forest land to be clear-cut during construction works will create an area that is susceptible to erosion. Water erosion is an important threat especially at sloping land. Necessary measures to prevent possible erosion and landslides is as follows:

- Soil stabilization will be ensured by leaving the roots of the trees to be cut in place,
- Appropriate vegetation cover will be laid on soil after completion of the works,
- Terrace system will be applied at high slope lands,
- Locations having high erosion risk will be continuously monitored.

During reforestation and landscaping, oak species (Quercus pubescens, Quercus trojana) which are compatible with the vegetation type of the region.

V.1.21. Starting from land preparation to commissioning of the units; the types and properties of fuels to be used, emissions to be produced, oils to be produced and their ingredients, commitment for analysis and disposal

Starting from land preparation to commissioning of the units, electrical energy and catalytic stove will be used for heating purposes. The construction works of the project will last for a period of 32 months and testing studies will be started in the last 6 months. The working schedule is presented in **Appendix: 11**. TÜPRAŞ diesel oil - 400, the properties of which is given below, will be used in all phases of the project.

Table 5.1.21.1 Properties of TÜPRAŞ Diesel Oil 400

Property	Unit	Value	Limit	Experiment Method
Density (at 15 ^{0}C)	kg/m^3	820-845		TS 1013 EN ISO 3675
				TS EN ISO 12185
Polycyclic aromatic hydrocarbons	% weight	8	At most	TS EN 12916
Flash point	^{0}C	55	At least	TS EN ISO 2719
Cold filter plugging point	^{0}C			TS EN 116
Winter (a)		-15	At most	
Summer (b)		5	At most	
Distillation				TS 1232 EN ISO 3405
Obtained at 250 ^{0}C	% by volume	65	At most	

Property	Unit	Value	Limit	Experiment Method
Obtained at 350 ^{0}C	% by volume	85	At least	
Temperature that 95% (vol/vol) is obtained	^{0}C	360	At most	
Sulphur	mg/kg	10	At most	TS EN ISO 20846
				TS EN ISO 20884
Carbon residual (10 % in distillation residual)	% by weight	0.3	At most	TS 6148 EN ISO 10370
Viscosity (at 40 ^{0}C)	cSt	2.0-4.5		TS 1451 EN ISO 3104
Copper strip corrosion (3 hours at 50 ^{0}C)		No.1	At most	TS 2741 EN ISO 2160
Ash	% by weight	0.01	At most	TS EN ISO 6245
Fatty acid methyl esters (FAME)	% by volume	7	At most	TS EN 14078
Cetane number		51	At least	TS 10317 EN ISO 5165
				TS EN 15195
Cetane Index	by calculation	46	At least	TS EN ISO 4264
Water	mg/kg	200	At most	TS 6147 EN ISO 12937
Total pollutant	mg/kg	24	At most	TS EN 12662
Oxidation stability	g/m^3	25	At most	TS EN ISO 12205
Lubricity wear scar diameter (wsd 1.4) at 60 ^{0}C	µm	460	At most	TS EN ISO 12156-1

Waste Oil

Used tires, accumulators, batteries, cables, waste oil, grease trap filters, and similar hazardous wastes will be produced at the material quarries and during construction, land preparation, and facility construction phases of the project. These wastes will be temporarily stored at the proper location of the facility in accordance with “Regulation on Control of Hazardous Wastes” published in Official Gazette dated 14.03.2005 and numbered 25755 and will be sent to the nearest hazardous waste recycling plant or hazardous waste disposal plant that is licensed by the Ministry of Environment and Urbanization. Transportation of these will also be performed by licensed vehicles.

The number of construction equipment to work will be different at Onur Regulator site, energy tunnel site, and HEPP site. The calculations are performed in consideration with the number of equipment to be used at maximum. According to this, the number of construction equipment to be used at HEPP site, at which the construction equipment will be used at most, is 13; 1 crawler crane, 3 trucks, 2 excavators, 1 concrete pump, 1 transmixer, 1 rock drill, 1 tractor, 2 compressors, 1 generator. The calculation made by assuming that the oil fill capacity of each equipment is 5 L and the oil has to be changed every 3 months on average is as follows.

Amount of waste oil = 13 x 5 L x 4 (number of change per year) = 260 L

In the construction phase of the project, 260 L/year waste oil will be produced on average. Likewise, wastes will be produced during the operation phase due to maintenance, repair, oil and filter change of the equipment and transportation vehicles. These activities will be performed by competent mechanics or service man at appropriate places of the site. Oily wastes and oil wastes to be produced as a result of oil change will be collected in tight head drums and will be disposed by sending to waste recycling plants licensed by the Ministry of Environment and Urbanization. In the course of the maintenance and oil change of equipment and transportation vehicles, “Regulation on Control of Hazardous Wastes”

published in Official Gazette dated 14.03.2005 and numbered 25755 and all related provisions of regulation amendments, besides “Regulation on Control Waste Oil” published in Official Gazette dated 30.07.2008 and numbered 26952 and all related provisions of regulation amendments will be complied with. Release of waste oil to a receiving medium, such as soil, surface water or groundwater shall definitely be avoided.

During the operation phase of Onur Regulator, waste oil generation due to the facilities or units is out of question. However, in case generation of such wastes, wastes will be collected at tight head drums and disposed by sending waste recycling plants licensed by the Ministry of environment and Urbanization.

Emissions

Onur Regulator and Construction Site: The number of construction equipment to be used in this phase may change. In calculations, use of maximum number of equipment are taken into consideration.

Table 5.1.21.2. Equipment to be used at Regulator Site Construction

Equipment	Quantity
Crawler Loader	1
Truck	3
Excavator	2
Concrete Pump	1
Transmixer	1
Rock Drill	1
Tractor	1
Total	10

Assuming that 4 L of diesel oil per hour is used by each equipment, the hourly diesel oil to be consumed is expected as 4 x 10 = 40 liter.

By assuming that all equipment will work simultaneously, the amount of fuel to be used is found as 34 kg/h (0.85 kg/L x 40 L/h = 34 kg/h).

Table 5.1.21.3. Pollutant Emission Factors for Diesel Vehicles

POLLUTANT	DIESEL OIL (kg/L)
Carbon Monoxide	9.7
Hydrocarbons	29.0
Nitrogen Oxides	36.0
Sulphur Oxides	6.5

Accordingly;

Pollutant	kg/L	Calculated Value
Carbon Monoxide	9.7	9.7 kg/L x 34 kg/h /1000 kg/L = 0.329 kg/h
Hydrocarbons	29.0	29 kg/L x 34 kg/h/1000 kg/L = 0.986 kg/h
Nitrogen Oxides	36.0	36 kg/L x 34 kg/h/1000 kg/L = 1.224 kg/h
Sulphur Oxides	6.5	6.5 kg/L x 34 kg/h/1000 kg/L = 0.221 kg/h

(Emissions are calculated based on data given in **Table 5.1.21.3**.)

Table 5.1.21.4. Limit Values for Gaseous Emissions to be released from Equipment to be used at Construction at Onur Regulator Site

Pollutants	Emissions to be released from Equipment (kg/h)	Limit Values (kg/h)
Carbon Monoxide	0.329	1000
Hydrocarbons	0.986	-
Nitrogen Oxides	1.224	40
Sulphur Oxides	0.221	60

Emissions to be produced by construction equipment is found to be below the limit values defined by Air Quality Control Regulation. The influence area of the exhaust emissions to be produced during Onur Regulator construction works is limited with the area where construction works take place.

Construction of Energy Tunnel is planned to be completed in 20 months time. The construction equipment to be used in this phase of the project is given below.

Table 5.1.21.5. Equipment to be used in Construction of Energy Tunnel

Equipment	Quantity
Crawler Loader	1
Truck	2
Excavator	2
Concrete Pump	1
Transmixer (8-13 m^3)	1
Rock Drill	1
Tractor	1
Compressor	2
Generator	1
Total	12

Assuming that 4 L of diesel oil per hour is used by each equipment, the hourly diesel oil to be consumed is expected as 4 x 12 = 48 liter.

By assuming that all equipment will work simultaneously, the amount of fuel to be used is found as 40.8 kg/h (0.85 kg/L x 48 L/h = 40.8 kg/h).

Accordingly;

Pollutant	kg/L	Calculated Value
Carbon Monoxide	9.7	9.7 kg/L x 40.8 kg/h /1000 kg/L = 0.395 kg/h
Hydrocarbons	29.0	29 kg/L x 40.8 kg/h/1000 kg/L = 1.183 kg/h
Nitrogen Oxides	36.0	36 kg/L x 40.8 kg/h/1000 kg/L = 1.468 kg/h
Sulphur Oxides	6.5	6.5 kg/L x 40.8 kg/h/1000 kg/L = 0.265 kg/h

(Emissions are calculated based on data given in **Table 5.1.21.3**.)

Emission factors are taken from Regulation on Industrial Air Pollution Control.

Table 5.1.21.6 Limit Values for Gaseous Emissions to be released from Equipment to be used at Construction at Transmission Site

Pollutants	Emissions to be released from Equipment (kg/h)	Limit Values (kg/h)
Carbon Monoxide	0.395	1000
Hydrocarbons	1.183	-
Nitrogen Oxides	1.468	40
Sulphur Oxides	0.265	60

Emissions to be produced by construction equipment is found to be below the limit values defined by Air Quality Control Regulation. The influence area of the exhaust emissions to be produced during transmission site construction works is limited with the area where construction works take place.

HEPP Site; Powerhouse and penstock construction works will take place. These works will be completed in 15 months time. The construction equipment to be used in this phase of the project is given below.

Table 5.1.21.7. Equipment to be used in Construction of HEPP Site

Equipment	Quantity
Crawler Loader	1
Truck	3
Excavator	2
Concrete Pump	1
Transmixer (8-13 m^3)	1
Rock Drill	1
Tractor	1
Compressor	2
Generator	1
Total	13

Assuming that 4 L of diesel oil per hour is used by each equipment, the hourly diesel oil to be consumed is expected as 4 x 13 = 52 liter.

By assuming that all equipment will work simultaneously, the amount of fuel to be used is found as 44.2 kg/h (0.85 kg/L x 52 L/h = 44.2 kg/h).

Accordingly;

Pollutant	kg/L	Calculated Value
Carbon Monoxide	9.7	9.7 kg/L x 44.2 kg/h /1000 kg/L = 0.428 kg/h
Hydrocarbons	29.0	29 kg/L x 44.2 kg/h/1000 kg/L = 1.281 kg/h
Nitrogen Oxides	36	36 kg/L x 44.2 kg/h/1000 kg/L = 1.591 kg/h
Sulphur Oxides	6.5	6.5 kg/L x 44.2 kg/h/1000 kg/L = 0.287 kg/h

(Emissions are calculated based on data given in **Table 5.1.21.3**.)

Table 5.1.21.8. Limit Values for Gaseous Emissions to be released from Equipment to be used at Construction at HEPP Site

Pollutants	Emissions to be released from Equipment (kg/h)	Limit Values (kg/h)
Carbon Monoxide	1.281	1000
Hydrocarbons	1.591	-
Nitrogen Oxides	0.287	40
Sulphur Oxides	1.281	60

Emissions to be produced by construction equipment is found to be below the limit values defined by Air Quality Control Regulation. The influence area of the exhaust emissions to be produced during HEPP site construction works is limited with the area where construction works take place.

Fuel system of vehicles will be controlled continuously, and the provisions of "Regulation on Control of Exhaust Gas Emissions" that was put into force by being published by the Ministry of Forestry and Water Affairs in Official Gazette dated 04.04.2009 and numbered 27190 will be complied with.

In order to minimize the emissions of equipment to be used in construction phase of the project, the following measures will be taken:

- Daily, weekly, and monthly maintenance of the equipment will be carried out regularly, and oil leaks will be avoided.

- Fuel filters will be checked regularly,

- Oil and filter changes will always be held at petroleum stations in accordance with the provisions of "the Circular on Petroleum Wastes"

During construction phase of the project, related provisions of "Regulation on Industrial Air Pollution Control" published in Official Gazette dated 03.07.2009 and numbered 27277, "Regulation on Making Amendments Related to Regulation on Industrial Air Pollution Control" published in Official Gazette dated 30.03.2010 and numbered 27537, "Regulation on Control of Air Pollution due to Heating" published in Official Gazette dated 13.01.2005 and numbered 25699 will be complied with and emission permission will be taken in accordance with this regulation.

V.1.22. Water supply system plan in the context of the project (both for the construction and operation phases), where to supply water, the amount of water to be supplied from these resources and the amount of water with respect to their purpose of use, type and amount of wastewater to be produced, disposal methods and mediums that water to be discharged, in case water is to be supplied from groundwater, taking necessary permissions in accordance with the Law numbered 167 (necessary permissions taken and attaching the permit to the report)

Water Use

Construction Phase: During land preparation and construction works, water will be needed for drinking and cleaning purposes. In construction phase, the maximum number of workers will be 75, and their water requirement is foreseen as 11.25 m^3 per day. In addition, daily 15 m^3 of water will be used on average for spraying to prevent dust generation due to construction works.

Operation Phase: During the operation phase, 10 person will be working and daily 1.5 m^3 of water will be consumed.

Drinking and utility water needed in the construction and operation phases will be supplied by the tankers to be brought from Toklar Village. Related to the subject, the letter that has been taken from Toklar Village Mukhtar is presented in **Appendix: 16-e**.

Wastewater Generation

Construction Phase: Due to water use of personnel to work in the construction phase of the project, domestic wastewater will be produced.

75 worker will be employed in the construction phase of the project. Assuming that water use per capita is 150 L/day = 0.15 m^3/capita-day ("Design Principles of Wastewater Treatment Systems" (Vol-1) DEU Eng. Fac. Assoc. Prof. Hikmet TOPRAK Environmental Eng. Dept., İzmir, 1996) and all water used is converted to wastewater, the amount of domestic wastewater to be generated is calculated as follows;

Q_{ww} = (q) x (N)

where:

Q_{ww}: Wastewater flow rate (L/day),

q : Unit water consumption (L/capita.day),

N : Number of person.

Q_{ww} = 75 x 150 L/day = 11,250 L/day = 11.25 m^3/day

Pollution loads of domestic wastewater is given in Table below.

Table 5.1.22.1. Pollutants in Domestic Wastewater and Their Average Concentrations (Benefield, L. And Randall,C., 1980)

Parameter	Concentration (mg/L)
pH	6-9
Suspended Solids (SS)	200
BOD_5	200
COD	500
Total Nitrogen	40
Total Phosphorus	10

Parameter	Concentration (kg/day)
SS	2.25
BOD_5	2.25
COD	5.65
Total Nitrogen	0.45
Total Phosphorus	0.11

(Pollution loads are calculated in accordance with the data given in Table 5.1.22.1.)

Domestic wastewater to be generated during construction phase will be treated at the package treatment plant to be installed at the construction site. Treated wastewater will be discharged by taking discharge permission. Wastewater will not be generated due to 10 m^3/day of water to be used to prevent dust generation during the activities performed at construction phase and due to 10 m^3/day of water to be used for concrete mixing.

In addition, during construction of the tunnel, water pits will be formed at both end of the tunnel for water that is likely accumulate inside the tunnel. The water accumulated in pits will be collected at the regulator site by pumping and at the powerhouse site by elevation difference. Sludge to come along with water will be eliminated from solid substances in the sedimentation ponds to be built at both end of the tunnel. The purified water at the surface will be released to the stream, and solid substances obtained as a result of sedimentation will be stored at the excess material storage area.

Concrete plant will be constructed within the facility. As the sand to be used at the concrete plant will be supplied from the outside, sand washing process will not be carried out at the site. Therefore, wastewater will not be produced in this context. In addition, water to be used for making concrete will be transferred from Toklar Village by tanker. As the water to be used for making concrete remains in the produced concrete, no liquid waste will be produced in this context. However, wastewater will be produced as a result of activities, such as washing of mixers to be used for small-scale concrete mixing operations. Because of these reasons, “sedimentation pond” will be built at the construction site to reuse wastewater and aggregates remaining in the mixer. Capacity of the sedimentation pond will be 4 m x 3 m x 2 m = 24 m^3 with two sections. Water to be sluiced at the sedimentation pond will be given back to the system and thus be re-circulated. By this means, water use and wastewater generation will be minimized. Since the water will evaporate over time and be used in concrete mixing, no wastewater will be generated.

During these processes, the provisions of “Regulation on Water Pollution Control” put into force by being published in Official Gazette dated 31.12.2004 and numbered 25687, and “Regulation on “Regulation on Making Amendments Related to Regulation on Water Pollution Control” put in force by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with.

Operation Phase: Due to water use of personnel to work in the operation phase of the project, domestic wastewater will be produced.

10 worker will be employed in the operation phase of the project. Assuming that water use per capita is 150 L/day = 0.15 m^3/capita-day (“Design Principles of Wastewater Treatment Systems” (Vol-1) DEU Eng. Fac. Assoc. Prof. Hikmet TOPRAK Environmental Eng. Dept., İzmir, 1996) and all water used is converted to wastewater, the amount of domestic wastewater to be generated is calculated as follows;

Q_{ww} = (q) x (N)

where:

Q_{ww}: Wastewater flow rate (L/day),

q : Unit water consumption (L/capita.day),

N : Number of person.

Q_{ww} = 10 capita x 150 L/capita.day = 1500 L/day = 1.5 m^3/day

Pollution loads of domestic wastewater is given in Table below.

Parameter	Concentration (kg/day)
SS	0.3
BOD_5	0.3
COD	0.75
Total Nitrogen	0.06
Total Phosphorus	0.015

(Pollution loads are calculated in accordance with the data given in Table 5.1.22.1.)

Domestic wastewater to be generated during operation phase will be treated at the package treatment plant to be installed at the construction site. Treated wastewater will be discharged by taking discharge permission. Wastewater will not be generated due to 10 m^3/day of water to be used to prevent dust generation during the activities performed at construction phase and due to 10 m^3/day of water to be used for concrete mixing.

During these processes, the provisions of "Regulation on Water Pollution Control" put into force by being published in Official Gazette dated 31.12.2004 and numbered 25687, and "Regulation on "Regulation on Making Amendments Related to Regulation on Water Pollution Control" put in force by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with.

V.1.23. Starting from land preparation until commissioning of the units; the amount and type of solid waste to be produced, where to transfer these wastes and for what purposes to use, how to dispose, commitment with respect to Regulation on Solid Waste Control and the Circular of Prime Ministry and other related legislation, commitment for making proper and convenient disposal and storage, 1/1,000 scaled map of storage areas and 1/25,000 scaled map of disposal areas, and locations of alternative areas

Construction Phase: In the construction phase of the project, solid waste will be produced due to;

- domestic solid waste to be produced by workers (glass, paper, plastic, etc.),
- organic originated domestic solid waste arising from food service of staff,
- metal sheets and plates, packaging and boxes, lumber, and similar construction originated waste,
- excavation waste resulting from excavation works.

It is planned to employ 75 workers in the construction phase of the project. Domestic solid waste to be produced per capita is 1.15 kg/capita.day (Source: TUİK-2008), thus total waste is calculated as follows:

1.15 kg/day-capita x 75 capita = 86.25 kg/day

Recyclable solid waste such as glass, plastic, paper taking place in domestic solid waste will be collected at closed drums separately and will be delivered to the solid waste team of Bereketli Municipality with regular intervals.

Un-recyclable domestic solid waste will be collected at the garbage barrels located within the facility separate from other wastes, will be kept closed in an environmentally friendly way in terms of appearance, odor, dust, leakage, and similar factors, and will be collected on regular intervals and disposed by the team of Bereketli Municipality (**APPENDIX: 16-d**).

Packaging wastes will be produced due to some materials (ceramic, electrical, plumbing, painting, etc.) to be used in construction phase. Among these wastes, recyclable and un-recyclable ones will be collected separately and be delivered to Bereketli Municipality or to another company licensed by the Ministry of Environment and Urbanization by making an agreement.

As can be seen in Table 5.1.1.1 of Chapter V.1.1, totally 325,224.8 tons of excavation material will be produced within the scope of the project. 5% (16,261 tons) of this amount is expected to be vegetative soil, which will be used for landscaping and rehabilitation of areas where construction is completed. Besides, a part of 308,963.8 tons of excess excavation material to be produced during the project will be used as upper and lower foundation material for construction of the regulator and powerhouse access roads. The remaining material will be stored at the storage areas displayed in 1/1,000 and 1/25,000 scaled maps given in Appendix.

Excess excavation material shall not be left to streambeds. Since the excavation material storage area is specified by the 7th Regional Directorate of SHW, any other alternative area was not considered.

During these processes, the provisions of “Regulation on Control of Solid Wastes” put into force by being published in Official Gazette dated 14.03.1991 and numbered 20814, and “Regulation on Making Amendments to Regulation on Control of Solid Wastes” put into force by being published in Official Gazette dated 05.04.2005 and numbered 25777 will be complied with. The provisions of “Regulation on Control of Packaging Wastes” put into force by being published in Official Gazette dated 24.06.2007 and numbered 26562, and “Regulation on Making Amendments Related to Regulation on Control of Packaging Wastes” put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with.

Operation Phase: The management of domestic solid waste to be produced due to domestic solid waste (glass, paper, plastic, etc.) of facility staff and guests and due to organic originated solid wastes resulting from food service will be performed in compliance with “Regulation on Solid Waste Control”, “Regulation on Control of Packaging and Packaging Wastes”, and “Regulation on Control of Vegetable Oil Wastes”.

It is planned to employ 10 persons in the operation phase of the project. Domestic solid waste to be produced per capita is 1.15 kg/capita.day (Source: TUİK-2008), thus total domestic solid waste is calculated as follows:

10 capita x 1.15 kg/day.capita = 11.5 kg/day

Recyclable solid waste such as glass, plastic, paper taking place in domestic solid waste shall be collected at closed drums separately and will be delivered to the solid waste team of Bereketli Municipality with regular intervals.

Un-recyclable domestic solid waste shall be collected at the garbage barrels located within the facility separate from other wastes, shall be kept closed in an environmentally friendly way in terms of appearance, odor, dust, leakage, and similar factors, and will be collected on regular intervals and disposed by the team of Bereketli Municipality.

In the operation phase, packaging wastes will be produced due to kitchen supplies, cleaning supplies, etc. Among these wastes, recyclable and un-recyclable ones will be collected separately and in accordance with the packaging wastes management plant they will be delivered to a company licensed by the Ministry of Environment and Urbanization by making an agreement.

During these processes, the provisions of “Regulation on Solid Waste Control” put into force by being published in Official Gazette dated 14.03.1991 and numbered 20814, and “Regulation on Making Amendments to Regulation on Solid Waste Control” put into force by being published in Official Gazette dated 05.04.2005 and numbered 25777 will be complied with. The provisions of “Regulation on Control of Packaging Wastes” put into force by being published in Official Gazette dated 24.06.2007 and numbered 26562, “Regulation on Making Amendments to Regulation on Control of Packaging Wastes” put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537, and “Regulation on Control of Vegetable Oil Wastes” published in Official Gazette dated 19.04.2005 and numbered 25791 will be complied with.

V.1.24. Starting from the land preparation until the commissioning of the units; vibration and noise to be generated, sources and level of noise, their distance to the planned facility and cumulative values (satisfying the threshold levels given in regulation)

Noise will be generated due to construction equipment and transportation vehicles to be used during construction works, and to blasting to be performed in the construction of transmission channel. The facility of concern takes place in the Appendix-1 and Appendix-II lists of “Regulation on Permissions and Licenses to be taken in accordance with Environmental Legislation” published in Official Gazette dated 29.04.2009 and numbered 27214, and all related permissions will be taken in all phases of the project.

The following calculations were performed to estimate noise levels to be produced during the construction phase of the project.

Construction Phase: Starting from land preparation to the commissioning of the units, electrical energy and catalytic stove will be used for heating purposes.

Onur Regulator and Construction Site; Regulator, gravel pass, and sedimentation pool construction will be performed. These construction works are planned to be completed in about 15 months period. Also, concrete plant will take place within the construction site to be installed in the vicinity of regulator site. The equipment to be used in this phase of the project and their engine powers are shown in **Table 5.1.24.2**. The noise to be generated in this phase will be due to operation of the equipment.

The facility of concern takes place in the Appendix-1 and Appendix-II lists of “Regulation on Permissions and Licenses to be taken in accordance with Environmental Legislation” published in Official Gazette dated 29.04.2009 and numbered 27214, and all related permissions will be taken in operation phase of the project.

In addition to this, the following calculations were performed to estimate noise levels to be produced during the construction phase of the project.

Related with the noise to be generated during construction activities and during operation of tools, equipment and machines, the issues mentioned in Regulation on Machine Safety (98/37/AT) that is prepared by the Ministry of Science, Industry and Technology and published in the Official Gazette dated 5/6/2002 and numbered 24776 shall be complied with.

In the construction phase of the project, special attention will be paid to use equipment that are new and qualified with latest technology, and are subjected to vehicle inspection and exhaust measurement.

Noise levels of potential sources are found by using the equations given with respect to the engine power levels defined in table given under 5th article of Regulation on Environmental Noise Emission Generated by Equipment used at Open Air Area that is prepared by Science, Industry and Technology and published in the Official Gazette dated 22/01/2003 and numbered 25001. From the machine-equipment list given in the table under 5th article, equipment types to be used at site and equations corresponding to their engine power are given below.

Table 5.1.24.1. Equipment Types and Their Noise Power Level Corresponding to Their Net Power Level

Equipment Type	Net Installed Power, P (kW), Application Power, m (kg)	Allowable Noise Power Level	
		After 03.07.2004	After 03.01.2006
Wheeled Dozers, Wheeled Loaders, Wheeled Excavators, Loaders, Dump Truck, Graders, Loader Type Landfill Compactor	P ≤55	104	101
	P > 55	85 + 11 log P	82 + 11 log P
Excavators	P≤15	96	93
	P>15	83 + ll logP	80 + ll logP
Hand-held Concrete Breaker and Driller	m≤ l5	107	105
	15< m <30	94 + 11 log m	92 + 11 log m
	m≥ 30	96 +11log m	94 + ll log m
Compressors	P≤ 15	99	97
	P> l5	97 + 2 logP	95 + 2 log P

Noise levels to be produced by equipment depend on the power level of equipment, thus the equations given above will be used to calculate noise level of equipment. Engine powers of the equipment to be used at the project site during construction phase is given below.

Table 5.1.24.2. Equipment to be used at Onur Regulator Site and Their Engine Powers

Phase	**Equipment to be used**	**Engine power (HP)**	**Engine power (kW)**	**Quantity**
Construction	Crawler Crane	120	89.52	1
	Truck	110	82.06	3
	Excavator	135	100.7	2
	Concrete Pump	50	37.10	2
	Transmixer	115	85.79	1
	Rockdrill	170	126.82	1
	Tractor	85	63.41	1
	Concrete Plant	220	164.12	1

Calculation of Noise Power Levels of Equipment

Noise power level of each equipment is calculated below with respect to the equations given in **Table 5.1.21.1.**

Crawler Loader

Engine power of the crawler loader to be used at the project site is 120 HP = 89.52 kW. According to the evaluation given in Table 5.1.24.1; since P = 89.52 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 89.52
Lw= **103.47 dB**

Truck:

Engine power of the truck to be used at the project site is 110 HP = 82.06 kW. According to the evaluation given in Table 5.1.24.1; since P = 82.06 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 82.06
Lw= **103.1 dB**

Excavator:

Engine power of the excavator to be used at the project site is 135 HP = 100.7 kW. According to the evaluation given in Table 5.1.24.1; since P = 100.7 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 100.7
Lw= **104.0 dB**

Concrete Pump:

Engine power of the concrete pump to be used at the project site is 50 HP = 37.10 kW. According to the evaluation given in Table 5.1.24.1; Lw = 101 equation was used.

Lw = **101.0 dB**
Transmixer:

Engine power of the transmixer to be used at the project site is 115 HP = 85.79 kW. According to the evaluation given in Table 5.1.24.1; since P = 85.79 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 85.79
Lw= **103.26 dB**

Rockdrill:

Engine power of the rockdrill to be used at the project site is 170 HP = 126.82 kW. According to the evaluation given in Table 5.1.24.1; since P = 126.82 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 126.82
Lw= **105.13 dB**

Tractor:

Engine power of the tractor to be used at the project site is 85 HP = 63.41 kW. According to the evaluation given in Table 5.1.24.1; since P = 63.41 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 63.41
Lw= **101.82 dB**

Concrete Plant:

Engine power of the concrete plant to be used at the project site is 220 HP = 164.12 kW. According to the evaluation given in Table 5.1.24.1; since P = 164.12 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 164.12
Lw= **120.77 dB**

Noise levels of the equipment to be used in construction is as follows:

Table 5.1.24.3. Noise Level of the Equipment to be used during Construction of Onur Regulator

Noise Sources	Quantity	Noise Levels (dB)
Crawler Loader	1	103.47
Truck	3	103.10
Excavator	2	104.00
Concrete Pump	2	101.00
Transmixer	1	103.26
Rockdrill	1	105.13
Tractor	1	101.82
Concrete Plant	1	120.77

Distribution of total sound power level of all noise sources given in the table above to 4 octave bands between 500-4,000 Hz is presented below. For this purpose, sound power level in each octave band is calculated by taking reverse summation of decibels.

Table 5.1.24.4. Distribution of Sound Power Level of the Equipment to be used during Construction of Onur Regulator to Octave Bands

Noise Sources	Sound Power Level			
	50 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	97.4	97.4	97.4	97.4
Truck	97.1	97.1	97.1	97.1
Excavator	98.0	98.0	98.0	98.0
Concrete Pump	95.0	95.0	95.0	95.0
Transmixer	97.2	97.2	97.2	97.2
Rockdrill	99.1	99.1	99.1	99.1
Tractor	95.8	95.8	95.8	95.8
Concrete Plant	114.7	114.7	114.7	114.7

Sound power level of each noise source in 4 octave bands is calculated by use of the following equation and the results are given in the table below.

$$\mathbf{Lp = L_w + 10\ Log\ (Q/\ 4\ \pi\ r^2)}$$

where;
Lw : Sound power level of source (dB)
Q : Directivity coefficient (taken as 1 for mobile sources)
R : Distance from source (meter)

Table 5.1.24.5. Sound Pressure Level of the Equipment to be used during Construction of Onur Regulator

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	50	55.51	55.51	55.51	55.51
	100	49.49	49.49	49.49	49.49
	250	41.53	41.53	41.53	41.53
	500	35.51	35.51	35.51	35.51
	1000	29.49	29.49	29.49	29.49
	2000	23.47	23.47	23.47	23.47
	3000	19.95	19.95	19.95	19.95
Truck	50	55.14	55.14	55.14	55.14
	100	49.12	49.12	49.12	49.12
	250	41.16	41.16	41.16	41.16
	500	35.14	35.14	35.14	35.14
	1000	29.12	29.12	29.12	29.12
	2000	23.10	23.10	23.10	23.10
	3000	19.58	19.58	19.58	19.58
Excavator	50	56.04	56.04	56.04	56.04
	100	50.02	50.02	50.02	50.02
	250	42.06	42.06	42.06	42.06
	500	36.04	36.04	36.04	36.04
	1000	30.02	30.02	30.02	30.02
	2000	24.00	24.00	24.00	24.00
	3000	20.48	20.48	20.48	20.48
Concrete Pump	50	53.04	53.04	53.04	53.04
	100	47.02	47.02	47.02	47.02
	250	39.06	39.06	39.06	39.06
	500	33.04	33.04	33.04	33.04
	1000	27.02	27.02	27.02	27.02
	2000	21.00	21.00	21.00	21.00
	3000	17.48	17.48	17.48	17.48
Transmixer	50	55.30	55.30	55.30	55.30
	100	49.28	49.28	49.28	49.28
	250	41.32	41.32	41.32	41.32
	500	35.30	35.30	35.30	35.30
	1000	29.28	29.28	29.28	29.28
	2000	23.26	23.26	23.26	23.26
	3000	19.74	19.74	19.74	19.74
Rockdrill	50	57.17	57.17	57.17	57.17
	100	51.15	51.15	51.15	51.15
	250	43.19	43.19	43.19	43.19
	500	37.17	37.17	37.17	37.17
	1000	31.15	31.15	31.15	31.15
	2000	25.13	25.13	25.13	25.13
	3000	21.61	21.61	21.61	21.61
Tractor	50	53.86	53.86	53.86	53.86
	100	47.84	47.84	47.84	47.84
	250	39.88	39.88	39.88	39.88
	500	33.86	33.86	33.86	33.86
	1000	27.84	27.84	27.84	27.84
	2000	21.82	21.82	21.82	21.82
	3000	18.30	18.30	18.30	18.30

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Concrete Plant	50	72.81	72.81	72.81	72.81
	100	66.79	66.79	66.79	66.79
	250	58.83	58.83	58.83	58.83
	500	52.81	52.81	52.81	52.81
	1000	46.79	46.79	46.79	46.79
	2000	40.77	40.77	40.77	40.77
	3000	37.25	37.25	37.25	37.25

Atmospheric absorption values are calculated for each frequency by using the following equation and relative humidity (Φ) is taken as 62.23%.

$$A_{atm} = 6.2 \times 10^{-8} (f^2 r / \Phi)$$

where;

F : Frequency of noise source
r : Distance
Φ : Relative humidity

Table 5.1.24.6. Atmospheric Absorption

500	50	0.02
	100	0.03
	250	0.08
	500	0.17
	1000	0.34
	2000	0.68
	3000	1.02
1000	50	0.07
	100	0.14
	250	0.34
	500	0.68
	1000	1.36
	2000	2.71
	3000	4.07
2000	50	0.27
	100	0.54
	250	1.36
	500	2.71
	1000	5.42
	2000	10.84
	3000	16.26
4000	50	1.08
	100	2.17
	250	5.42
	500	10.84
	1000	21.68
	2000	43.37
	3000	65.05

After subtracting the atmospheric absorption levels, final sound pressure level of each source at 4 octave bands is calculated with respect to the following equation and the results are given in the table below.

$$L_p = L_p - A_{atm}$$

Table 5.1.24.7. Final Sound Pressure Levels to occur during Onur Regulator Construction

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	50	55.49	55.44	55.24	54.43
	100	49.46	49.35	48.95	47.32
	250	41.45	41.19	40.18	36.11
	500	35.34	34.83	32.80	24.67
	1000	29.15	28.14	24.07	7.81
	2000	22.79	20.76	12.63	-19.90
	3000	18.93	15.88	3.68	-45.11
Truck	50	55.12	55.07	54.87	54.06
	100	49.09	48.98	48.58	46.95
	250	41.08	40.82	39.81	35.74
	500	34.97	34.46	32.43	24.30
	1000	28.78	27.77	23.70	7.44
	2000	22.42	20.39	12.26	-20.27
	3000	18.56	15.51	3.31	-45.48
Excavator	50	56.02	55.97	55.77	54.96

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
	100	49.99	49.88	49.48	47.85
	250	41.98	41.72	40.71	36.64
	500	35.87	35.36	33.33	25.20
	1000	29.68	28.67	24.60	8.34
	2000	23.32	21.29	13.16	-19.37
	3000	19.46	16.41	4.21	-44.58
Concrete Pump	50	53.02	52.97	52.77	51.96
	100	46.99	46.88	46.48	44.85
	250	38.98	38.72	37.71	33.64
	500	32.87	32.36	30.33	22.20
	1000	26.68	25.67	21.60	5.34
	2000	20.32	18.29	10.16	-22.37
	3000	16.46	13.41	1.21	-47.58
Transmixer	50	55.28	55.23	55.03	54.22
	100	49.25	49.14	48.74	47.11
	250	41.24	40.98	39.97	35.90
	500	35.13	34.62	32.59	24.46
	1000	28.94	27.93	23.86	7.60
	2000	22.58	20.55	12.42	-20.11
	3000	18.72	15.67	3.47	-45.32
Rockdrill	50	57.15	57.10	56.90	56.09
	100	51.12	51.01	50.61	48.98
	250	43.11	42.85	41.84	37.77
	500	37.00	36.49	34.46	26.33
	1000	30.81	29.80	25.73	9.47
	2000	24.45	22.42	14.29	-18.24
	3000	20.59	17.54	5.34	-43.45
Tractor	50	53.84	53.79	53.59	52.78
	100	47.81	47.70	47.30	45.67
	250	39.80	39.54	38.53	34.46
	500	33.69	33.18	31.15	23.02
	1000	27.50	26.49	22.42	6.16
	2000	21.14	19.11	10.98	-21.55
	3000	17.28	14.23	2.03	-46.76
Concrete Plant	50	72.79	72.74	72.54	71.73
	100	66.76	66.65	66.25	64.62
	250	58.75	58.49	57.48	53.41
	500	52.64	52.13	50.10	41.97
	1000	46.45	45.44	41.37	25.11
	2000	40.09	38.06	29.93	-2.60
	3000	36.23	33.18	20.98	-27.81

To calculate A-weighted noise levels, correction factors given in the table below are used.

Table 5.1.24.8. Correction Factors

Center Frequency	Correction Factor
500	-3.20
1000	0.00
2000	1.20
4000	1.00

The results of noise level calculation for each noise sources for 4 octave bands by using the correction factors given above and total noise levels calculated by using the equation given below are presented in the table below.

$$L_T = 10 \log \Sigma 10^{Li/10}$$

where;

Lt: Total noise level

Li: Noise source corrected noise level

Table 5.1.24.9. Total Noise Level in Onur Regulator Construction Phase

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
Crawler Loader	50	52.29	55.44	56.44	55.43	61.17
	100	46.26	49.35	50.15	48.32	54.77
	250	38.25	41.19	41.38	37.11	45.88
	500	32.14	34.83	34.00	25.67	38.79
	1000	25.95	28.14	25.27	8.81	31.43
	2000	19.59	20.76	13.83	0.00	23.72
	3000	15.73	15.88	4.88	0.00	19.04
Truck	50	51.92	55.07	56.07	55.06	60.80
	100	45.89	48.98	49.78	47.95	54.40
	250	37.88	40.82	41.01	36.74	45.51
	500	31.77	34.46	33.63	25.30	38.42
	1000	25.58	27.77	24.90	8.44	31.06
	2000	19.22	20.39	13.46	0.00	23.35
	3000	15.36	15.51	4.51	0.00	18.68
Excavator	50	52.82	55.97	56.97	55.96	61.70
	100	46.79	49.88	50.68	48.85	55.30
	250	38.78	41.72	41.91	37.64	46.41
	500	32.67	35.36	34.53	26.20	39.32
	1000	26.48	28.67	25.80	9.34	31.96
	2000	20.12	21.29	14.36	0.00	24.24
	3000	16.26	16.41	5.41	0.00	19.57
Concrete Pump	50	49.82	52.97	53.97	52.96	58.70
	100	43.79	46.88	47.68	45.85	52.30
	250	35.78	38.72	38.91	34.64	43.41
	500	29.67	32.36	31.53	23.20	36.32
	1000	23.48	25.67	22.80	6.34	28.96
	2000	17.12	18.29	11.36	0.00	21.26
	3000	13.26	13.41	2.41	0.00	16.62
Transmixer	50	52.08	55.23	56.23	55.22	60.96
	100	46.05	49.14	49.94	48.11	54.56
	250	38.04	40.98	41.17	36.90	45.67
	500	31.93	34.62	33.79	25.46	38.58
	1000	25.74	27.93	25.06	8.60	31.22
	2000	19.38	20.55	13.62	0.00	23.51
	3000	15.52	15.67	4.67	0.00	18.84
Rockdrill	50	53.95	57.10	58.10	57.09	62.83
	100	47.92	51.01	51.81	49.98	56.43
	250	39.91	42.85	43.04	38.77	47.54
	500	33.80	36.49	35.66	27.33	40.45
	1000	27.61	29.80	26.93	10.47	33.09
	2000	21.25	22.42	15.49	0.00	25.37
	3000	17.39	17.54	6.54	0.00	20.69

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
Tractor	50	50.64	53.79	54.79	53.78	59.52
	100	44.61	47.70	48.50	46.67	53.12
	250	36.60	39.54	39.73	35.46	44.23
	500	30.49	33.18	32.35	24.02	37.14
	1000	24.30	26.49	23.62	7.16	29.78
	2000	17.94	19.11	12.18	0.00	22.07
	3000	14.08	14.23	3.23	0.00	17.42
Concrete Plant	50	69.59	72.74	73.74	72.73	78.47
	100	63.56	66.65	67.45	65.62	72.07
	250	55.55	58.49	58.68	54.41	63.18
	500	49.44	52.13	51.30	42.97	56.09
	1000	43.25	45.44	42.57	26.11	48.73
	2000	36.89	38.06	31.13	0.00	41.00
	3000	33.03	33.18	22.18	0.00	36.29

Considering the worst case scenario, equivalent noise levels for the case that all noise sources operate simultaneously are calculated and given in the following table. For this purpose, the following equation is used and calculations are performed considering the number of equipment.

L_{day} noise levels **(L_{day} = L_{eq})** are calculated by use of the following equation and the following table is produced.

$$L_{eq}=10\ log\Sigma 10^{\,LT(i)\,/10}$$

Table 5.1.24.10. L_{day} Levels to occur during Construction of Onur Regulator

Distance	L_{day} (dBA)
50	78.98
100	72.58
250	63.69
500	56.60
1000	49.24
2000	41.51
3000	36.81

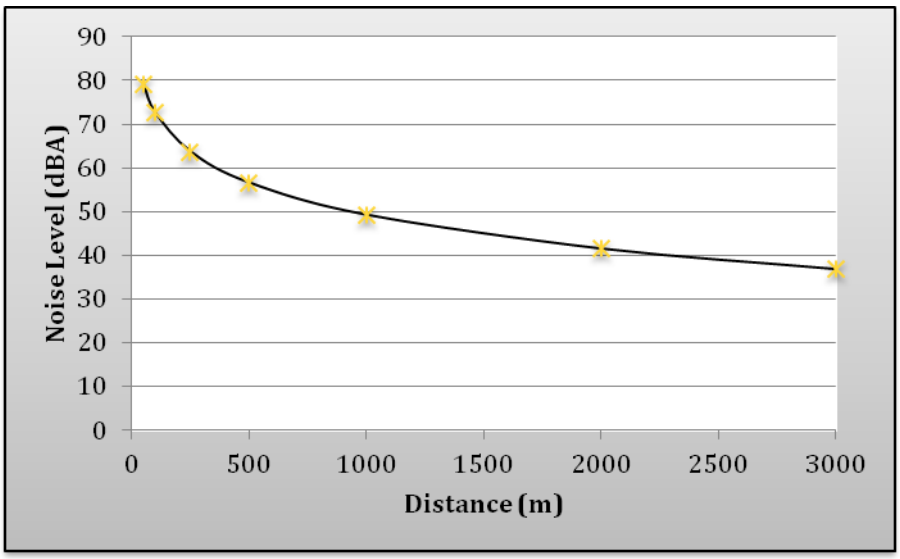


Figure 5.1.24.1. Distribution of Noise to occur during Construction of Onur Regulator

Calculations are done by considering that all construction equipment to work at the same location. However, these vehicles and equipment will be working at different locations. Besides, all of these equipment will not work simultaneously. Hence, noise level at the nearest settlement will be lower.

Table 5.1.24.11. Environmental Noise Limit Values for Construction Sites

Activity Type (construction, demolition, and renovation)	**$L_{gündüz}$ (dBA)**
Building	70
Road	75
Other Sources	70

In the (a) item of 22nd article of the relevant regulation, it is mentioned that "Noise level generated by an facility or plant should not exceed the standards given in Table-4 of Appendix-VIII of this regulation". Environmental Noise Level Standards for construction sites are given in **Chapter V, Table 5.1.24.11**. The nearest settlement to the project site is Tokatlar Village that is 1 km far away from the project site. As can be seen from **Table 5.1.24.10,** daily noise level at a distance of 1000 m from the project site will be lower than 70 dBA. Therefore, noise to generated at the project site will not affect the nearest settlement.

In addition, necessary measures will be taken by the investing company to control the noise to be generated due to project activities.

In relation to noise, necessary measures shall be taken in accordance with "Regulation on Occupational Health and Safety" published in the Official Gazette dated 09/12/2003 and numbered 25311. As stated in the regulation employees working at the project site shall use the provided headphones to compensate for the noise, and the other provisions of the regulation shall be complied with.

Besides, all the issues stated in "Regulation on Assessment and Management of Environmental Noise" published in the Official Gazette dated 04.06.2010 and numbered 27601 shall be complied with during the project activities.

***Construction of Energy Tunnel*;** Tunnel construction will be accomplished. These construction works are planned to be completed in about 20 months period. In this phase of the project, 1 crawler loader, 2 trucks, 2 excavators, 1 concrete pump, 1 transmixer, 1 rockdrill, 1 tractor, 2 compressors and 1 generator, totally 13 construction equipment is planned to be used.

Calculation of Noise Power Levels of Equipment

Noise power level of each equipment is calculated below with respect to the equations given in **Table 5.1.21.1.**

Crawler loader:

Engine power of the crawler loader to be used at the project site is 120 HP = 89.52 kW. According to the evaluation given in Table 5.1.24.1; since P = 89.52 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 89.52
Lw= **103.47 dB**

Truck:

Engine power of the truck to be used at the project site is 110 HP = 82.06 kW. According to the evaluation given in Table 5.1.24.1; since P = 82.06 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 82.06
Lw= **103.1 dB**

Excavator:

Engine power of the excavator to be used at the project site is 135 HP = 100.7 kW. According to the evaluation given in Table 5.1.24.1; since P = 100.7 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 100.7
Lw= **104.0 dB**

Concrete Pump:

Engine power of the concrete pump to be used at the project site is 50 HP = 37.10 kW. According to the evaluation given in Table 5.1.24.1; Lw = 101 equation was used.

Lw = **101.0 dB**

Transmixer:

Engine power of the transmixer to be used at the project site is 115 HP = 85.79 kW. According to the evaluation given in Table 5.1.24.1; since P = 85.79 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 85.79
Lw= **103.26 dB**

Rockdrill:

Engine power of the rockdrill to be used at the project site is 170 HP = 126.82 kW. According to the evaluation given in Table 5.1.24.1; since P = 126.82 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 126.82
Lw= **105.13 dB**

Tractor:

Engine power of the tractor to be used at the project site is 85 HP = 63.41 kW. According to the evaluation given in Table 5.1.24.1; since P = 63.41 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 63.41
Lw= **101.82 dB**

Compressor:

Engine power of the compressor to be used at the project site is 75 HP = 56 kW. According to the evaluation given in Table 5.1.24.1; since P = 56 kW > 55 kW, Lw=95 + 2Log P equation was used.

Lw= 95 + 2 Log 56
Lw= **98.50 dB**

Generator:

Noise power level of the generator to be used at the project site is Lw = **90 dB.**

Table 5.1.24.12. Noise Level of the Equipment to be used during Construction of Energy Tunnel

Noise Sources	Quantity	Noise Levels (dB)
Crawler loader	1	103.47
Truck	2	103.10
Excavator	2	104.00
Concrete Pump	1	101.00
Transmixer	1	103.26
Rockdrill	1	105.13
Tractor	1	101.82
Compressor	2	98.50
Generator	1	90.00

Distribution of total sound power level of all noise sources given in the table above to 4 octave bands between 500-4,000 Hz is presented below. For this purpose, sound power level in each octave band is calculated by taking reverse summation of decibels.

Table 5.1.24.13. Distribution of Sound Power Level of the Equipment to be used during Construction of Energy Tunnel to Octave Bands

Noise Sources	Sound Power Level			
	50 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler loader	97.4	97.4	97.4	97.4
Truck	97.1	97.1	97.1	97.1
Excavator	98.0	98.0	98.0	98.0
Concrete Pump	95.0	95.0	95.0	95.0
Transmixer	97.2	97.2	97.2	97.2
Rockdrill	99.1	99.1	99.1	99.1
Tractor	95.8	95.8	95.8	95.8
Compressor	92.5	92.5	92.5	92.5
Generator	84.0	84.0	84.0	84.0

Sound power level of each noise source in 4 octave bands is calculated by use of the following equation and the results are given in the table below.

$$\mathbf{Lp = L_w + 10\ Log\ (Q/\ 4\ \pi\ r^2)}$$

where;

Lw : Sound power level of source (dB)
Q : Directivity coefficient (taken as 1 for mobile sources)
R : Distance from source (meter)

Table 5.1.24.14. Sound Pressure Level of the Equipment to be used during Construction of Energy Tunnel

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	50	55.51	55.51	55.51	55.51
	100	49.49	49.49	49.49	49.49
	250	41.53	41.53	41.53	41.53
	500	35.51	35.51	35.51	35.51
	1000	29.49	29.49	29.49	29.49
	2000	23.47	23.47	23.47	23.47
	3000	19.95	19.95	19.95	19.95
Truck	50	55.14	55.14	55.14	55.14
	100	49.12	49.12	49.12	49.12
	250	41.16	41.16	41.16	41.16
	500	35.14	35.14	35.14	35.14
	1000	29.12	29.12	29.12	29.12
	2000	23.10	23.10	23.10	23.10
	3000	19.58	19.58	19.58	19.58
Excavator	50	56.04	56.04	56.04	56.04
	100	50.02	50.02	50.02	50.02
	250	42.06	42.06	42.06	42.06
	500	36.04	36.04	36.04	36.04
	1000	30.02	30.02	30.02	30.02
	2000	24.00	24.00	24.00	24.00
	3000	20.48	20.48	20.48	20.48
Concrete Pump	50	53.04	53.04	53.04	53.04
	100	47.02	47.02	47.02	47.02
	250	39.06	39.06	39.06	39.06
	500	33.04	33.04	33.04	33.04
	1000	27.02	27.02	27.02	27.02
	2000	21.00	21.00	21.00	21.00
	3000	17.48	17.48	17.48	17.48
Transmixer	50	55.30	55.30	55.30	55.30
	100	49.28	49.28	49.28	49.28
	250	41.32	41.32	41.32	41.32
	500	35.30	35.30	35.30	35.30
	1000	29.28	29.28	29.28	29.28
	2000	23.26	23.26	23.26	23.26
	3000	19.74	19.74	19.74	19.74
Rockdrill	50	57.17	57.17	57.17	57.17
	100	51.15	51.15	51.15	51.15
	250	43.19	43.19	43.19	43.19
	500	37.17	37.17	37.17	37.17
	1000	31.15	31.15	31.15	31.15
	2000	25.13	25.13	25.13	25.13
	3000	21.61	21.61	21.61	21.61
Tractor	50	53.86	53.86	53.86	53.86
	100	47.84	47.84	47.84	47.84
	250	39.88	39.88	39.88	39.88
	500	33.86	33.86	33.86	33.86
	1000	27.84	27.84	27.84	27.84
	2000	21.82	21.82	21.82	21.82
	3000	18.30	18.30	18.30	18.30

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Compressor	50	50.54	50.54	50.54	50.54
	100	44.52	44.52	44.52	44.52
	250	36.56	36.56	36.56	36.56
	500	30.54	30.54	30.54	30.54
	1000	24.52	24.52	24.52	24.52
	2000	18.50	18.50	18.50	18.50
	3000	14.98	14.98	14.98	14.98
Generator	50	42.04	42.04	42.04	42.04
	100	36.02	36.02	36.02	36.02
	250	28.06	28.06	28.06	28.06
	500	22.04	22.04	22.04	22.04
	1000	16.02	16.02	16.02	16.02
	2000	10.00	10.00	10.00	10.00
	3000	6.48	6.48	6.48	6.48

Atmospheric absorption values are calculated for each frequency by using the following equation and relative humidity (Φ) is taken as 62.23%.

$$A_{atm} = 6.2 \times 10^{-8} (f^2 r / \Phi)$$

where;

F : Frequency of noise source
r : Distance
Φ : Relative humidity

After subtracting the atmospheric absorption levels given in **Chapter V, Table 5.1.24.6**, final sound pressure level of each source at 4 octave bands is calculated with respect to the following equation and the results are given in **Table 5.1.24.15**.

$$L_p = L_p - A_{atm}$$

Table 5.1.24.15. Final Sound Pressure Levels to occur during Energy Tunnel Construction

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	50	55.50	55.45	55.27	54.56
	100	49.46	49.37	49.01	47.59
	250	41.46	41.23	40.34	36.77
	500	35.36	34.92	33.13	25.99
	1000	29.19	28.30	24.73	10.46
	2000	22.87	21.09	13.95	-
	3000	19.06	16.38	5.67	-
Truck	50	55.13	55.08	54.90	54.19
	100	49.09	49.00	48.64	47.22
	250	41.09	40.86	39.97	36.40
	500	34.99	34.55	32.76	25.62
	1000	28.82	27.93	24.36	10.09
	2000	22.50	20.72	13.58	-
	3000	18.69	16.01	5.30	-

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Excavator	50	56.03	55.98	55.80	55.09
	100	49.99	49.90	49.54	48.12
	250	41.99	41.76	40.87	37.30
	500	35.89	35.45	33.66	26.52
	1000	29.72	28.83	25.26	10.99
	2000	23.40	21.62	14.48	-
	3000	19.59	16.91	6.20	-
Concrete Pump	50	53.03	52.98	52.80	52.09
	100	46.99	46.90	46.54	45.12
	250	38.99	38.76	37.87	34.30
	500	32.89	32.45	30.66	23.52
	1000	26.72	25.83	22.26	7.99
	2000	20.40	18.62	11.48	-
	3000	16.59	13.91	3.20	-
Transmixer	50	55.29	55.24	55.06	54.35
	100	49.25	49.16	48.80	47.38
	250	41.25	41.02	40.13	36.56
	500	35.15	34.71	32.92	25.78
	1000	28.98	28.09	24.52	10.25
	2000	22.66	20.88	13.74	-
	3000	18.85	16.17	5.46	-
Rockdrill	50	57.16	57.11	56.93	56.22
	100	51.12	51.03	50.67	49.25
	250	43.12	42.89	42.00	38.43
	500	37.02	36.58	34.79	27.65
	1000	30.85	29.96	26.39	12.12
	2000	24.53	22.75	15.61	-
	3000	20.72	18.04	7.33	-
Tractor	50	53.85	53.80	53.62	52.91
	100	47.81	47.72	47.36	45.94
	250	39.81	39.58	38.69	35.12
	500	33.71	33.27	31.48	24.34
	1000	27.54	26.65	23.08	8.81
	2000	21.22	19.44	12.30	-
	3000	17.41	14.73	4.02	-
Compressor	50	50.53	50.48	50.30	49.59
	100	44.49	44.40	44.04	42.62
	250	36.49	36.26	35.37	31.80
	500	30.39	29.95	28.16	21.02
	1000	24.22	23.33	19.76	5.49
	2000	17.90	16.12	8.98	-
	3000	14.09	11.41	0.70	-
Generator	50	42.03	41.98	41.80	41.09
	100	35.99	35.90	35.54	34.12
	250	27.99	27.76	26.87	23.30
	500	21.89	21.45	19.66	12.52
	1000	15.72	14.83	11.26	-
	2000	9.40	7.62	0.48	-
	3000	5.59	2.91	-	-

To calculate A-weighted noise levels, correction factors given in **Chapter V, Table 5.1.24.8** are used.

The results of noise level calculation for each noise sources for 4 octave bands by using the correction factors given in **Chapter V, Table 5.1.24.8** and total noise levels calculated by using the equation given below are presented in the following table.

$$L_T = 10 \log \Sigma 10^{Li/10}$$

where;

Lt: Total noise level
Li: Noise source corrected noise level

Table 5.1.24.16. Total Noise Level in Energy Tunnel Construction Phase

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
Crawler Loader	50	52.30	55.45	56.47	55.56	61.22
	100	46.26	49.37	50.21	48.59	54.86
	250	38.26	41.23	41.54	37.77	46.05
	500	32.16	34.92	34.33	26.99	39.01
	1000	25.99	28.30	25.93	11.46	31.70
	2000	19.67	21.09	15.15	0.00	24.07
	3000	15.86	16.38	6.87	0.00	19.44
Truck	50	51.93	55.08	56.10	55.19	60.85
	100	45.89	49.00	49.84	48.22	54.49
	250	37.89	40.86	41.17	37.40	45.68
	500	31.79	34.55	33.96	26.62	38.64
	1000	25.62	27.93	25.56	11.09	31.33
	2000	19.30	20.72	14.78	0.00	23.70
	3000	15.49	16.01	6.50	0.00	19.07
Excavator	50	52.83	55.98	57.00	56.09	61.75
	100	46.79	49.90	50.74	49.12	55.39
	250	38.79	41.76	42.07	38.30	46.58
	500	32.69	35.45	34.86	27.52	39.54
	1000	26.52	28.83	26.46	11.99	32.23
	2000	20.20	21.62	15.68	0.00	24.59
	3000	16.39	16.91	7.40	0.00	19.96
Concrete Pump	50	49.83	52.98	54.00	53.09	58.75
	100	43.79	46.90	47.74	46.12	52.39
	250	35.79	38.76	39.07	35.30	43.58
	500	29.69	32.45	31.86	24.52	36.54
	1000	23.52	25.83	23.46	8.99	29.23
	2000	17.20	18.62	12.68	0.00	21.61
	3000	13.39	13.91	4.40	0.00	17.00
Transmixer	50	52.09	55.24	56.26	55.35	61.01
	100	46.05	49.16	50.00	48.38	54.65
	250	38.05	41.02	41.33	37.56	45.84
	500	31.95	34.71	34.12	26.78	38.80
	1000	25.78	28.09	25.72	11.25	31.49
	2000	19.46	20.88	14.94	0.00	23.86
	3000	15.65	16.17	6.66	0.00	19.23

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
Rockdrill	50	53.96	57.11	58.13	57.22	62.88
	100	47.92	51.03	51.87	50.25	56.52
	250	39.92	42.89	43.20	39.43	47.71
	500	33.82	36.58	35.99	28.65	40.67
	1000	27.65	29.96	27.59	13.12	33.36
	2000	21.33	22.75	16.81	0.00	25.72
	3000	17.52	18.04	8.53	0.00	21.08
Tractor	50	50.65	53.80	54.82	53.91	59.57
	100	44.61	47.72	48.56	46.94	53.21
	250	36.61	39.58	39.89	36.12	44.40
	500	30.51	33.27	32.68	25.34	37.36
	1000	24.34	26.65	24.28	9.81	30.05
	2000	18.02	19.44	13.50	0.00	22.42
	3000	14.21	14.73	5.22	0.00	17.81
Compressor	50	47.33	50.48	51.50	50.59	56.25
	100	41.29	44.40	45.24	43.62	49.89
	250	33.29	36.26	36.57	32.80	41.08
	500	27.19	29.95	29.36	22.02	34.04
	1000	21.02	23.33	20.96	6.49	26.73
	2000	14.70	16.12	10.18	0.00	19.13
	3000	10.89	11.41	1.90	0.00	14.57
Generator	50	38.83	41.98	43.00	42.09	47.75
	100	32.79	35.90	36.74	35.12	41.39
	250	24.79	27.76	28.07	24.30	32.58
	500	18.69	21.45	20.86	13.52	25.54
	1000	12.52	14.83	12.46	0.00	18.26
	2000	6.20	7.62	1.68	0.00	10.94
	3000	2.39	2.91	0.00	0.00	7.55

Considering the worst case scenario, equivalent noise levels for the case that all noise sources operate simultaneously are calculated and given in the following table. For this purpose, the following equation is used and calculations are performed considering the number of equipment.

L_{day} noise levels **(L_{day} = L_{eq})** are calculated by use of the following equation and the following table is produced.

$$L_{eq}=10 \log \Sigma 10^{LT(i)/10}$$

Table 5.1.24.17. L_{day} Levels to occur during Construction of Energy Tunnel

Distance	L_{day} (dBA)
50	69.72
100	63.36
250	54.55
500	47.51
1000	40.20
2000	32.58
3000	27.97

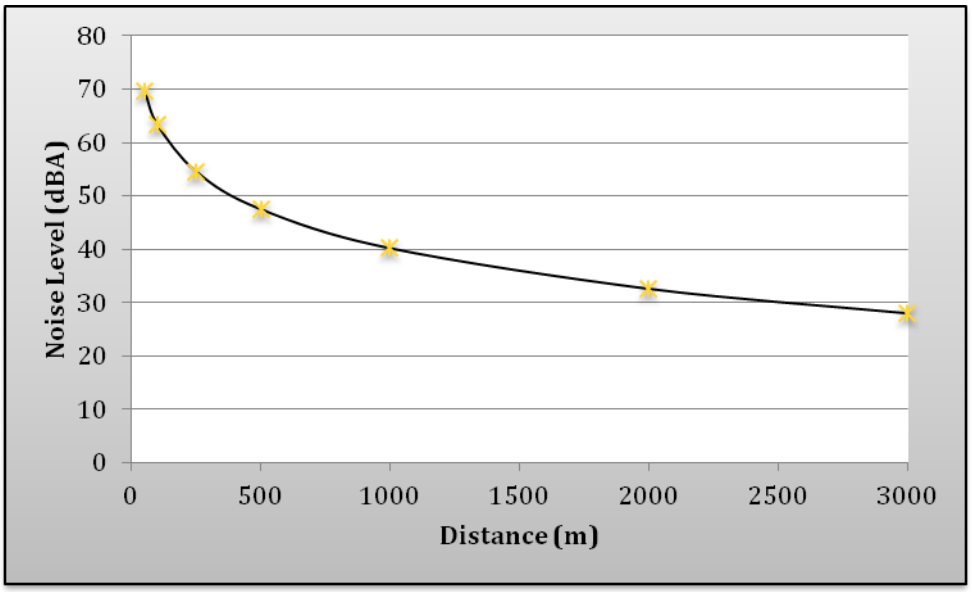


Figure 5.1.24.2. Distribution of Noise to occur during Energy Tunnel Construction

Calculations are done by considering that all construction equipment to work at the same location. However, these vehicles and equipment will be working at different locations. Besides, all of these equipment will not work simultaneously. Hence, noise level at the nearest settlement will be lower.

In the (a) item of 22nd article of the relevant regulation, it is mentioned that "Noise level generated by an facility or plant should not exceed the standards given in Table-4 of Appendix-VIII of this regulation". Environmental Noise Level Standards for construction sites are given in **Chapter V, Table 5.1.24.11**. The nearest settlement to the project site is Tokatlar Village that is 1 km far away from the project site. As can be seen from **Table 5.1.24.17,** daily noise level at a distance of 50 m from the project site will be lower than 70 dBA. Therefore, noise to generated at the project site will not affect the nearest settlement.

In addition, necessary measures will be taken by the investing company to control the noise to be generated due to project activities.

In relation to noise, necessary measures shall be taken in accordance with "Regulation on Occupational Health and Safety" published in the Official Gazette dated 09/12/2003 and numbered 25311. As stated in the regulation employees working at the project site shall use the provided headphones to compensate for the noise, and the other provisions of the regulation shall be complied with.

Besides, all the issues stated in "Regulation on Assessment and Management of Environmental Noise" published in the Official Gazette dated 04.06.2010 and numbered 27601 shall be complied with during the project activities.

HEPP Site;Powerhouse, powerhouse intercepting channel, penstock and its supports will be constructed. These processes will be completed in 15 months duration. In this phase of the project, 1 crawler loader, 3 trucks, 2 excavators, 1 concrete pump, 1 transmixer, 1 rockdrill, 1 tractor, 2 compressors and 1 generator, totally 13 construction equipment is planned to be used.

Calculation of Noise Power Levels of Equipment

Noise power level of each equipment is calculated below with respect to the equations given in **Table 5.1.24.1.**

Crawler loader:

Engine power of the crawler loader to be used at the project site is 120 HP = 89.52 kW. According to the evaluation given in Table 5.1.24.1; since P = 89.52 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 89.52
Lw= **103.47 dB**

Truck:

Engine power of the truck to be used at the project site is 110 HP = 82.06 kW. According to the evaluation given in Table 5.1.24.1; since P = 82.06 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 82.06
Lw= **103.1 dB**

Excavator:

Engine power of the excavator to be used at the project site is 135 HP = 100.7 kW. According to the evaluation given in Table 5.1.24.1; since P = 100.7 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 100.7
Lw= **104.0 dB**

Concrete Pump:

Engine power of the concrete pump to be used at the project site is 50 HP = 37.10 kW. According to the evaluation given in Table 5.1.24.1; Lw = 101 equation was used.

Lw = **101.0 dB**

Transmixer:

Engine power of the transmixer to be used at the project site is 115 HP = 85.79 kW. According to the evaluation given in Table 5.1.24.1; since P = 85.79 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 85.79
Lw= **103.26 dB**

Rockdrill:

Engine power of the rockdrill to be used at the project site is 170 HP = 126.82 kW. According to the evaluation given in Table 5.1.24.1; since P = 126.82 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 126.82
Lw= **105.13 dB**

Tractor:

Engine power of the tractor to be used at the project site is 85 HP = 63.41 kW. According to the evaluation given in Table 5.1.24.1; since P = 63.41 kW > 55 kW, Lw = 82 + 11 Log P equation was used.

Lw= 82 + 11 Log 63.41
Lw= **101.82 dB**

Compressor:

Engine power of the compressor to be used at the project site is 75 HP = 56 kW. According to the evaluation given in Table 5.1.24.1; since P = 56 kW > 55 kW, Lw=95 + 2Log P equation was used.

Lw= 95 + 2 Log 56
Lw= **98.50 dB**

Generator:

Noise power level of the generator to be used at the project site is Lw = **90 dB.**

Table 5.1.24.18. Noise Level of the Equipment to be used in HEPP Site Construction Phase

Noise Sources	Quantity	Noise Levels (dB)
Crawler loader	1	103.47
Truck	3	103.10
Excavator	2	104.00
Concrete Pump	1	101.00
Transmixer	1	103.26
Rockdrill	1	105.13
Tractor	1	101.82
Compressor	2	98.50
Generator	1	90.00

Distribution of total sound power level of all noise sources given in the table above to 4 octave bands between 500-4,000 Hz is presented below. For this purpose, sound power level in each octave band is calculated by taking reverse summation of decibels.

Table 5.1.24.19. Distribution of Sound Power Level of the Equipment to be used during HEPP Site Construction to Octave Bands

Noise Sources	Sound Power Level			
	50 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler loader	97.4	97.4	97.4	97.4
Truck	97.1	97.1	97.1	97.1
Excavator	98.0	98.0	98.0	98.0
Concrete Pump	95.0	95.0	95.0	95.0

Transmixer	97.2	97.2	97.2	97.2
Rockdrill	99.1	99.1	99.1	99.1
Tractor	95.8	95.8	95.8	95.8
Compressor	92.5	92.5	92.5	92.5
Generator	84.0	84.0	84.0	84.0

Sound power level of each noise source in 4 octave bands is calculated by use of the following equation and the results are given in the table below.

$$\mathbf{Lp = L_w + 10\ Log\ (Q/\ 4\ \pi\ r^2)}$$

where;
Lw : Sound power level of source (dB)
Q : Directivity coefficient (taken as 1 for mobile sources)
R : Distance from source (meter)

Table 5.1.24.20. Sound Pressure Level of the Equipment to be used during HEPP Site Construction

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	50	55.51	55.51	55.51	55.51
	100	49.49	49.49	49.49	49.49
	250	41.53	41.53	41.53	41.53
	500	35.51	35.51	35.51	35.51
	1000	29.49	29.49	29.49	29.49
	2000	23.47	23.47	23.47	23.47
	3000	19.95	19.95	19.95	19.95
Truck	50	55.14	55.14	55.14	55.14
	100	49.12	49.12	49.12	49.12
	250	41.16	41.16	41.16	41.16
	500	35.14	35.14	35.14	35.14
	1000	29.12	29.12	29.12	29.12
	2000	23.10	23.10	23.10	23.10
	3000	19.58	19.58	19.58	19.58
Excavator	50	56.04	56.04	56.04	56.04
	100	50.02	50.02	50.02	50.02
	250	42.06	42.06	42.06	42.06
	500	36.04	36.04	36.04	36.04
	1000	30.02	30.02	30.02	30.02
	2000	24.00	24.00	24.00	24.00
	3000	20.48	20.48	20.48	20.48
Concrete Pump	50	53.04	53.04	53.04	53.04
	100	47.02	47.02	47.02	47.02
	250	39.06	39.06	39.06	39.06
	500	33.04	33.04	33.04	33.04
	1000	27.02	27.02	27.02	27.02
	2000	21.00	21.00	21.00	21.00
	3000	17.48	17.48	17.48	17.48
Transmixer	50	55.30	55.30	55.30	55.30
	100	49.28	49.28	49.28	49.28
	250	41.32	41.32	41.32	41.32
	500	35.30	35.30	35.30	35.30
	1000	29.28	29.28	29.28	29.28
	2000	23.26	23.26	23.26	23.26

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
	3000	19.74	19.74	19.74	19.74
Rockdrill	50	57.17	57.17	57.17	57.17
	100	51.15	51.15	51.15	51.15
	250	43.19	43.19	43.19	43.19
	500	37.17	37.17	37.17	37.17
	1000	31.15	31.15	31.15	31.15
	2000	25.13	25.13	25.13	25.13
	3000	21.61	21.61	21.61	21.61
Tractor	50	53.86	53.86	53.86	53.86
	100	47.84	47.84	47.84	47.84
	250	39.88	39.88	39.88	39.88
	500	33.86	33.86	33.86	33.86
	1000	27.84	27.84	27.84	27.84
	2000	21.82	21.82	21.82	21.82
	3000	18.30	18.30	18.30	18.30
Compressor	50	50.54	50.54	50.54	50.54
	100	44.52	44.52	44.52	44.52
	250	36.56	36.56	36.56	36.56
	500	30.54	30.54	30.54	30.54
	1000	24.52	24.52	24.52	24.52
	2000	18.50	18.50	18.50	18.50
	3000	14.98	14.98	14.98	14.98
Generator	50	42.04	42.04	42.04	42.04
	100	36.02	36.02	36.02	36.02
	250	28.06	28.06	28.06	28.06
	500	22.04	22.04	22.04	22.04
	1000	16.02	16.02	16.02	16.02
	2000	10.00	10.00	10.00	10.00
	3000	6.48	6.48	6.48	6.48

Atmospheric absorption values are calculated for each frequency by using the following equation and relative humidity (Φ) is taken as 62.23%.

$$\mathbf{A_{atm} = 6.2 \times 10^{-8} (f^2 r / \Phi)}$$

where;

F : Frequency of noise source
r : Distance
Φ : Relative humidity

After subtracting the atmospheric absorption levels given in **Chapter V, Table 5.1.24.6**, final sound pressure level of each source at 4 octave bands is calculated with respect to the following equation and the results are given in **Table 5.1.24.21**.

$$\mathbf{L_p = L_p - A_{atm}}$$

Table 5.1.24.21. Final Sound Pressure Levels to occur during HEPP Site Construction

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Crawler Loader	50	55.50	55.45	55.27	54.56
	100	49.46	49.37	49.01	47.59
	250	41.46	41.23	40.34	36.77
	500	35.36	34.92	33.13	25.99
	1000	29.19	28.30	24.73	10.46
	2000	22.87	21.09	13.95	-14.60
	3000	19.06	16.38	5.67	-37.16
Truck	50	55.13	55.08	54.90	54.19
	100	49.09	49.00	48.64	47.22
	250	41.09	40.86	39.97	36.40
	500	34.99	34.55	32.76	25.62
	1000	28.82	27.93	24.36	10.09
	2000	22.50	20.72	13.58	-
	3000	18.69	16.01	5.30	-
Excavator	50	56.03	55.98	55.80	55.09
	100	49.99	49.90	49.54	48.12
	250	41.99	41.76	40.87	37.30
	500	35.89	35.45	33.66	26.52
	1000	29.72	28.83	25.26	10.99
	2000	23.40	21.62	14.48	-
	3000	19.59	16.91	6.20	-
Concrete Pump	50	53.03	52.98	52.80	52.09
	100	46.99	46.90	46.54	45.12
	250	38.99	38.76	37.87	34.30
	500	32.89	32.45	30.66	23.52
	1000	26.72	25.83	22.26	7.99
	2000	20.40	18.62	11.48	-
	3000	16.59	13.91	3.20	-
Transmixer	50	55.29	55.24	55.06	54.35
	100	49.25	49.16	48.80	47.38
	250	41.25	41.02	40.13	36.56
	500	35.15	34.71	32.92	25.78
	1000	28.98	28.09	24.52	10.25
	2000	22.66	20.88	13.74	-
	3000	18.85	16.17	5.46	-
Rockdrill	50	57.16	57.11	56.93	56.22
	100	51.12	51.03	50.67	49.25
	250	43.12	42.89	42.00	38.43
	500	37.02	36.58	34.79	27.65
	1000	30.85	29.96	26.39	12.12
	2000	24.53	22.75	15.61	-
	3000	20.72	18.04	7.33	-
Tractor	50	53.85	53.80	53.62	52.91
	100	47.81	47.72	47.36	45.94
	250	39.81	39.58	38.69	35.12
	500	33.71	33.27	31.48	24.34
	1000	27.54	26.65	23.08	8.81
	2000	21.22	19.44	12.30	-
	3000	17.41	14.73	4.02	-

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz
Compressor	50	50.53	50.48	50.30	49.59
	100	44.49	44.40	44.04	42.62
	250	36.49	36.26	35.37	31.80
	500	30.39	29.95	28.16	21.02
	1000	24.22	23.33	19.76	5.49
	2000	17.90	16.12	8.98	-
	3000	14.09	11.41	0.70	-
Generator	50	42.03	41.98	41.80	41.09
	100	35.99	35.90	35.54	34.12
	250	27.99	27.76	26.87	23.30
	500	21.89	21.45	19.66	12.52
	1000	15.72	14.83	11.26	-
	2000	9.40	7.62	0.48	-
	3000	5.59	2.91	-	-

To calculate A-weighted noise levels, correction factors given in **Chapter V, Table 5.1.24.8** are used.

The results of noise level calculation for each noise sources for 4 octave bands by using the correction factors given in **Chapter V, Table 5.1.24.8** and total noise levels calculated by using the equation given below are presented in the following table.

$$L_T = 10 \log \Sigma 10^{Li/10}$$

where;

Lt: Total noise level
Li: Noise source corrected noise level

Table 5.1.24.22. Total Noise Level in HEPP Site Construction Phase

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
Crawler loader	50	52.30	55.45	56.47	55.56	61.22
	100	46.26	49.37	50.21	48.59	54.86
	250	38.26	41.23	41.54	37.77	46.05
	500	32.16	34.92	34.33	26.99	39.01
	1000	25.99	28.30	25.93	11.46	31.70
	2000	19.67	21.09	15.15	0.00	24.07
	3000	15.86	16.38	6.87	0.00	19.44
Truck	50	51.93	55.08	56.10	55.19	60.85
	100	45.89	49.00	49.84	48.22	54.49
	250	37.89	40.86	41.17	37.40	45.68
	500	31.79	34.55	33.96	26.62	38.64
	1000	25.62	27.93	25.56	11.09	31.33
	2000	19.30	20.72	14.78	0.00	23.70
	3000	15.49	16.01	6.50	0.00	19.07
Excavator	50	52.83	55.98	57.00	56.09	61.75
	100	46.79	49.90	50.74	49.12	55.39
	250	38.79	41.76	42.07	38.30	46.58
	500	32.69	35.45	34.86	27.52	39.54
	1000	26.52	28.83	26.46	11.99	32.23

Noise Sources	Distance	500 Hz	1000 Hz	2000 Hz	4000 Hz	Total Noise Level
	2000	20.20	21.62	15.68	0.00	24.59
	3000	16.39	16.91	7.40	0.00	19.96
Concrete Pump	50	49.83	52.98	54.00	53.09	58.75
	100	43.79	46.90	47.74	46.12	52.39
	250	35.79	38.76	39.07	35.30	43.58
	500	29.69	32.45	31.86	24.52	36.54
	1000	23.52	25.83	23.46	8.99	29.23
	2000	17.20	18.62	12.68	0.00	21.61
	3000	13.39	13.91	4.40	0.00	17.00
Transmixer	50	52.09	55.24	56.26	55.35	61.01
	100	46.05	49.16	50.00	48.38	54.65
	250	38.05	41.02	41.33	37.56	45.84
	500	31.95	34.71	34.12	26.78	38.80
	1000	25.78	28.09	25.72	11.25	31.49
	2000	19.46	20.88	14.94	0.00	23.86
	3000	15.65	16.17	6.66	0.00	19.23
Rockdrill	50	53.96	57.11	58.13	57.22	62.88
	100	47.92	51.03	51.87	50.25	56.52
	250	39.92	42.89	43.20	39.43	47.71
	500	33.82	36.58	35.99	28.65	40.67
	1000	27.65	29.96	27.59	13.12	33.36
	2000	21.33	22.75	16.81	0.00	25.72
	3000	17.52	18.04	8.53	0.00	21.08
Tractor	50	50.65	53.80	54.82	53.91	59.57
	100	44.61	47.72	48.56	46.94	53.21
	250	36.61	39.58	39.89	36.12	44.40
	500	30.51	33.27	32.68	25.34	37.36
	1000	24.34	26.65	24.28	9.81	30.05
	2000	18.02	19.44	13.50	0.00	22.42
	3000	14.21	14.73	5.22	0.00	17.81
Compressor	50	47.33	50.48	51.50	50.59	56.25
	100	41.29	44.40	45.24	43.62	49.89
	250	33.29	36.26	36.57	32.80	41.08
	500	27.19	29.95	29.36	22.02	34.04
	1000	21.02	23.33	20.96	6.49	26.73
	2000	14.70	16.12	10.18	0.00	19.13
	3000	10.89	11.41	1.90	0.00	14.57
Generator	50	38.83	41.98	43.00	42.09	47.75
	100	32.79	35.90	36.74	35.12	41.39
	250	24.79	27.76	28.07	24.30	32.58
	500	18.69	21.45	20.86	13.52	25.54
	1000	12.52	14.83	12.46	0.00	18.26
	2000	6.20	7.62	1.68	0.00	10.94
	3000	2.39	2.91	0.00	0.00	7.55

Considering the worst case scenario, equivalent noise levels for the case that all noise sources operate simultaneously are calculated and given in the following table. For this purpose, the following equation is used and calculations are performed considering the number of equipment.

L_{day} noise levels **(L_{day} = L_{eq})** are calculated by use of the following equation and given in Table 5.1.24.23.

$$L_{eq}=10\ log\Sigma 10^{\,LT(i)\,/10}$$

Table 5.1.24.23. L_{day} Levels to occur during HEPP Site Construction

Distance	L_{day} (dBA)
50	70.86
100	64.50
250	55.69
500	48.65
1000	41.34
2000	33.72
3000	29.11

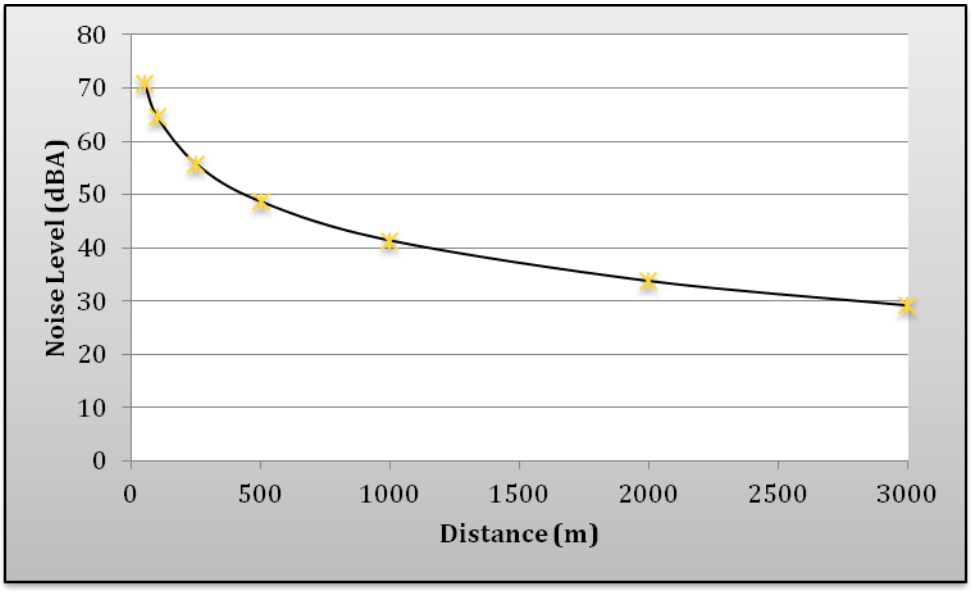


Figure 5.1.24.3. Distribution of Noise to occur during HEPP Site Construction

Calculations are done by considering that all construction equipment to work at the same location. However, these vehicles and equipment will be working at different locations. Besides, all of these equipment will not work simultaneously. Hence, noise level at the nearest settlement will be lower.

In the (a) item of 22nd article of the relevant regulation, it is mentioned that “Noise level generated by an facility or plant should not exceed the standards given in Table-4 of Appendix-VIII of this regulation”. Environmental Noise Level Standards for construction sites are given in **Chapter V, Table 5.1.24.11**. The nearest settlement to the project site is Tokatlar Village that is 1 km far away from the project site. As can be seen from **Table 5.1.24.23,** daily noise level at a distance of 100 m from the project site will be lower than 70 dBA. Therefore, noise to generated at the project site will not affect the nearest settlement.

In addition, necessary measures will be taken by the investing company to control the noise to be generated due to project activities.

In relation to noise, necessary measures shall be taken in accordance with “Regulation on Occupational Health and Safety” published in the Official Gazette dated 09/12/2003 and numbered 25311. As stated in the regulation employees working at the project site shall use the provided headphones to compensate for the noise, and the other provisions of the regulation shall be complied with.

Besides, all the issues stated in “Regulation on Assessment and Management of Environmental Noise” published in the Official Gazette dated 04.06.2010 and numbered 27601 shall be complied with during the project activities.

Effect of Vibration due to Blasting on he Environmental Structures

The main purpose of the blasting operation to be performed at site is to loosen the rocks by breaking. In this process, the removal of rocks is ensured by the seismic waves emitted from the explosives. Fading distance of the seismic waves propagated in the rock differs with respect to the type and structure of rock. However it may cause damage on the structures that take place within the fading distance of this energy and may disturb the residents. These environmental problems indicate that not all energy of the explosives is used for fragmentation. The effects resulting from blasting is composed of the movement of the remaining part of the energy released during blasting after fragmentation and translation process in rock and atmosphere. Considering this fact, a blasting design that is free of environmental effects can also be regarded as a design minimizing the environmental effects by making the best of explosive energy.

Propagation of vibration to occur during blasting to far distances is a function of the hole charge and the rock structure and geology around settlements. Vibration waves to occur after blasting propagates as regular in homogenous structures, whereas fading distance becomes small in fractured or faulted units.

The effects of vibration to occur as a result of blasting on environmental structures is determined by Devine equation (Devine, 1966).

$$V = k \times (D / \sqrt{W})^{-1.6}$$

where;

V : vibration velocity in rock (in/s)
k : coefficient depending on rock type
D : effective distance between blasting location and surrounding settlement areas (ft)
W : charge weight per delay(lb)

K coefficient is the capacity of rock to transmit vibration. The differences in the units between blasting source and the sensitive area and the density of discontinuities, such as fracture, fault, cracks, etc., determines the value of “k” coefficient. The coefficient approaches to 260 in homogeneous units, while it approaches to 25 due to the units where tectonic effects are abundant and to the increasing number of different units. In the calculations, k coefficient was taken as 260 assuming that the units are homogenous and non-fractured (at maximum distance). The results of the calculations are given in Table 5.1.24.32.

Table 5.1.24.24. The Effect of Vibration in Rock on Environmental Structures

K (coefficient)	D (m)	W (kg)	V (in/s)	V (mm/s)	Vo(mm/s)	
					1/5V (mm/s)	1/2V (mm/s)
260	50	2.31	0.274	6.960	1.392	3.480
260	60	2.31	0.205	5.207	1.041	2.604
260	70	2.31	0.160	4.064	0.813	2.032
260	80	2.31	0.129	3.277	0.655	1.638
260	90	2.31	0.107	2.718	0.544	1.359
260	100	2.31	0.091	2.311	0.462	1.156
260	110	2.31	0.078	1.981	0.396	0.991
260	120	2.31	0.068	1.727	0.345	0.864
260	130	2.31	0.060	1.524	0.305	0.762
260	140	2.31	0.053	1.346	0.269	0.673
260	150	2.31	0.048	1.219	0.244	0.610
260	160	2.31	0.043	1.092	0.218	0.546
260	170	2.31	0.039	0.991	0.198	0.495
260	180	2.31	0.036	0.914	0.183	0.457
260	190	2.31	0.033	0.838	0.168	0.419
260	200	2.31	0.030	0.762	0.152	0.381
260	210	2.31	0.028	0.711	0.142	0.356
260	220	2.31	0.026	0.660	0.132	0.330
260	230	2.31	0.024	0.610	0.122	0.305
260	240	2.31	0.023	0.584	0.117	0.292
260	250	2.31	0.021	0.533	0.107	0.267
260	300	2.31	0.016	0.406	0.081	0.203
260	350	2.31	0.013	0.330	0.066	0.165
260	400	2.31	0.010	0.254	0.051	0.127
260	450	2.31	0.009	0.229	0.046	0.114
260	500	2.31	0.007	0.178	0.036	0.089

Note: 1 feet = 0.3048 , 1 lb = 0.4536 , 1 in = 25.4 mm

where;

V : vibration velocity with respect to distance (mm/s)
Vo : vibration velocity at the base of the building, Vo is assumed as 1/2 - 1/5 of the vibration velocity in rock.

Table 5.1.24.25. Building Types that may be damaged due to Blasting versus Vibration Velocity at the Base of Building (Vo) (Forssbland, 1981)

Building Type	***Vo (mm/s)***
a- Dilapidated very old historical buildings	*2*
b- Plastered briquette, brick, masonry houses	*5*
c- Reinforced concrete buildings	*10*
d- Very strong industrial buildings, such as factories	*10-40*

The closest settlement area along the tunnel is Toklar Village that is 1 km far away from tunnel entrance. The most sensitive buildings located in the nearest settlement area is assumed to be “b” type building given Table 5.1.24.33, thus Vo velocity should not exceed 5 mm/s. The results of the modeling studies is given in Table 5.1.24.32. Vo velocity is assumed as 1/2 - 1/5 of the vibration velocity in rock (V). In this study, Vo velocity is taken as 1/2V with respect to the maximum effect. According to this, after the first 50 m from the blasting point, vibration velocity is reduced below 5 mm/s with the effect of 2.3 kg of charge. Therefore, the

settlement areas in the vicinity of the project site will not be affected due to blasting activities to be performed at the tunnel.

Calculation of damage to buildings in terms of vibration amplitude

The amplitude of vibrations resulting from blasting is calculated by the following equation (Armac Printing Company).

$A = (K\sqrt{W}) / D$

where;

A : maximum vibration amplitude resulting from blasting (mm)
W : amount of explosive detonated per delay (kg)
D : distance between detonation source and surrounding settlements (m)
K : coefficient depending on rock type

K coefficient is selected based on the values given in **Table5.1.24.26**.

Table 5.1.24.26. Maximum and Minimum Values of K Coefficient Depending on the Rock Type to be Blasted and the Rock Type at the Base of the Building (Armac Printing Company)

EXAMINATION OF THE DAMAGES ON BUILDINGS IN TERMS OF AMPLITUDE OF OSCILLATION

Unit to be Blasted	Rock Type at the Base of Building	k Coefficient	
		Minimum	Maximum
Rock	Rock	0.57	1.15
Rock	Clay (Soil)	1.15	2.3
Clay (Soil)	Rock	1.15	2.3
Clay (Soil)	Clay (Soil)	2.3	3.4

Since it is known that no damage occurs at buildings when vibration amplitude is taken as 0.05 mm, the detonations made with a maximum instant charge (40.8 kg), the distance of influence is calculated as:

$D = (K \sqrt{W}) / A$
$= (1.15 \sqrt{2.3}) / 0.05 =$ 34.96 m

Therefore, the settlement areas in the vicinity of the project site will not be affected due to the vibrations to occur as a result of blasting activities to be performed.

V.1.25. Starting from land preparation until the commissioning of units; the housing and other technical/social requirements of the personnel to be employed in these works, where and how these requirements will be provided

In the scope of Onur HEPP and Onur Regulator project; it is planned to employ 75 person in the construction phase to perform land preparation and construction works, while in it is planned to employ 10 person in the operation phase. The needed utility water will be provided from Toklar Village. Most of the workers, who will be working throughout the construction period that will last for 3 years, will be employed from local people. So that, both employment opportunity will be provided to local people and the cost of staff housing will be reduced by the investor.

Another benefit of the project in terms of local economy is that all food and other requirements of the personnel to work in the construction and operation phase is to be supplied from the region. Hence, this will be an additional source of income for local people. It is planned to install a construction site, which includes cafeteria, kitchen, dressing room, shower, toilet, sink, storage, administrative and technical offices, to meet all technical and social infrastructure needs of the personnel to be employed in the construction phase of the project. In the end of the construction phase this installation will be removed completely.

V.1.26. Among the works to be carried out starting from the land preparation until the commissioning of the units those which are risky and dangerous for human health and environment (in case blasting is to be performed, commitment for not using gallery method for blasting, assessment of the effects of explosives on groundwater, and indirectly on water, explanation of other alternatives to blasting, where to store explosives), the measures to be taken to protect human, public, and environmental health, explanations related to emergency action plan

During the works to be performed within the scope of Onur HEPP and Onur Regulator project, blasting will be done and heavy construction equipment will be used. The possible risks of accidents based on the used technology and materials might occur due to blasting, inappropriate use of machine-equipment, and carelessness of workers and worker failure to comply with safety regulations, not taking the necessary measures, not using security tools and equipment. In order to minimize possible occupational accidents, qualified workers will be employed and employees will be trained against occupational accidents. Warning signs will be placed within the construction site to prevent accidents and protective equipment will be supplied to workers.

During the blasting process, which can be dangerous to human health, all personnel will be taken out of the area, excavation will start after making necessary checks. Blasting will definitely be not performed by using gallery method.

In terms of bedrock, the lower and upper strata of the project site are unbedded or very thick-bedded, whereas its middle strata are thick-bedded, brittle and very fractured. Making blasting at or in the vicinity of the discharge points of sources discharging from fractured or cracked aquifers may have positive or negative effects on regional groundwater. The positive effect of blasting on groundwater is to create new cracks and fractures that sustains flow of groundwater to surface, whereas the negative effects are formation of new groundwater flow paths after blasting and decrease in source discharge. The blasting operations to take place in the scope of the project are not expected trigger the underground cracks or fractures, and the water flow to occur as a result of this is determined not to effect the tunnel excavation (Source: Feasibility Report of Onur Regulator and HEPP Project).

In addition, in case of transition of fault-fraction zones, permanent-temporary shoring applications will be held. In this context, any adverse effect on groundwater due to the explosions to be made in the tunnel is out of question.

During use of the heavy construction equipment, workers will not be allowed to come up to vicinity of the equipment, and warning signs will be placed to prevent citizens from entering the quarry area. During construction operations, workers shall be supplied with personal protection tools, such as helmets, headphones, eyeglasses, etc. by the business owner and use of these tools shall be made mandatory.

Formation of occupational accidents due to loss of concentration shall be prevented by providing short breaks during working hours.

Of the occupational safety measures to be taken by the operator; careful selection of personnel to use machinery and equipment to be used in the facility, taking the necessary security measures within the operation site, supplying material that are suitable for these measures, determination of the boundaries of the production sites with appropriate tools and materials, and providing appropriate training to the works, take place.

A vehicle shall be ready at the project site to be used for possible occupational accidents. Emergency action plan is given in Chapter VIII.1.

Within the scope of the project, the provisions of "Labor Law" put into force by being published in Official Gazette dated 22.05.2004 and numbered 4857, "Regulation on Health and Safety Requirements for the Use of Work Equipment" put into force by being published in Official Gazette dated 11.02.2004 and numbered 25370, "Regulation on Health and Safety Requirements for Underground and Surface Mines" put into force by being published in Official Gazette dated 21.02.2004 and numbered 25380, "Bylaw Concerning the Methods and Principles for Production, Importation, Transportation, Keeping, Storage, Sale, Use, Disposal, Audit of Explosives and Hunting Materials that are Un-monopolized" put into force by being published in Official Gazette dated 29.09.1987 and numbered 19589, and "Bylaw Concerning Precautions to be taken in Work Places Operating with Flammable, Explosive, Dangerous and Hazardous Substances" put into force by being published in Official Gazette dated 24.12.1973 and numbered 14752 will be complied with.

V.1.27. In the project site; the size of the area to form landscaping elements and other landscaping arrangements (plantation and/or green area arrangements, etc.), how to perform these activities, types of plants and trees to be used for this purpose, (Excluding the site where main structures are built during the construction works, the measures to be taken not to damage the existing water, sewer system, communication and electricity networks, and other infrastructure facilities during the landscaping works to be done in a limited area)

In the beginning of the construction phase of the project, at the entrance and exit of the transmission tunnel and around the HEPP reforestation will be made both to prevent erosion and to form landscape elements compatible with the environment. At the areas that are considered to be forest land, reforestation will be made in coordination with the Forest Sub-District Directorate of Reşadiye. For landscaping purposes, the surrounding of powerhouse will be planted in accordance with the natural structure, and some parts will be covered with grass. Since no infrastructure takes place within the area of concern, negative effects on such structures is out of question. No landscaping work has been considered other than this.

V.1.28. Determining the possible impacts on cultural and natural assets under and over the ground (traditional urban texture, archeological relics, natural values to be protected, historical structures, mills, churches, mosques, and such similar areas and their protection status) located at and in the vicinity of the project site (including the surroundings of material quarries, concrete plants, and crushing-screening-washing plants), measures to be taken

There exist no registered cultural property at or around the project site. However, in case a cultural or natural asset is encountered during the construction phase, the nearest Administrative Authorities and the Directorate of Museum will be informed pursuant to the 4th article of the Law numbered 2863. The opinion of Regional Board Directorate of Cultural and Natural Heritage of Sivas is presented in **Appendix: 16-c**.

Excluding the site where main structures are built during the construction works, necessary measures shall be taken not to damage the existing water, sewer system, communication and electricity networks, and other infrastructure facilities during the landscaping works to be done in a limited area,.

Roads to be used for access and material transportation shall be maintained such that the transportation during winter and rainy seasons is not disturbed. New access roads that are needed for construction shall not be planned so as to form adverse effects on the existing routes. In case of road renovation, the new roads to be constructed at the main routes shall be high above the quality of the current roads. In case the road route has to pass through forested area, the road width shall be kept as minimum. In addition, considering the tourism potential of the region where project site takes place, necessary measures shall be taken to ensure the visual compliance of the facility with the general structure of the environment.

Losses due to impedance of village access routes, possible damages on roads, distortion of village channels, the damages that may occur in the drinking water network and other possible damages shall be compensated by the business owner pursuant to the Provincial Special Administration Law numbered 5302.

The general characteristics of the project site is degraded oak coppice and stony rocky stand. The trees within the degraded oak coppice are very sparse, their density has been fell below 10%, and at most places they have grown in bushy form. Since transmission tunnel will pass through the hilly forested area, grazing and cutting of trees shall only take place at the entrance and exit of the transmission tunnel, and these activities shall be held after taking necessary permissions from the General Directorate of Forestry.

V.1.29. Other issues

There exist no issue to be assessed under this section.

V.2. Acitivities in the operation phase of the project, impacts on physical and biological environment and measures to be taken

V.2.1. Properties, coordinates, satellite and photographic images of all units within the project scope (if exists, information related to energy transmission line, its voltage, length, properties, where to be connected, etc.), their display, what activities to be performed at what units, their capacities, goods and/or services to be produced in the units, production quantities of final and by-products, protective measures to be taken at the sides of regulator lake, forebay pool, etc.

Onur Regulator and HEPP are situated between 4 483 000 north and 352 000 east coordinates, and between 4 488 000 north and 354 000 east coordinates in 1/25,000 scaled Tokat H38 – b1 numbered map. Location map displaying the project site is given in **Appendix:1,** and the pictures of the project site are presented in **Appendix:21.**

Properties of the Units to take place in the Project

Regulator; Regulator is full-bodied and free flowing. Water level was selected as 1180 m. Thalweg elevation is 1165.50 m at the regulator axis. The grading elevation of the surroundings of the regulator is determined as 1182.6 m to confront 100 years flood flow of 146.4 m^3/s at the spillway securely and without forming freeboard. The crest length of regulator is 34 m and height from thalweg is 14.50 m. Plans and cross sections of the regulator location are given in **Appendix:6.** Security signs including the necessary warning and safety signs shall be placed around the regulator. All safety measures shall be taken by

the investing company. In addition, to prevent filling of lake area as a result of erosion and landslides, retaining walls will be established at the sides of lake.

Onur Regulator

Aim	:Energy Production
Type	:Cross Flow, Full-Bodied
Drainage Area	:196.50 km^2
Flow of the Project	:10 m^3/s
Crest Elevation	:1180 m
Crest Length	:34 m
Thalweg Elevation	:1165.50 m
Landscaping Elevation	:1182.6 m
Normal Water Elevation	:1180 m
Elevation ofWater Stilling Basin	:1163 m

Gravel Pass

Threshold Elevation	:1166.6 m
Foundation Elevation	:1164
Number of Gates	:2
Width of Gate	:3 m
Size of Gate	:3 m x 4 m

Water Acquisition Structure and Sedimentation Pool; It is required to built a sedimentation pool so as the sediments coming from the river basin of Onur Regulator do not affect the benefits of the project. Therefore, the flows converted in the regulator are planned to be taken to the pool to be built in the left bank. It is planned to pass water from a screened and gated structure, and pass it to the sedimentation pool and then to the transmission tunnel. The minimum particle diameter is considered to be 0.3 mm. At the end of the sediment pool, a discharge pipe is planned to be built which will provide the discharge of sediments to the streambed.

Water Acquisition System and Sedimentation Pool

Water Acquisition Threshold Elevation	: 1171 m
Water Acquisition System Width	: 2 m x 3 m
Sedimentation Pool Length	: 46 m
Sedimentation Pool Width	: 2 m x 3 m
Number of Sedimentation Pool Gates	: 2
Slope of the Sedimentation Pool	: 0.01
Diameter of the Sediment Particles	: 0.30 mm

Energy Tunnel: The energy tunnel is planned to begin subsequent to the sedimentation pool, and inside of the tunnel is planned to be built as circular and the outside as horseshoe with concrete cover on it. The inside caliber of the tunnel is planned as 4 m, coating thickness as 0.3 m, the entrance axis elevation as 1173.9 m, exit axis elevation as 953.5 m, tunnel length as 3133.43 m, and the slope as 0.00 - 0.08. Plans and cross sections of the transmission tunnel are given in **Appendix:7**

Tunnel Inside Caliber	: 4 m
Coating thickness	: 0.3 m
Entrance axis elevation	: 1173.9 m
Exit axis elevation	: 953.5 m
Tunnel length	: 3133.43 m

Penstock and Cleats : Subsequent to the transmission tunnel, it is planned to start penstock. The caliber of penstock is planned to be 2 m for the proposed project flow. Average wall thickness of penstock is planned to be 14.5 mm and total length of penstock is planned to be 324.06 m.

Caliber of Penstock	:2 m
Average Wall Thickness of Penstock	:14.5 mm
Total Length of Penstock	:324.06 m

Powerhouse and Tailwater Channel: Onur HEPP is planned to be at 955.00 m tailwater elevation, the length of powerhouse is planned as 29.4 m, and the width as 18.7 m. Water coming out of the power plant is planned to be sent to the streambed. The location map of the powerhouse is presented in **Appendix: 8**.

Tailwater Elevation	:955.00 m
Length of Powerhouse	:29.4 m
Width of Powerhouse	:18.7 m
Height of Powerhouse	:27.10 m

Turbine Type, Power of the Unit and Quantity: For Onur HEPP, which is planned to have 225.00 m gross head and 10 m^3/s project flow, two vertical axis Francis turbines with 19,568 MW of total installed power (2 x 9,784 MW) are thought to be required.

Total Installed Power	:19,568 MWe (20.82 Mwm)
Number of Units	:2
Turbine Type	:Francis Vertical Axis
Gross Head	:225.00 m
Net Head (for project flow)	:428.96 m
Installed Power of Units	:2 x 9,784 MW
Synchronous Speed	:750 rev/min
Specific Speed	:99.46 m-kW
Turbine Output	:0.92

Generator Type and Capacity: Generators will be vertical axis, salient-pole, three phased.

Type	:3 Phased SynchronousGenerator
Quantity	:2
Power	:2 x 10,900 kVA
Power factor	:0.90
Frequency	:50 Hz
Number of Poles	:6 pair (12 item)
Numberof Revolutions	:750 rev/min
Generator Output	:0.98

Transformer Type and Quantity:

Transformers

Unit Transformers:

Quantity	:2
Type	:External, 3 Phased, Grease Insulated
Constant Power	:2 x 11,000 kVA
Nominal Voltage	:6.3 / 34.5 kV (+/- 2 x 2.5 %)
Frequency	:50 Hz

Linkage Group	:YNd 11
Cooling Form	:Onan
Output	:0.99

Internal Transformers:

Quantity	:2
Type	:Internal, 3 Phased, Dry or Silicon Grease
Constant Power	:400 kVA
Nominal Voltage	:6.30 (+/- 2 x 2.5 %) / 0.4 kV
Frequency	:50 Hz
Linkage Group	:Dyn 5

Energy Transmission Line and Switchyard: Electricity produced at the power plant is planned to be connected to Tuna HEPP River Basin Transformer Center's medium voltage dam. Within this scope, energy transmission line will be 9 km.

Onur Regulator and HEPP project has been designed by using recent hydraulic data. With respect to the properties of the facilities, energy generation rates of Onur Regulator and HEPP are given below.

Reliable Energy	: 3,485 GWh/year
Secondary Energy	: 39,364 GWh/year
Total Energy	: 42,848 GWh/year

Electricity produced at the power plant is planned to be connected to Tuna HEPP River Basin Transformer Center's medium voltage dam. Within this scope, energy transmission line will be 9 km.

Satellite and photographic images showing the current situation of the units taking place within the project are presented in **Appendix: 21**. In this project, energy is the final product, whereas any by-product formation is out of question within the scope of the project.

V.2.2. Calculation of water to be released to downstream (river basin flows, precipitation-flow relation, ecological potential, fish species protected by national and international legislation and their possible requirements, properties of the river basin, seasonal needs of river habitat, joining tributaries, if available their flow rates, condition of river bed and cross-section, other water rights devising at the basin, hydrological characteristics of the basin, its ecological potential, spill water and their periods should also be considered including the recommended amount of other environmental flow for other facilities, if any), information on the structure to release environmental flow, average flow rates of the last 10 year, regulator site flow duration curve and/or table, water rights (drinking-utility or use for other purposes) should be taken into attention. Preparation of Water Use Rights Report (approved by related institution) and presentation of the report to be prepared according to the Assessment Report Format for HEPP Projects and Other Hydraulic Activity Requests and in accordance with the letter of the General Directorate of Nature Conservation and National Parks dated 15.03.2011 and numbered 21767 in the attachment of the EIA Report, total amount determined in the report will be done according to this amount. Locations of gauging stations for measuring the amount of water at the upstream and the amount to be released o downstream, drawings showing the catchment area, gauging stations (equipment of the station with GPRS modem devices) and downstream environmental flow outlet location, commitment to act in accordance with the Feasibility Report approved by SHW and Water Use Rights Report

Onur Regulator and Onur HEPP Project is placed in Central Black Sea Region, within Yeşilırmak River Basin, within the boundary of Reşadiye District of Tokat Province, about 9 km northwest of this district, on Zinav Stream that is a branch of Kelkit River, an important branch of Yeşilırmak River.

Local small-scale water use may occur due to the settlements surrounding Zinav Stream basin. The branches join to Zinav Stream at the downstream of project sections. Therefore, the flows in the river bed at the downstream of project sections may be sufficient. Because the transmission system of the project is short, it is considered that the project is effective only at an area of 1 km^2 and that the surrounding settlements may supply their small-scale water use from tributaries. As a result, no significant water right exists within the basin of Zinav Stream. The water taken into the regulator will pass through the tribunes and released back to Zinav Stream, thus this project, aiming energy generation, do not pose any water right trouble. In accordance with the statement of SHW: “The amount of water to be released to downstream to sustain natural life should be at least 10% of the last 10 years’ average flow rate forms the basis for the project”, the amount of environmental flow was found as 0.277 m^3/s. As for the site of Onur Regulator, considering that the annual average flow rate (1966-2009) is 3,218 m^3/s, environmental flow is determined as 0.450 m^3/s for June-July-August and 0.350 m^3/s for the other months, and any adverse condition is not expected at the lake with constant release of this amount of water to the stream. In the tables below, the values recommended by the experts, which is also committed by the company, are given.

Table 5.2.2.1 General Averages of Monthly Average Flow Rates of Onur Regulator

	Percent (%)	**General Average**
Onur Regulator Monthly Average Flow Rates	0.322 m^3/s (%10)	3,218 m^3/s

Table 5.2.2.2 The Amount of Environmental flow Recommended by the Experts Preparing Ecosystem Report

	Percent (%)	Average
Prof.Dr.Latif KURT Plant Ecologist	0.322 m^3/s (%10)	3,218 m^3/s
Prof. Dr. Serdar BAYARI Hydrogeologist	0.322 m^3/s (%10)	3,218 m^3/s
Prof. Dr. Nuri YİĞİT Fauna Specialist	0.322 m^3/s (%10)	3,218 m^3/s
Assist. Prof. S. Cevher ÖZEREN Hydrobiologist	0.418 m^3/s (%13)	3,218 m^3/s

Table 5.2.2.3 The Amount of Environmental flow Committed by the Company

	Percent (%)	Average
The amount of environmental flow committed by the Company	0.350 m^3/s (%10.87)	3,218 m^3/s
The amount of environmental flow committed by the Company (for June-July-August period)	0.450 m^3/s (%13.99)	3,218 m^3/s

There exists no gauging station on Zinav Stream where Onur Regulator and HEPP is to be built. However, Karakuş River is found in the northwest of Zinav Stream. Considering that the basins of these rivers are neighbor and they are fed at approximately the same altitude, 14-122 and 14-121 numbered gauging stations that are located on Karakuş River are used to calculate flow rate at Onur Regulator site. Also, observations of 14-121 and 14-117 (14-32) numbered gauging stations were utilized to complete the years that are lacking for 14-122 numbered gauging station. Natural flow rates at Onur Regulator site was calculated by utilizing 14-122 numbered Karakuş Brook-Gökçebayır gauging station's extended daily average flow rates and by taking the ratio of drainage area (196.50 km^2 / 363.00 km^2). The flow rate data of Onur Regulator site that is formed by this approach is presented in **Appendix: 16-g** (1966-2009) as approved by SHW.

Long-term (44 years, 1966-2009) annual average flow rate of Onur Regulator site is 3,218 m^3/s. Minimum and maximum values of the long-term annual average flow rate are 0.021 m^3/s and 18,720 m^3/s, respectively. On the other hand, long-term monthly average flow rates range between 0.672 m^3/s (in August) and 8,111 m^3/s (in April) (Chart 3).

In Figure 4.2.7.1, monthly average flow rates of Onur Regulator site is compared with Bereketli meteorological station's monthly average precipitation amounts. It can be observed from the chart that flow rates of Onur Regulator site is affected in the first months (March) of spring due to melting of snow at high elevations. In the rest of the year, flow rates that is parallel to the amount of precipitation observed at Bereketli station. The lowest precipitation and flow rate data are observed in July-August.

There exists no project, other than energy generation, that has been developed or planned to be developed in relation to water use within the basin of Zinav Stream and at the project site. Since any settlement area that can be considered as significant is not found at the project site, there is no drinking-utility water or irrigation water requirement. There is no water requirement other than for energy generation and water use is out of question.

When water taken into the regulator reaches to sufficient level, it will be given to the transmission tunnel that is 3133.43 m in length. Penstock begin at the 2824.85 m of the transmission tunnel. The total length of penstock is 324.06 m, 308.58 m of which will be built inside the transmission tunnel and 15.48 m will be built outside the tunnel to pass underground. Water sent to the power plant system by penstock will carry out totally 42,848 GWh of annual energy production by means of turbines. Tailwater coming out at the end of the system will be given to the stream flow without any change in the initial amount. So, there will not be any alteration of flow in Zinav Stream.

Gauging station shall be equipped with GPRS modem devices in the operation phase of the project and during all phases of the project the Feasibility Report approved by SHW and Water Use Rights Report (**Appendix:18**) shall be complied with.

V.2.3. Possible effects on water quality and aquatic organisms (species and ecological inventory within the route where environmental flow to be released) due to use of resource where water to be supplied, information on transition systems for determined fish species and sketch showing the outlet location of downstream environmental flow (bearing arrangement for movement of fish between upstream and downstream, according to assessment results taking opinion of related institutions, when fish pass and ladder start operating, being functional as such the inside is completely filled and the chambers are overflowing, installation of additional equipment that sustain temporarily migrating fish species to find fish pass approach, not using the entrance and exit of fish pass as hunting area)

Onur HEPP project is located on Zinav Stream that feeds Zinav Lake. Water transmission will occur from Zinav Stream to the regulator through transmission tunnel. For protection of ecological balance, the system will constantly release 0.450 m^3/s of environmental flow during June-July-August months and 0.350 m^3/s during the other months to the stream without taking it into regulator system.

Releasing required amount of water to the streambed is important in terms of continuity of Riparian vegetation. As the channel system is planned as a tunnel, damages on habitats will be out of question. Accomplishing the activities in construction phase precisely and taking the necessary measures will reduce the negative effects on floristic diversity. Restoration of the areas to be affected by construction activities in accordance with the principles of “Ecological Restoration” is assumed to reduce adverse effects on floristic diversity to minimum.

In order to sustain biological diversity of aquatic organisms, it is necessary to determine the optimum environmental flow rates at the area of Regulator and HEPP that is planned to be built. In accordance with the existing data related to project site, Montana-Tenant Hydraulic Method and Wet Environment Hydraulic Ratio Method was applied to calculate ‘Environmental Flow Rate’ (see Ecosystem Report).

In Montana Method, the flow rate within a year is assessed separately for October-March and April-September periods by considering wet and dry months and water requirement amount of aquatic habitat. Disregarding the shifts in wet and dry months of other regions of the world and the different internal flow condition requirements of different species in aquatic habitat (e.g. flow rate, water depth) are major weaknesses of the method.

Freshwater fish species identified at the field and the minimum water depth (m) and current velocity (m/s) required by these species to live are given in Table 5.2.3.1.

Table 5.2.3.1. Species Identified at Site and the Minimum Depth (m) and Current Velocity (m/s) of Habitat They Require

Fish Species	Minimum Depth Required (m)	Minimum Current Flow Required (m/s)
Alburnoides bipunctatus	0.15	0.20
Barbus tauricus	0.15	0.25
Capoeta banarescui	0.15	0.20
Squalius cephalus	0.15	0,20
Oxynemacheilus sp.	0.10	0.15

The results of the hydrogeological assessments done in accordance with Montana (Tenant) and Wet Environment Methods showed that QÇA_e flow rates of 1.0 m^3/s for the period between June-February and 1.8 m^3/s for the period between March-May, which is requested by the Ministry of Forestry and Water Affairs, the General Directorate of Nature Preservation and National Parks, are sufficient to overcompensate the required conditions for aquatic continuity.

In case QÇA_e flow rates of 1.0 m^3/s for the period between June-February and 1.8 m^3/s for the period between March-May, which is requested by the Ministry of Forestry and Water Affairs, the General Directorate of Nature Preservation and National Parks, is released to the streambed at the regulator site, according to the results of Hydraulic Model calculations performed by considering the change in typical bed geometry and Manning roughness coefficient (n) as normal, normal +10% and normal -10%, in case QÇA_e = 1.00 m^3/s (June-February) and QÇA_e = 1.8 m^3/s (March-May) of environmental flow is released to the bed, considering the uncertainties in bed geometry and n value, the depth of the streambed is determined to be between 38 cm - 51 cm and average current velocity is determined to be between 55 cm/s - 70 cm/s. These values overcompensate minimum water depth (0.15 m) and minimum current velocity (0.25 m/s) limits that has been foreseen as the need of aquatic habitat.

Fish Passes

Although the species that belong to Cyprinidae (Carps) family identified at the project site have high ecological tolerance and well adapted to stagnant water system, they do spawning migration to upper parts of the river and/or to tributaries in the reproduction period.

In case fish pass is constructed to a hydroelectric power plant, water inlet (outlet to upstream) should be placed away from dam or turbine as such to prevent dragging of fish outgoing through the pass towards turbine along with flow. In general, the minimum distance between fish pass and water acquisition system of turbine or screen should be 5 m.

Fish passes, which has been recommended in consideration with the fish species and transportation of water between the regulator and power plant at the project site, was prepared by compiling from the source titled “Fish Passes: Design, Sizing, and Monitoring” published by SHW in 2009. According to this, “Bypass Channels” will be installed at the project area.

These fish passes having natural river properties pass over the regulator through bypass channel. The section in the middle of the stream tuned into reservoir because of the regulator is passed over through bypass channel. Fish species may continue to migrate by passing through this passage. As a rule, only a part of the flow is released to bypass channel. This amount is named as “environmental flow” to sustain continuity of aquatic organisms. In addition to this, the expired dams, protection thresholds or all of the flow that has been defined before for the power plants on small rivers may be given through bypass

channel. Bypass channels to be constructed are preferred type of passage since they provide passage for migratory fish and ensure continuity of reofilic species.

"Natural-like" river restoration principles will be applied to design bypass channel. However, slopes steeper and measures shall be taken to reduce flow rates. According to the reference titled "Fish Passes: Design, Sizing, and Monitoring" published by SHW in 2009, the minimum slope recommended for bypass channels should be between 1:100 - 1:20; base width should be greater than 80 cm; average water depth should be greater than 20 cm; and current velocity should be between 0.4 - 0.6 m/s. However, these values may be modified with respect to the structure of river and the properties of fish species. The basement of bypass channel will be built by use of natural material found at construction site and rocky steps will be formed to ensure water continuity.

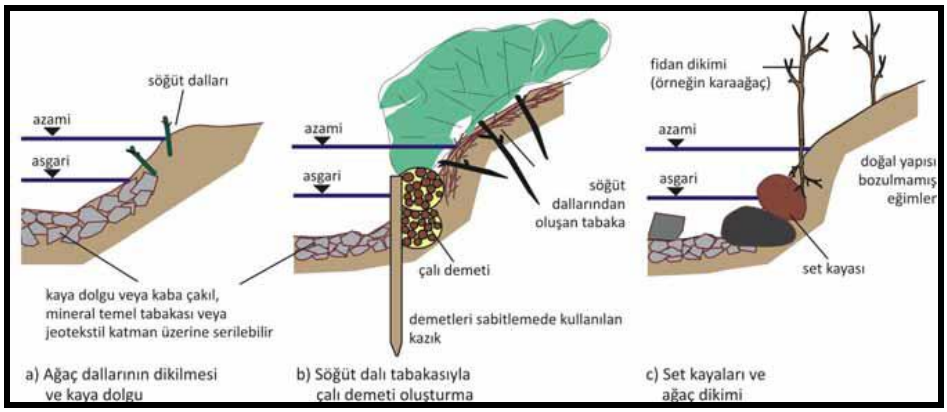


Figure 5.2.3.1. Consolidation of the Basement and Coasts of Bypass Channel (SHW, 2009)

The form of bypass channel can be curved or flat, or even in meander structure according to the topographical conditions. Thus, stagnant and fast flowing water sections may be formed (SHW, 2009) (see Figure 4.2; 4.3)

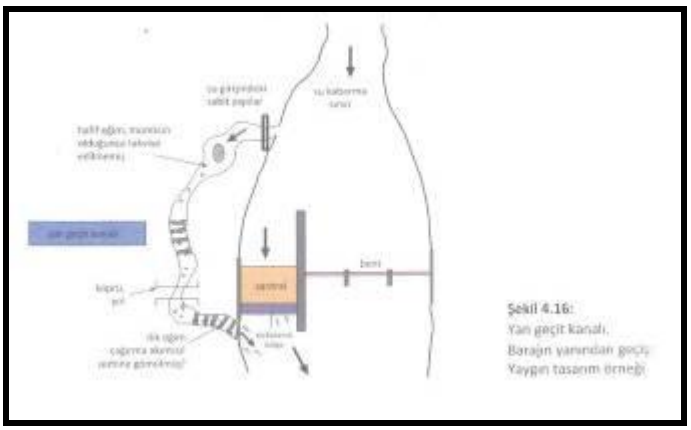


Figure 5.2.3.2. Design of "Bypass Channel" to provide Passage of Fish Species (SHW, 2009)

Figure 5.2.3.3. Bypass Channels of Varrel Bake Stream and Stöbber River (SHW, 2009)

Fish passes will be installed for protection of the existing fish species at the project site. Thus, the effect of Regulator and HEPP can be minimized and continuity of the existing species of aquatic ecosystem can be ensured.

V.2.4. Impacts on areas to be protected pursuant to national and international legislation

Onur Regulator and Onur HEPP project site is not among the areas to be protected in regard to national and international legislation. However, Zinav Lake that is about 1850 m away from Onur HEPP is covered by B-Type Recreation Area to be protected. Water that is circulated at Onur Regulator will be released to Zinav Stream without any physical or chemical change through Onur HEPP's tailwater channels after being used for electricity generation. For this reason, there will be no change between the quality and quantity of Zinav Stream water at the entrance of the regulator and the quality and quantity of water that flows into Zinav Lake, thus Zinav Lake ecosystem will not be affected adversely.

V.2.5. Possible changes to occur at downstream due to use of water resource and water retention, impacts of these changes on water quality and aquatic organisms, impacts on natural life (land slides, erosion, river hydrology, aquatic life, sedimentation, etc.), the measures to eliminate these impacts (including the measures to be taken against land slide)

In terms of causing environmental problems, hydroelectric power plants are the energy generation facilities causing the least harmful effects. Such kinds of facilities do not create the danger of air pollution, water pollution, solid waste or radioactive leak. Therefore, the effects on the basins where water retained is being assessed, not the effects of the facility itself.

Hydroelectric power plants may have positive and negative effects on fish population and fish diversity generally due to the alterations in water flow, quality of surface and groundwater, and change in vegetative structure. Conversion of draining habitat into a stagnant habitat (as a result of dam construction) is effective on the growth of fish rather than the composition of fish species.

Although adverse effects of regulators on fish growth and breeding is less than dams, it may cause decrease in population as it hinders reproduction behavior of some species living and breeding in rivers.

The most important criteria in regulator installation is the amount of stream water and/or side channel water released. In order to minimize the effects of regulator, the following suggestions should be considered.

Stream water shall not be polluted with regard of the biological and ecological properties of fish, or water flow shall not be interrupted especially during breeding period (between April-July that is the breeding period of the existing fish species) of the identified species.

Necessary physical conditions (minimum values for species in Cyprinidae family: 15 cm of water depth, 0.20 m/s of flow) (Cows and Welcomme, 1998) shall be established for the species that exist in water to be released after reservoir.

Since regulator construction will result in alteration of flow regime, certain habitat changes will occur. Necessary measures shall be taken to minimize this effect.

Considering in terms of aquatic organisms;

Reduction of the existing habitat of algae, among aquatic organisms, means formation of a new habitat. As a result of lake and pond formation, phytoplanktonic forms (free forms) will be observed as dominant instead of algae species living in attached form. In stagnant areas, forms living as attached to sediment, rock and plants will keep existing. Increased phytoplanktonic organisms (algae capable of moving freely) in the lake area will be a source of food for zooplanktonic organisms. In general, any adverse condition to affect fresh water algae flora of the region will be out of question. Because fresh water algae will maintain their conditions in lake system as well.

Stagnant water to be formed at the regulator site will create a suitable living environment for zooplanktonic organisms. The increase in phytoplanktonic organisms at the regulator site will result positively in terms of zooplankton and an increase will occur both in density and diversity of species. Zooplanktonic organisms, which have low species diversity and population density in creek and river systems of the region, will be represented by more species and density after formation of the regulator lake. As a result, optimum conditions will be satisfied for zooplanktonic organisms after realization of the project.

A part of benthic organisms may move away from the regulator site. These are the species that prefer to live in flowing environments. Conversely, other benthic organisms will come to the fore at the stagnant area. These species prefer to live in deep mediums consist of heavy silt and sediment.

Increase of planktonic species forming the nutrients for fish at the regulator site will affect fish population positively.

Another factor affecting the biological diversity of the region is the flowing mediums and the stagnant water habitat to occur after construction of the regulator. Because the composition of species living in these habitats is different.

During construction phase of the regulator, where body construction is handled, some devastating effects may occur. Because this condition is not permanent, the system will recover itself as soon as possible. In addition to this, it will be ensured to release minimum amount of water to the downstream during the operation phase of the regulator.

In general, fish living in creek, river and/or stream migrate in certain periods from downstream to upstream for breeding, feeding, and wintering. It is planned to make fish pass at the regulator and HEPP not to hinder breeding of endemic fish species existing at site.

V.2.6. Identification of other projects, if any, at upstream and downstream of the project site and their distance to project site (such as dam, regulator, HEPP, etc.), assessment of their impacts on ecosystem

There exists no project, other than Onur Regulator and HEPP project, that has been developed or planned to be developed in relation to water use within the basin of Zinav Stream and at the project site.

V.2.7. Possible effects on the bridge found at the entrance of Toklar Village due to water retention at the regulator and measures to be taken

The bridge that connects Bereketli Town to Toklar Village will be submerged due to the lake to form as Onur HEPP regulator starts retaining water. Therefore, a new bridge will be constructed in the upstream of the existing one.

V.2.8. The distance of power plant to be built in the scope of the project to Zinav Lake, possible impacts of the project and measures to be taken

Onur HEPP project will be constructed on Zinav Lake that feeds Zinav Lake. Zinav Lake is 1600 m far away from the project site. As the water outflowing from the power plant will reach to Zinav Lake without any loss, Zinav Lake is not expected to be affected from the project.

In all phases of the project, deterioration of water quality shall be avoided, in case it is deteriorated and Zinav Stream and Zinav Lake is adversely affected due to the project, the loss will be covered by the project owner.

V.2.9. Other purpose of uses, if any, (water rights of settlements at the downstream (if there exists any settlement using water along transmission tunnel, purpose and amount of their use, including water abstraction between regulator and power plant for drinking-utility, irrigation and for any other purposes). Impacts of project on irrigation, agricultural activities, fish production facility, beekeeping, etc. and such areas

4 mills are located in sequence, starting immediately after the downstream of Onur Regulator taking place at the project site. 80 L/s of water requirement of 4 mills take place in calculations as 80 L/s, since the outlet water of one mill in the upstream will be the inlet water of the mill in the downstream.

Water need of the mills will be calculated with respect to 12 months, however, this amount will be released as long as the mills is operating.

There exists no other project aiming water use that has been developed or planned to be developed, other than these mills.

Local small-scale water use may occur due to the settlements surrounding Zinav Stream basin. The branches join to Zinav Stream at the downstream of project sections. Therefore, the flows in the river bed at the downstream of project sections may be sufficient. Because the transmission system of the project is short, it is considered that the project is effective only at an area of 1 km^2 and that the surrounding settlements may supply their

small-scale water use from tributaries. Other than energy production, no significant water need and use is in question.

Around Zinav Stream and Zinav Lake, there exists no fish production facility that is in design phase or in operation.

Some arrangements will be made on the regulator bridge to not pose adverse effects on the residents dealing with animal husbandry at Toklar Village that is situated nearby of the regulator area to be installed within the scope of the project. Moreover, in order to prevent the villagers dealing with animal husbandryto be aggrieved, it will be supported to create new pasture areas. Within this scope, some kind of forage seeds like clover will be supplied to the villagers.

V.2.10. Possible impacts on groundwater and surface water resources (water use (such as irrigation of agricultural lands, etc.), project flow rate, length of transmission channel, width of water resource bed, alluvium structure, display of drinking water bore holes, and assessment of similar parameters)

The subject of the project is electricity generation, and its impact to groundwater is out of question. Water that is circulated at the turbines will be released back to Zinav Stream without any change in physical, chemical, and volumetric structure. For this reason, existing surface water will not be affected.

Domestic wastewater to be generated during construction and operation phase will be treated at the package treatment plant to be installed and then discharged. Discharge permission will be taken related to the subject.

In addition, during construction of the tunnel, water pits will be formed at both end of the tunnel for water that is likely accumulate inside the tunnel. The water accumulated in pits will be collected at the regulator site by pumping and at the powerhouse site by elevation difference. Sludge to come along with water will be eliminated from solid substances in the sedimentation ponds to be built at both end of the tunnel. The purified water at the surface will be released to the stream, and solid substances obtained as a result of sedimentation will be stored at the excess material storage area.

V.2.11. Possible impacts on forest areas (including forest fires) and definition of measures to be taken against these impacts

During all kinds of activity to be performed within the scope of the project, the methods having the least effect on forested area will be applied. However, during construction phase of the project, excavation will be carried out for the 15.48 m part that is located outside the tunnel and the trees located at this area will be cut down during excavation works. Tree cutting may have negative impact on forest ecosystem. In addition, the fauna species living at the area of trees to be cut down may be exposed to pressure of tree cutting and increasing anthropogenic effects at the area. Following the completion of construction works, these areas will be reforested within the scope of restoration works.

The forest land to be clear-cut during construction works will create an area that is susceptible to erosion. Water erosion is an important threat especially at sloping land. Necessary measures to prevent possible erosion and landslides is as follows:

- Soil stabilization will be ensured by leaving the roots of the trees to be cut in place,
- Appropriate vegetation cover will be laid on soil after completion of the works,
- Terrace system will be applied at high slope lands,
- Locations having high erosion risk will be continuously monitored.

During reforestation and landscaping, oak species (Quercus pubescens, Quercus trojana) which are compatible with the vegetation type of the region.

In construction phase of the project, construction equipment will be bought to the site. Due to these activities, the site will become sensitive to anthropogenic effects, and thus the fauna will move to appropriate habitats. During the construction phase, although it is not possible to eliminate these effects completely, construction works will be carried out in consideration with the breeding periods and it will be attempted to keep these effects at minimum. Following the construction phase, destruction on ecosystem will be tried to be compensated through plantation works to be performed at the surrounding of the powerhouse. As mentioned in EIA Assessment and Evaluation Form given in Appendix: 16-a, there is no fire-sensitive region within the project site. However, against any fire that may occur at site, sufficient number of fire-fighting equipment (digger, shovel, ax, water bucket, etc.) will be kept at site during operation and construction phases. Personnel to work at the facilities shall be trained on possible effects and on the tasks to be performed in case of fire. In case of fire, the nearest organizations shall be informed. Following fire detection and alarm, the problem shall be tried to be eliminated immediately by using fire-fighting equipment that is kept ready at definite locations.

During the excavation works to be done at project site, vegetable soil, other non-economical wastes and excavation material will be stored separately and vegetable soil will be protected against erosion.

V.2.12. Possible impacts on agricultural lands and definition of measures to be taken against these impacts

10.06 ha of the site is composed of forest area, and 14.51 ha of it is composed of non-forest area.

The land determined as the construction site is agricultural land with private property. For these lands and the other agricultural lands to lie within project site, non-agricultural land use permission will be taken in accordance with the application of EMRA. For the meadow property land around the regulator, non-agricultural land use permission was taken before. Other than this, non-agricultural land use permission was also taken for the access roads found in the power plant area.

Agricultural lands are found at Toklar Village that is the closest settlement area to the project site. It is considered that there will be no effects on these agricultural lands both during the construction and operation phase of the project.

V.2.13. The housing and other technical/social requirements of the personnel to be employed in operation phase of the project, where and how these requirements will be provided

During the operation phase of the project, 10 personnel is planned to be employed in shifts for security, control, and other fields, and the personnel need will be provided primarily from the settlements located in the vicinity of the project site. For the employees to work in the operation phase, an administration building, which includes sections, such as staff rooms, tea room, lounge, etc., will be installed.

There will be a first aid kit for the first aid needs of the staff. The Village Clinic and Public Hospital located in Reşadiye District center in Tokat will be utilized for the such health care as the heath control of staff and emergency treatments. Electrical heater will be used in heating such units as the management or social facilities and the security hut when air-conditioner and heating system is not sufficient.

The roads to berenewed within the scope of the project will provide the transportation of local people and enhance the infrastructure of the locality.

V.2.14. Characteristics of wastewater treatment plant to be used for treatment of wastewater to be produced as a result of water use at administrative and social units for drinking and utility purposes (including water arising from concrete plant and vehicle washing), displaying the location and the main lines of treatment plant on sketch, definition of discharge location, details of the process, the amount and type of wastewater to be generated, disposal methods (including septic tank plan), at what amounts and how the water to be discharged to the receiving medium (necessary permissions should be taken and these permission certificates should be attached to the report), in case discharged water retains within drinking water basin, taking it out to drinking water basin.

Domestic wastewater to be generated during construction and operation phase will be treated at the package treatment plant to be installed and then discharged. Discharge permission will be taken related to the subject.

In addition, during construction of the tunnel, water pits will be formed at both end of the tunnel for water that is likely accumulate inside the tunnel. The water accumulated in pits will be collected at the regulator site by pumping and at the powerhouse site by elevation difference. Sludge to come along with water will be eliminated from solid substances in the sedimentation ponds to be built at both end of the tunnel. The purified water at the surface will be released to the stream, and solid substances obtained as a result of sedimentation will be stored at the excess material storage area.

10 m^3/day of water will be used to prevent dust generation during the activities performed at construction phase and 15 m^3/day of water will be used for concrete mixing and mixer washing. Totally 25 m^3/day of water will be supplied from Toklar Village. Related to the subject, the letter that has been taken from Toklar Village Mukhtar is presented in **Appendix: 16-e**.

Wastewater production due to water to be used for spraying of roads against dust generation and preparation of concrete mortar is not in question. Since concrete aggregate washing will be done at stone quarry, no wastewater will be produced in this context.

However, wastewater will be produced as a result of activities, such as washing of mixers to be used for small-scale concrete mixing operations. Because of these reasons, “sedimentation pond” will be built at the construction site to reuse wastewater and aggregates remaining in the mixer. Capacity of the sedimentation pond will be 4 m x 3 m x 2 m = 24 m^3 with two sections. Water to be sluiced at the sedimentation pond will be given back to the system and thus be re-circulated. By this means, water use and wastewater generation will be minimized. Since the water will evaporate over time and be used in concrete mixing, no wastewater will be generated.

Small amount of settleable material that settles down the pool, so called silt, will be reused within aggregate granulometry at concrete plant. Therefore, washing water transferred to sedimentation pool shall not be discharged to a receiving medium. During these processes, the provisions of “Regulation on Water Pollution Control” put into force by being published in Official Gazette dated 31.12.2004 and numbered 25687, and “Regulation on “Regulation on Making Amendments to Regulation on Water Pollution Control” put in force by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with.

V.2.15. Amount, type, and properties of solid waste to be produced at housings, social and administrative facilities, their disposal, where and how to transfer these wastes and for what purposes and how to recycle

Various types of solid waste will be produced due to 10 personnel to be employed in the operation phase of the project. The wastes to be produced and disposal methods of these are discussed under the following sub-headings. By taking necessary measures, it is not expected the solid wastes to be produced throughout the operation phase to cause negative effects on the environment.

Domestic Solid Wastes

Domestic solid waste will be produced due to personnel to be employed in the operation phase of the project. 10 persons will be employed in operation phase; domestic solid waste to be produced per capita is 1.15 kg/capita.day (Source: TUİK-2008), thus total domestic solid waste is calculated as follows (source: TUİK -2008):

Number personnel : 10
Unit solid waste amount : 1.15 kg/cap/day
Amount of solid waste : 10 x 1.15 = 11.50 kg/day

Among domestic solid wastes, wastes such as food waste, plastic, glass, office wastes (paper, etc.) will take place. These domestic solid wastes to be produced will be kept at closed drums and will be collected regularly by refuse collection vehicles of Bereketli Municipality or the project owner will ensure the transfer of wastes by special closed vehicles and disposal of these to the waste collection site of Bereketli Municipality (the opinion of Bereketli Municipality is given in Appendix:16-d).

Collection, accumulation, and disposal of solid wastes shall be done as stated in "Regulation on Solid Waste Control". As stated in 18th Article of "Regulation on Solid Waste Control", disposal of domestic solid wastes to sea, lake, and similar receiving mediums, streets, forests, and places that may cause environment to be affected negatively is prohibited. For this reason, solid wastes to be produced (metals, glass, plastic, sheet, etc.) shall be collected separately at containers with respect to their property, and shall be transferred by special closed vehicles in an environmentally friendly way in terms of appearance, odor, dust, leakage, and similar factors. By keeping the containers closed at all times, rodents and insects will be prevented. These containers will be served to re-use by being disinfected at regular intervals.

Packaging Wastes

Among domestic wastes to be produced in operation phase of the project, reusable and recyclable wastes will be found. Packaging wastes constitute 30% of solid wastes by weight (Source: The Ministry of Environment and Urbanization, General Directorate of Environmental Management, Waste Management Action Plan 2008-2012). The amount of domestic solid waste to be produced during operation phase is calculated as 11.50 kg per day. According to this, the amount of packaging waste to be produced is:

Amount of packaging waste = Amount of solid waste x 30/100
= 11.50x 30/100 = 3.45 kg/day

When other materials' wastes that are not domestic in nature are added to this amount, the amount of packaging waste to be produced in the scope of the project is foreseen as about 3.5 kg/day. Packaging wastes shall be collected separate from other wastes at the project site in order to minimize environmental pollution, to benefit from landfill sites at maximum, and to contribute to economy. For the purpose of preservation of natural

resources and minimization of wastes to be disposed, preventing the production of packaging wastes, in case production is inevitable, primarily reusing, recycling and recovery shall be essential. These wastes shall be collected separate from other wastes and delivered to licensed companies for recycling.

Disposal of packaging wastes shall be done in accordance with “Regulation on Control of Packaging Wastes” put into force by being published in Official Gazette dated 24.06.2007 and numbered 26562 and amended by being published in Official Gazette dated 30.03.2010 and numbered 27537.

Waste Batteries and Accumulators

Waste accumulators possibly be generated during the operation phase of the project are the waste accumulators of passenger cars. The accumulator change will be carried out at places that are qualified in terms of infrastructure and the change will be undertaken by the places for vehicle maintenance and repair. The source of waste battery are the electronic tools used. Waste batteries will be collected apart from the domestic waste and given in the collecting points which are planned to be formed by the establishments distributing and selling battery products, and municipalities. While changing the accumulator of vehicles, old ones will be given in the establishments distributing and selling accumulator products and temporary storage areas formed by the managers of the places for vehicle maintenance-repair free of charge.

For collection and disposal of waste batteries and accumulators to produce during the project, the provisions of “Regulation on Control of Waste Battery and Accumulators’’ put into force by being published in Official Gazette dated 31.08.2004 and numbered 25569 and amended by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with.

Hazardous Wastes

Yarn waste which is expected to be formed and such hazardous waste as fluorescent will be temporarily preserved in containers which are tough, impermeable, secure and convenient with internationally approved standards, and will be sent to licensed hazardous waste recycle and eliminating facility by licensed vehicles.

During the activity, the provisions of “Regulation on Control of Hazardous Waste” put into force by being published in Official Gazette dated 14.03.2005 and numbered 25755 and amended by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with.

There will be no infirmary during the operation phase of the project. So, medical waste is not a point in question in the activity area.

Besides, “Regulation on Control of Hazardous Waste” put into force by being published in Official Gazette dated 22.07.2005 and numbered 25883 and amended by being published in Official Gazette dated 30.03.2010 and numbered 27537 will be complied with regarding the collection, transportation and elimination of the medical waste that might be generated within the scope of the project.

V.2.16. The distance of the source of the noise, which will be generated during the operation of the project units, to the closest settlement area and the precautions to be taken for its control

The noise, which will happen during the operation of the activity results only from the generator in the HEPP building and the turbines. Against the noise to be generated during the operation, HEPP building will be built as sound-insulating. The staff who will work in the power plant house will be prevented from the adverse effects of the noise in the building by the precautionary measures declared in “LaborLegislation” numbered 4857.

As the HEPP planned to be established is surrounded by hills regarding its location, any adverse effect of the noise, which it produces, on the neighbor settlements is out of question.

During operation phase, all workers shall be supplied with personal protection tools and use of these tools shall be made mandatory and necessary measures shall be taken in accordance with the provisions of “Regulation on Occupational Health and Safety” put into force by being published in the Official Gazette dated 09.12.2003 and numbered 25311, and “Regulation on Assessment and Management of Environmental Noise” put into force by being published in the Official Gazette dated 04.06.2010 and numbered 27601.

During the operation phase, the legislation on occupational health and safety will be complied with, and use of special helmets, headphones or earplugs by the staff shall be made mandatory.

V.2.17. The size of the area to form landscaping elements and other landscaping arrangements (plantation and/or green area arrangements, etc.), how to perform these activities, types of plants and trees to be used for this purpose

In the beginning of the construction phase of the project, at the entrance and exit of the transmission tunnel and around the HEPP reforestation will be made both to prevent erosion and to form landscape elements compatible with the environment. At the areas that are considered to be forest land, reforestation will be made in coordination with the Forest Sub-District Directorate of Reşadiye. For landscaping purposes, the surrounding of powerhouse will be planted in accordance with the natural structure, and some parts will be covered with grass.

V.2.l8. The Evaluation of traffic (vehicle) load and effect of all the in-site and off-site transportation within the scope of the project

It is possible to reach the activity area by using available state and village roads within the scope of the project. However, totally 2,883 km road, 880 m of which for the access to the regulator area and 2,003 of which for the access to the power plant building, will be built. In this context, the permissions of the authorized institutions and organizations will be taken and the access roads, which will be built as a result of building the on-site service roads and enlargement or renovation of the available village roads, will be used.

Various construction vehicles (grader, dozer, truck etc.) will be used during the building of on-site service roads and enlargement of the available village roads. The required materials within this scope will be provided by the large and small materials produced during tunneling operations. The use of any chemical substance is out of question during the construction of the roads. Apart from this, the appropriate materials required for the project will be provided from the licensed stone pits in the region in case they are not obtained from the excavation.

As the transportation of the required materials will be carried out via state, village and stabilize service roads during the construction phase of the project, any operation that will constitute essential dust emissions is beside the point. Additionally, dust emissions to be generated during the transportation and storage processes of the excavation operations are calculated in Chapter V.1.4 and noise emissions in Chapter V.1.24

The road which is the closest to the activity area and has the most traffic load is Sivas-Erzincan Highway in the vicinity of Reşadiye District. The traffic load of this road is 2211 vehicles per day, and 765 of them are truck and some other heavy vehicles.

Accordingly, construction works will increase present traffic load of heavy vehicles on the available motorways at a rate of 0.28% (34.87%-34.59%=0.28%). It means that trucks that will transport the materials during the road construction works do not lead to an essential amount of extra load to the current traffic volume.

V.2.19. Other issues

There exists no issue to be reported under this section.

V.3. The effects of the project on Socio-Economic Environment

V.3.1. Increase of income expected with the realization of the project; employment opportunities to be created, population movements, migrations, education, health care, other social and technical infrastructure services, and changes in benefiting from these services, etc.

When the economical features of the settlements within the vicinity of the project area that can be affected from the project are examined, it is seen that no industrial plant or activity exist. Throughout the Toklar Village which is the closest settlement to the project area, agricultural activities are carried out in addition to ovine and bovine breeding. It is foreseen that newly-built and renewed roads will have a favorable effect on the villages to bring their agricultural products to the bazaars. Also, it is predicted that current production and income will be ameliorated by these favorable effects.

Moreover, subsequent to the beginning and operation of the construction works to be carried out, new job opportunities for local people will arise. Along with the operation and energy production of the project, the realization of variable new investments around Reşadiye Districtand its vicinity and creation of the new employment opportunities for the local people are predicted to happen.

Furthermore, during the land preparation and construction phase of the project 75 people, and during the operation phase about 10 people are planned to be employed. The staff need will be provided primarily from the settlements in vicinity of the project area. Additionally, the activity will provide an extra source of income for the local people as daily needs of the workers will be provided from the settlements near the project area.

The roads to be renewed within the scope of the project will supply the transportation needs of the local people and will enhance the infrastructure of the locality at the least.

V.3.2. The Environmental Cost-Benefit Analysis

The activity planned to be carried out is an important project in order to meet the Turkey’s energy deficit. Hydroelectric power plants are the cleanest systems in energy production in today’s conditions. They do not have an adverse impact on environment during the operation phase, and the harms happening during the construction phase are temporary

as the necessary precautions will be taken and these impacts will end with the completion of the project. The firm will do the needed investments in order to prevent environmental pollution and will be obliged to comply with the legislations and boundary values given in Solid Waste Control Regulation, Industrial Air Pollution Control Regulation, Control and Management of Environmental Noise and Water Pollution Control Regulations. The required permissions will be taken by making correspondence with the necessary institutions and organizations.

As a result, the activity planned to be made will not have adverse effects on physical, biological and social environment, and the project will freshen up the economic and social structure of the locality at the least.

V.3.3. The evaluation of the social effects dependent on the realization of the project. The presentation of the social effects by having an interview with the local people in the settlements which will be affected or potentially affected due to the project (The effects on agriculture, stock breeding, fishery etc. activities in the Project Area and Impact Area, the relationship of the people who will work during the construction and operation of the project with the local people, the effect of those on human life and Socio-Economic Analysis, The Social Responsibility Projects)

The data obtained from the interviews made with local people shows that the most important sources of income of the people living in the locality are composed of agricultural production, ovine and bovine breeding, wages earned from temporary jobs. Unemployment comes out as an essential problem as it does throughout Turkey. There are such problems as the absence of sewerage system, damaged roads and inadequate drinking water in the locality.

The true and actual information about the project is shared with the local people. The favorable-unfavorable impact of the project; how the unfavorable impacts will be resolved or minimized are also shared with the locals. The locals didn't object to the project but they made a claim to it.

The facts that the required labor will be provided from the local human sources and service purchases will be made at a specific amount at the construction and operation phases of the project will contribute to the region. Besides, it is foreseen that newly-built and renewed roads will have a favorable effect on the villages to bring their agricultural products to the bazaars. Also, it is predicted that correct production and income will be ameliorated by these favorable effects.

Some arrangements will be made on the regulator bridge to not pose adverse effects on the residents dealing with animal husbandry at Toklar Village that is situated nearby of the regulator area to be installed within the scope of the project. Moreover, in order to prevent the villagers dealing with animal husbandryto be aggrieved, it will be supported to create new pasture areas. Within this scope, some kind of forage seeds like clover will be supplied to the villagers.

CHAPTER VI: POTENTIAL IMPACT WHICH MAY ARISE OR CONTINUE AFTER THE OPERATION IS CLOSED AND THE MEASURES TO BE TAKEN AGAINST THESE IMPACTS

VI.1. Reinstatement

It is not planned to open material quarry within the scope of the project.

Land reclamation works are generally composed of terracing, field shaping, and land leveling operations. Apart from these, surface flow will be controlled by opening drainage ditches and drainage canals in order to hinder the accumulation of the surface flow that may originate during the reclamation works.

While the land reclamation works of the areas which were forest areas prior to the activity are carried out, the Regional Directorate of Forestry will be cooperated with. No facility waste will be left in the project site subsequent to the activity.

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VI.2. Reinstatement and reclamation works to be performed at the project site (material quarries, if any, concrete plant, and crushing-screening and washing plant, etc.)

Within the scope of the activity, borrow pit and crushing-screening facilities will not be built. Proper size of the material that is obtained from the tunnel excavation will be used as the foundation material for road construction (regulator access road and power plant access road). Nevertheless, proper materials will be used for the concrete plant which is planned to be built in order to provide the concrete needed during the construction period of tunnel inner coverage, power plant etc. intended within the scope of activity. As can be seen in the map given in **Appendix: 12,** the excess material will be stored at two different sites. The approval of SHW (State Hydraulic Works) on this issueis given in **Appendix: 16-b.**

Plant suitable for the natural surrounding will be implanted at the place of the electricity power plant and around the powerhouse, and some parts will be covered with grass. After the completion of the construction works of other units, leveling works, which are suitable to the topography in the land, will be conducted. Sloping will be made in order to hinder a landslide that may happen as a result of such natural disasters as a potential erosion or avalanche.

Land reclamation works are generally composed of terracing, field shaping, and leveling operations. Apart from these, surface flow will be controlled by opening drainage ditches and drainage canals in order to hinder the accumulation of the surface flow that may originate during the reclamation works.

While the land reclamation works of the areas which were forest areas prior to the activity are carried out, the Regional Directorate of Forestry will be cooperated with. No facility waste will be left in the project site subsequent to the activity.

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VI.3. Impact on Available Water Resources

After the operation activities finish in the project site, the discharge of any waste water without the proper decontamination to Zinav Stream is out of question.

As the land reclamation plan will be developed in a way that will hinder the accumulation of water on surface (by forming drainage canals), it is not expected to have adverse effects on the surface and groundwater quality with the end of the activity and land reclamation works.

Moreover, in all phases of the project, deterioration of water quality shall be avoided, in case it is deteriorated and Zinav Stream and Zinav Lake is adversely affected due to the project, the loss will be covered by the project owner.

CHAPTER VII: THE ALTERNATIVES OF THE PROJECT

(In this chapter, the selection of the location, technology, precautionary measures to be taken, the comparison and preference order of the alternatives isemphasized)

Within the scope of Onur Regulator and Onur HEPP Energy production facility which is planned to be made on Zinav Stream, a branch of Kelkit Stream, in the 15 km northwestern of Reşadiye District in Tokat Province, the installed power of Onur hydroelectric power plant is **19,568 MWe (20.82 Mwm)** and it is planned to produce total **42,848** GWh annually**.** The feasibility report on the project has been prepared and various alternatives have been assessed.

By being designed on the opposite bank of Zinav Stream previously in 2009, the project in question took the EIA acceptance from The Ministry of Environment and Urbanism. However, alternatives have been evaluated so that the project can work more efficiently later on. Within this scope, as the loss are reduced due to increasing the elevation of the Regulator and shortening of the transmission line in the new project, the efficiency of the project was increased by further increasing the gross head.

Within this context, the project has emerged as the most advantageous one due to the reasons that its annual net benefit (income) and profitability are pretty much high.

With the proposed project, total **42,848 GWh** energy is planned to be produced annually, and the project's

- income-expenditure ratio has been calculated as 9.5%
- inner Profitability Ratio as 10.45%

Additionally, it has been concluded in the studies which were carried out regarding the meteorological, geological and topographical conditions that it is not possible to make an alternative project in which stream water can be used more optimally and that the most appropriate solutions for different alternatives have been produced in the study in question.

Topographical and geological conditions have been examined for the project that will be established on Zinav Stream, which is a branch of Kelkit Stream. As the fact that the falling of water at a really high level from the closest distance in the production of energy has importance for these facilities, the area has been found suitable and any other alternative to the project site hasn't been found.

In conclusion, no alter alternative has been considered because there is not any drawback in the establishment and operation of the facility in the project area, and it is physically suitable for the Onur HEPP and Onur Regulator project.

CHAPTER VIII: MONITORING PROGRAMME

VIII.1. The monitoring programme proposed for the construction of the activity, the monitoring programme proposed for after the operation period, and emergency action plan

The purpose of the Environment Monitoring Plan is composed of monitoring, inspecting and inspection reports of all the activities to be carried out related to the project, which may potentially cause harmful results on health and environment, the points which are guaranteed in EIA Report, and the legal regulations which are to be obeyed in this context

Monitoring of the construction phase, controlling regarding whether the adverse impacts during the construction process exceed the limited values with the measurements pointed out in the report or whether they are obviated, will be carried out by the institution that prepared the EIA Report at regular intervals that are specified by the Ministry of Environment and Urbanism.

While determining the importance of all possible impacts of the project during the Environmental Impact Evaluation study, the studies intended to incorporate the appropriate interventions for these impacts are conducted. However, in spite of this, unforeseen impacts may arise with the realization of the project, so the data obtained though the performed monitoring programs will make it possible to solve these impacts before they turn into problems.

The parameters that are anticipated to be monitored within the scope of the project;

During the construction and operation phases, primarily the business owner according to the Agreement on the Procedures of Water Use and Operating Rights should provide maintenance of natural life, and it will release quantities of water that meets water rights (environmental flow) to the river bed.

Moreover, the required amount of irrigation water will be given to the requestors during the construction and operation phases in order to irrigate the agricultural lands located in the area where the project will be conducted. In the downstream of the regulator, online flow meters will be established on the points that are determined by the Regional Directorate of SHW for measuring amount of water, and it will be observed whether the pledged water amount is released or not. Additionally, in all the parameters given below, whether the adverse impacts are prevented or not will be observed periodically regarding the commitments given in the report.

- Liquid Waste,
- Solid Waste,
- Packing Waste,
- Noise,
- Hazardous Substances ,(Battery, waste oil, vegetable waste oil, medical waste etc.)
- Emission (Exhaust emission, Dust Emission)

After EIA certificate of acceptance given to the EIA Report, which was prepared in accordance with the Notification Certificate of Competency by being published in 27436 numbered and 18.12.2009 dated Official Gazette, whether the commitments on the construction phase are fulfilled or not will be put across the Ministry of Environment and Urbanism once in every three months by filling in the " Ultimate EIA Report Monitoring Reports Form" included in the " Notification of Competency"

Emergency Action Plan

Within the scope of the project, the draft emergency action plan for the emergency conditions that may happen during both the construction and operation periods shall be prepared. According to this plan, an Emergency Action Team shall be formed by the Emergency action Plan Coordinator, and duty and responsibility of each person and the procedures to be carried out in emergency shall be determined. The required first aid materials (first aid kit etc.) shall be kept in the site in case of such emergency conditions as natural disasters and accidents or sabotage with aim of doing the needed first aid. Prior to the beginning of the works, a fire report will be taken against a potential fire situation, emergency action plan will be prepared and both of them shall be approved by Civil Defense.

In case of situation like fire which requires emergency action, vehicles and materials that belong to the owner of the activity might be used for extinguishing the fire by the Forestry Operation Directorate. An emergency Action plan that aims to minimize the adverse impacts of the hazardous materials on environment and human health in case of a dangerous accident that may happen at the facility will be prepared.

Emergency action Plan will become functional in such urgent cases as natural disaster, fire, sabotage. The occurrence of any of these fire, earthquake or explosion can be defined as an emergency condition. Emergency Action Plan will be prepared with the aim of being able to take the measures for hindering the grow of danger, and safe and quick abandoning of the staff at the facility in case of a fire. Teams of saving and extinguishing will be composed among the workers, and the list of institutions and organizations that will be asked for help and their contact numbers will be held on the walls of the construction site

The legislations in “Occupational Health and Safety Regulation” of Ministry of Labor and Social Security published in 09.12.2003 dated and 25311 numbered Official Gazette will be complies with. All the points indicated in “Industrial Air Pollution Control Regulation” that was put into force by being published 03.07.2009 dated and 27277 numbered Official Gazette will be complied with. Workers will be provided to use dust masks and ear protectors so that they are not affected by the dust and noise. Additionally, the necessary training will be carried out and warning signs will be held in order to minimize occupational accidents due to the use of vehicle, machine or equipment. The maintenance of these machines and equipment will be done regularly.

“Regulation on Workers Health and Safety Measures to be taken in the Construction of Mines and Quarries Facilities” published in 22.10.1984 dated and 18553 numbered Official Gazette will be complied with against the risk of any accident resulting from the technology and material to be used. According to this legislation, the supervisor of the site is responsible for fulfilling the necessitiesof workers health and safety, and operation of the facility within the framework of technical principals.

Moreover, an equipped medicine chest will be available in a suitable place in the site and a vehicle will be kept to get to the nearest health care centers or hospitals in case an occupational accident or traffic accident happens. While passing through the settlement areas, truck drivers will bewarned about being more careful and obeying the speed limits. Also, the transportation will be carried out between 8 a.m. and 8 p.m. “ Traffic Regulations” published in 18.07.1997 dated and 23053 numbered Official Gazette will be complied with against the accidents that may happen during the transportation.

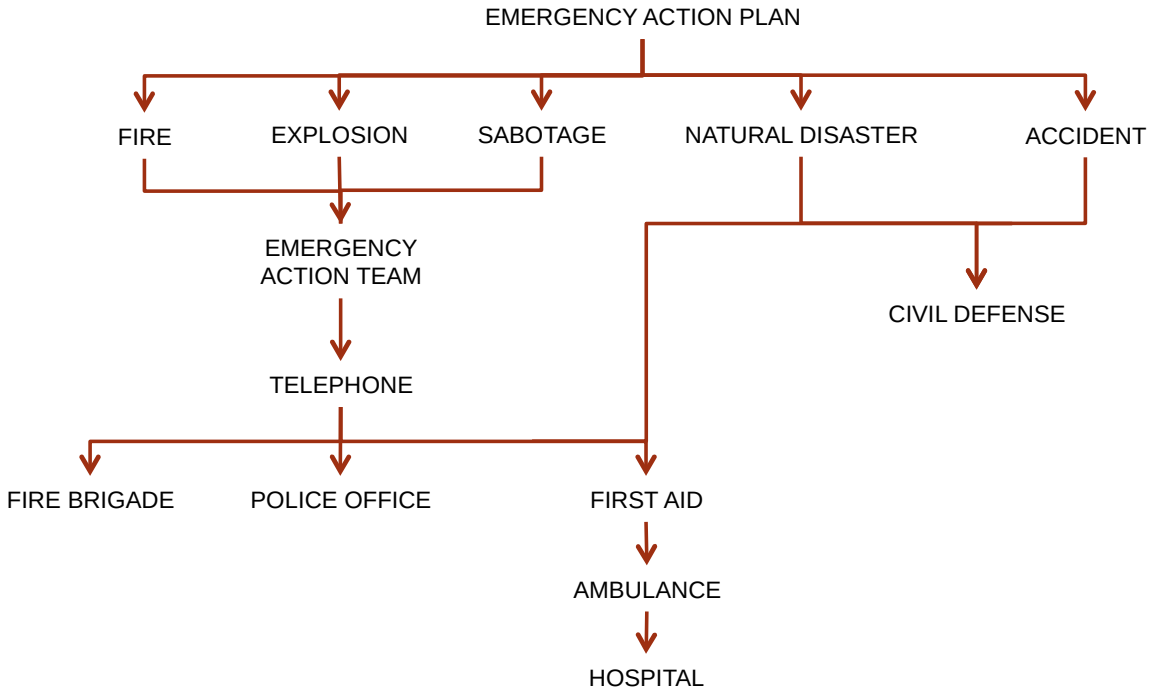
As it can be seen in EIA inspection and evaluation form of the activity site, it is now within fire-sensitive areas. Enough quantities of fire extinguisher equipment (picks, shovels, axes, water bucket, etc.) will be kept against any potential fire that may arise, the construction site will never be let solitary, a staff member will be on duty at the site constantly. It will be delicate on the issue of fire, no fire will be made in the site, the workers on duty will be checked and warned constantly.

Machines will only be run by only the concerning operators and started in accordance with the instruction manual. The workers on duty will be trained periodically. Also, periodical maintenance of the machines will be done according to facility maintenance instructions. Forest fire extinguishing equipment will be kept ready in the facility, the use of these equipment will be taught to the workers, and the equipment will be kept continuously maintained. The nearest Forest Administration will be got in contact with on this issue and the forest fires in the facility or in its vicinity will be reported to the Forest Administration immediately, and at a situation of a potential fire, all the workers will interfere in it.

During the operation of the facility, with the aim of hindering potential occupational accident that may put human health and security in danger, the provisions of Turkey Ministry of Labor and Social Security “Occupational Health and Safety Regulation” published in 11.01.1974 dated and 14765 numbered Official Gazette will be complied with.

In case of any emergency that may happen in the facility, an emergency team will be formed for the initial intervention. Providing of evacuation of the people in the buildings in disasters such as fire, earthquake and so on, doing the first intervention, taking part in search-rescue and extinguishing events are the duties of these teams.

In the facility, 09.12.2003 dated and 25311 numbered “Occupational Health and Safety Regulation” published in the Official Gazette will be complied with. Emergency Action plan will be prepared for the facility and approved to Provincial Directorate of Civil Defense, Search and Rescue Unit.



V.III.2. The program regarding the fulfillment of the matters indicated under the topic of " The responsibilities of the institutions/organizations with the certificate of competency" in the Competency Declaration in case EIA Positive Certificate is issued.

The fulfillment of the measures and commitments indicated in the report will be followed in accordance with the Environment Monitoring Programme which will be formed within the frame of the main topics stated in Chapter VIII.1.

The purpose of the Environment Monitoring Plan is composed of monitoring, inspecting and inspection reports of all the activities to be carried out related to the project, which may potentially cause harmful results on health and environment, the points which are guaranteed in EIA Report, and the legal regulations which are to be obeyed in this context

Monitoring of the construction phase, controlling regarding whether the adverse impacts during the construction process exceed the limited values with the measurements pointed out in the report or whether they are obviated, will be carried out by the institution that prepared the EIA Report at regular intervals that are specified by the Ministry of Environment and Urbanism.

The impact which may arise during the operation of the facility, and whether these the measures to be taken against these impacts are adequate or not should be followed by the Directorate of Environment and Urbanism.

CHAPTER IX: PUBLIC PARTICIPATION

(How and through which methods local people, likely to be affected from the project, are informed; the reflection of the opinions and statements of local people in the EIA Report)

The Presentation of the local people likely to be affected from the project

In accordance with the 9th article of EIA Regulation that was put into force by being published in 17.07.2008 dated and 26939 numbered Official Gazette, meeting notices are held on the noticeboards of the nearest settlements Toklar Village Ward and Bereketli Municipality with the purpose of informing public about the investment, getting their opinions and suggestions regarding the project.

Public Consultation meeting was held at 2 p.m. on 28.03.2011 in the Village Square in Toklar Village and participation was ensured from the neighbor settlements, TEMA Organization (Turkish foundation for combating erosion reforestation and the protection of natural habitats), and Local newspapers.

The methods that are used for the participation of local people in EIA Process

An announcement determining the date, hour, place, and topic of the meeting was prepared and published previously in one nationally published newspaper and one locally newspaper and at least 10 days before. Subsequent to the addressing speech, a presentation including the information about the environmental impacts and measures to be taken was made. Information of the necessity of the activity, the reason why this region was chosen, employment, measures to be taken in terms of environment were given, and the questions of the public about the project were replied, and their views and opinions were evaluated.

The concerns, opinions/suggestions of the public regarding the project and evaluation related to the issue

Toklar Village is the nearest settlement to the project area and they are informed on the issue as the Public Consultation Meeting was held there regarding the establishment od the facility beforehand. During the Public Consultation Meeting, there was no rejection of the public to the project. They merely had some desires such as employing workers from the village, generating a new meadow by the owner the activity if the meadow belonging to the village is exposed to adverse impacts, helping the villagers by giving them grains like crib, and meeting the food needs of the workers from the village. These demands of the people will be taken into account during the construction and operation of the project.

The sides whose opinions have been consulted, their opinions/suggestions, and evaluation related to the issue

Provided that the necessary precautions are taken in accordance with their legislations, the authorities of public institutions and organizations took a bright view of the project.

CHAPTER X: A NON-TECHNICAL SUMMARY OF THE INFORMATION GIVEN ABOVE

(The explanation of all the studies that are planned to be made during the construction and operation of the project, and all the anticipated measures to be taken for environmental impacts without any technical terms and at a simplicity that can be understood by public)

With 19,568 MWe (20.82 Mwm) installed power, and annual total 42,848 GWh energy production capacity, Onur Regulator and Onur HEPP Project are planned to be conducted by Temmuz Electricity Production Inc. on Zinav Stream, a branch of Kelkit Stream situated on H-38 map sheet, 15 km northwest on Reşadiye District in Tokat Province.

Water that will be kept by the regulator structure planned to be built on Zinav Stream will be transmitted to the hydroelectric power plant by means of the transmission structures, and electric energy will be produced here. With this purpose, regulator, sedimentation pool, penstocks, and powerhouse will be built. Additionally, construction site is planned to me made for meeting the social demands of the staff working within the scope of the project in addition to the excavation storage area.

The units which will be used and/or built in the project are given under the following main headings

- Onur Regulator
- Sedimentation pool
- Transmission Tunnel
- Penstock
- Onur HEPP
- Construction Site
- Excess Excavation Material Storage Area (2 units)

75 personnel during the construction phase of the project and 10 personnel during the operation phase are planned to take charge in. It is planned that the staff will be provided from local people as far as possible so that employment opportunities will be provided in the locality.

There isn't any area that will submerge as a settlement within the scope of the project, so resettlement is out of question.

Such impacts as dust and gas emissions, noise will happen during the construction of the units within the scope of the project. In the project impact zone, a few houses on Zinav Upland located at about 500 km distance and Toklar Village at about 1000 km distance to the Regulator (water intake structure) are situated.

During construction phase of HEPP, noise will arise due to the use of construction equipment and blasting. Special attention shall be paid to avoid noise pollution during the use of construction equipment and blasting, and will especially be more attentive in February-May that corresponds to breeding/spawning period of most of the animals.

The generation of dust will be a matter because of the excavation works during the construction of project units. In order to minimize the formation of dust, irrigation/spray works will be carried out, the trucks to be used for transportation will be covered by canvas, speed limit will be set for all the vehicles and construction machines, loading and unloading without scattering will be given attention. All kinds of measures will be taken in order to prevent dusting and impacts originated from dust.

The exhaust measurements of vehicles to work within the scope of the project will me made regularly and not to exceed exhaust emission limit values will be given attention.

The amount of environmental flow, which is necessary for the survival of the aquatic life situated in the downstream of Onur Regulator, will be released to the river bed. Moreover, adequate amount of water will be released for all the water rights apart form the environmental flow.

CHAPTER XI: RESULTS

(The summary of all explanations, a general evaluation in which essential environmental effects of the project are listed, and to what extend success is achieved in preventing environmental impacts in case of realization of the project, selections made among alternatives within the scope of the project and the reasons why these selections were made)

With 19,568 MWe (20.82 MWm) installed power, and annual total 42,848 GWh energy production capacity, Onur Regulator and Onur HEPP Project are planned to be conducted by Temmuz Electricity Production Inc. on Zinav Stream, a branch of Kelkit Stream situated on H-38 map sheet, 15 km northwest on Reşadiye District in Tokat Province.

The purpose of the project is to produce electric energy. The main units planned within the scope of the project are; regulator, sedimentation pool, transmission tunnel, penstock, and powerhouse facilities.

Zinav Stream is situated in the downstream of Onur Regulator and HEPP facilities, and environmental flow should be released to the stream in order to protect the natural environment.In the revised Feasibility Report, environmental flow has been determined as the flow that is equivalent to 10% of the last ten years' (2000-2009) annual average flows in Onur Regulator and HEPP project. Under this circumstances, environmental flow has been calculated as 0.277 m^3/s, which is equivalent to 10% of the last 10 years' annual average flow rate; 2,769 m^3/s. For the place of Onur Regulator, long term (1966-2009) annual average flow is 3,218 m^3/s,and environmental flow is determined as 0.450 m^3/s for June-July-August regarding long years' average, and for the other months as 0.350 m^3/s. Any kind of adverse condition is not expected to happen with the constant release of this amount of water to the stream.

Additionally, construction site is planned to be made for meeting the social demands of the staff working within the scope of the project and for the maintenance and repair of the construction vehicles and transportation trucks. Also, excess excavation storage area is planned to be built with the aim of storing the excavation materials that come out as a result of digging works. The natural tools required during the construction of the project units will be provided from the licensed material site located in the vicinity and ready-mixed concrete from the concrete facility to be established in the area.

Construction works of the project is considered to be completed totally in 32 months. Besides, life span of the project is foreseen as 50 years and it is planned to extend this economical life span by doing the necessary revision works in this period of time. 75 personnel during the construction phase of the project and 10 personnel during the operation phase are planned to take charge in. It is planned that the staff will be provided from local people as far as possible.

10.06 ha of the site, which is within the borders of Onur Regulator and HEPP project site, is composed of forest area; and 14.51 ha of it is composed of non-forest area. **).** Expropriation of the forest areas is out of question, but permission will be taken for these areas in accordance with the 17th Article of 6831 numbered Forest Law.

Moreover, whether the area, where the regulator will be constructed, coincides with an agriculture area or not is going to become apparent as a result of the works on Local Development Plan. In case the area coincides with agricultural land, necessary permissions will be taken from Tokat Provincial Directorate of Food, Agriculture and Livestock breeding for using the land for non-agricultural purposes in accordance with the provisions of 5403 numbered "Soil Conservation and Land Use Law" that came into force by being published in 19.07.2005 dated and 25880 numbered Official Gazette. As to the expropriation studies, a

mutual agreement will be initiated with the owners of the private property. In case of disagreements, expropriation will take place pursuant to the Expropriation Law No. 4650, which came into force by being published in the Official Gazette dated 05.05.2001 and numbered 24393; and by force of c and d items of the 15th Article of Electricity Market Law No. 4628, changed by law no. 5496.

The project area is on Zinav Stream, which is one of the branches of Kelkit Stream within Kelkit River Basin of Yeşilırmak River Basin. Zinav Stream is the only running water which has a constant flow of water. It is used by local people in small scaled irrigation works and watering livestock.

The amount of environmental flow, which is necessary for the survival of the aquatic life situated in the downstream of Onur Regulator, will be released to the river bed. Moreover, adequate amount of water will be released for all the water rights apart form the environmental flow. All kinds of precautionary measures will be taken so that the stream ecosystem is not deteriorated. The regulations of 1380 numbered "The Provisions of Fishery Laws", 17.05.2005 dated and 25818 numbered "Regulations on the Protection of Wetlands", and 26.08.2010 dated and 27684 numbered "Amending The Regulations on the Protection of Wetlands" will be complied with concerning the impacts on the organisms in the aquatic environment.

Evaluation Regarding the Alternatives of the Project

Within the scope of Onur Regulator and Onur HEPP Energy production facility which is planned to be made on Zinav Stream, a branch of Kelkit Stream, in the 15 km northwest of Reşadiye District in Tokat Province, the installed power of Onur hydroelectric power plant is **19,568 MWe (20.82 MWm)** and it is planned to produce total **42,848** GWhannually**.** The feasibility report on the project has been approved by SHW and various alternatives have been assessed.

Due to the fact that annual net benefit (income) and profitability is pretty much high, it is emerges as the most advantageous project.

Additionally, it has been concluded in the studies which were carried out regarding the meteorological, geological and topographical conditions that it is not possible to make an alternative project in which stream water can be used more optimally and that the most appropriate solutions for different alternatives have been produced in the study in question.

In conclusion, no alter alternative has been considered because there is not any drawback in the establishment and operation of the facility in the project area, and it is physically suitable for the Onur HEPP and Onur Regulator project.

The General Evaluation Concerning the Environmental Effects of the Project

Because of the factors such as dust and gas emissions, noise, vibration, density of traffic during the construction of the units within the scope of the project and decrease of water amount during the operation phase, environmental effects of the project will arise. In the project impact zone, a few houses on Zinav Upland located at about 500 km distance and Toklar Village at about 1000 km distance to the Regulator (water intake structure) are situated.

Blastings will be carried out along the tunnel route for the transmission tunnel and penstock construction during the construction of the units planned to be made. The necessary permissions for the explosives will be taken from Tokat Governorship,the products purchased from the manufacturers of explosives will be transported to the project site in

accordance with the legislations. The explosives that will be used for the blasting will not be stored in the project site, but they will be supplied from the authorized disposers, adequate quantity of them will be brought to the project site at pre-scheduled times of blasting, and all of them will be used up. When the results of the calculations are evaluated, such factors as potential rock leaps or air cannon due to the blasting are foreseen not to cause any adverse impacts on the settlements close to the project area.

The generation of dust will be a matter because of the excavation works during the construction of project units. In order to minimize the formation of dust, irrigation/spray works will be carried out, the trucks to be used for transportation will be covered by canvas, speed limit will be set for all the vehicles and construction machines, loading and unloading without scattering will be given attention. All kinds of measures will be taken in order to prevent dusting and impacts originated from dust.

Exhaust emissions will be generated due to the fuel that vehicles and construction equipment use within the scope of the project. The values obtained in the conducted emission calculations do not exceed the limit values given in Regulation on Industrial Air Pollution Control. Exhaust emission measurements of the running vehicles will be carried out regularly and will be attentive not to exceed the permitted limit values for the exhaust emissions. No adverse impact originated from exhaust emission will be developed.

During the construction of the project units, noise originating from the construction equipment will be developed. No adverse impact of the noise that will be generated in Regulator, Transmission Tunnel, Construction Site and Excess Excavation Materials Area on the closest settlement areas is a matter in concern .

At the phases of the project, the limit values will be set for sensitive receiving environment. Staff working within the scope of the project will be provided to use such equipment as dust masks and earplugs or ear protectors in order to protect them against the effects of such factor as dust and noise, protect their health and procure the continuity of activity. The legislations in “Occupational Health and Safety Regulation” that was put into force by being published in 09.12.2003 dated and 25311 numbered Official Gazette will be complied with in all the works to be conducted.

Domestic waste water generated during the construction and operation phases will be discharged after they are refined in the package treatment plant to be built. Regarding this issue, discharge permit will be taken. Generation of any adverse impact originated from the waste water generated during the construction and operation phases is not expected.

Additionally, water collection pits will be built on both banks of the river for potential water generation in the tunnel during its construction. This water will be collected by pumping in the regulator side and by differences in elevation on the power plant side. Mud that is brought by water will be decomposed from its solid substances in the sedimentation pits to be built on the both entrances of the tunnel. Cleaned water remained on the top will be released to the stream, the solid materials obtained as a result of the sedimentation will be stored in excess excavation materials area.

The domestic solid waste to be generated during the construction and operation phases of the project will be kept in closed vessels and they will be diffused into the wasteland determined by Municipality of Bereketli though transporting closed special vehicles by the activity owner or being collected by the garbage haulers of the Municipality of Bereketli at certain intervals. The provisions in “Regulation on Solid Waste Control” will be complied with in collection, accumulation and removal of solid waste.

Any kind of adverse impact originated from the solid waste during the construction and operation phases of the project is not expected. During the storage of the excavation waste generated within the scope of the project, incorruption of natural surface flow will be paid attention. The excavation to be generated within the scope of the project will not be released into the river bed from the slopes in an haphazard way

All the works will be carried out in a way that will not cause any devastation on the lands, will not affect the regime and quality of water adversely. The height and inclination while storing the materials will be adjusted in a way that prevents movement of them. The provisions of "Excavation Soil, Construction and DemolitionWaste Control Regulation" published in 18.03.2004 dated and 25406 numbered Official Gazette will be complied within the scope of the project. Discharge of excavation waste into river beds and storage though some methods out of the provisions of the regulation or disposal of it will not be a matter in concern.

Waste management will be ensured by minimizing the hazardous effect of waste oil and fuel of the construction vehicles on human health and environment in accordance with "Regulation on Control of Hazardous Wastes" published in Official Gazette dated 14.03.2005 and numbered 25755 and all related provisions of regulation amendments, besides "Regulation on Control Waste Oil" published in Official Gazette dated 30.07.2008 and numbered 26952. Accordingly, the transportation of the waste oil to be produced by the licensed firms will be ensured in accordance with the provisions of the concerning regulation throughout the activity and they will be given to licensed disposal facilities.

Such used waste as tires, batteries, battery, cable, oil removalfilters,medical wasteand so on that will come out as waste will be temporarily stored in accordance with the principles specified in the concerning regulations, then will be sent the nearest licensed recycling or licensed discharge facility. Licensed vehicles will be used in transportation. No adverse impact of the waste to be produced during the construction and operation phases of the project is expected.

Within the scope of the project, 2872 numbered Environmental Law and environmental legislation published pursuant to this law will be complied with. All kinds of precautionary measures that prevents pollution will be taken for the protection of environmental quality. All the measures and permissions will be taken pursuant to the legislation in force.

The main laws and regulations to be complied with during the construction and operation phase of Onur Regulator and HEPP Project are listed below:

"Regulation on Structures to be Built at Disaster Area'' put into force by being published in Official Gazette dated 14.07.2007 and numbered 26582

''Regulation on Control of Packaging Wastes" put into force by being published in Official Gazette dated 24.6.2007 and numbered 26562

"Regulation on Making Amendments to Regulation on Control of Packaging Wastes" put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537

"Regulation on Control of Waste Battery and Accumulators'' put into force by being published in Official Gazette dated 31.08.2004 and numbered 25569

"Regulation on Making Amendments to Regulation on Control of Waste Battery and Accumulators'' put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537

“Regulation on Control of Waste Oils” put into force by being published in Official Gazette dated 30.07.2008 and numbered 26952

“Regulation on Making Amendments to Regulation on Control of Waste Oils” put into force by being published in Official Gazette dated30.03.2010 and numbered 27537

“Regulation on General Principles of Waste Management” put into force by being published in Official Gazette dated 05.07.2008 and numbered 26927

“Environmental Audit Regulation” put into force by being published in Official Gazette dated 21.11.2008 and numbered 27061

“Regulation on Making Amendments to Environmental Audit Regulation” put into force by being published in Official Gazette dated 12.11.2010 and numbered 27757

“Regulation on Environmental Plans” put into force by being published in Official Gazette dated 11.11.2008 and numbered 27051

“Regulation on Making Amendments to Regulation on Environmental Plans” put into force by being published in Official Gazette dated 17.02.2009 and numbered 27144

“Regulation on Permissions and Licenses to be taken in accordance with Environmental Legislation” put into force by being published in Official Gazette dated 29.04.2009 and numbered 27214

“Regulation on Making Amendments to Regulation on Permissions and Licenses to be taken in accordance with Environmental Legislation“ put into force by being published in Official Gazette dated 25.04.2010 and numbered 27562

“Environmental Impact Assessment Regulation” put into force by being published in Official Gazette dated 17.07.2008 and numbered 26939

“Regulation on Assessment and Management of Environmental Noise” put into force by being published in the Official Gazette dated 04.06.2010 and numbered 27601

“Regulation on Buildings to be Constructed at Earthquake Zones” put into force by being published in Official Gazette dated 06.03.2007 and numbered 26454

“Regulation on Making Amendments to Regulation on Buildings to be Constructed at Earthquake Zones” put into force by being published in Official Gazette dated 03.05.2007 and numbered 26511

“Regulation on Control of Exhaust Gas Emissions” put into force by being published in Official Gazette dated 04.04.2009 and numbered 27190

“Regulation on Occupational Health and Safety at Temporary or Fixed Term Works” put into force by being published in Official Gazette dated 15.05.2004 and numbered 25463

“Regulation on Control of Excavation Soil, Construction and Demolition Wastes” put into force by being published in Official Gazette dated 18.03.2004 and numbered 25406

“Regulation on Assessment and Management of Air Quality” put into force by being published in Official Gazette dated 06.06.2008 and numbered 26898

“Regulation on Occupational Health and Safety” put into force by being published in Official Gazette dated 09.12.2003 and numbered 25311

“Regulation on Control of Solid Wastes” put into force by being published in Official Gazette dated 14.03.1991 and numbered 20814

“Regulation on Making Amendments to Regulation on Control of Solid Wastes” put into force by being published in Official Gazette dated 05.04.2005 and numbered 25777

“Regulation on Pits to be made at Places Where Construction of Sewage Course is Impossible” put into force by being published in Official Gazette dated 13.03.1971 and numbered 13783

“Regulation on Control of End-of-Life Tires” put into force by being published in Official Gazette dated 25.11.2006 and numbered 26357

“Regulation on Making Amendments to Regulation on Control of End-of-Life Tires” put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537

“Regulation on Industrial Air Pollution Control” put into force by being published in Official Gazette dated 03.07.2009 and numbered 27277

“Regulation on Making Amendments to Regulation on Industrial Air Pollution Control” Put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537

“Regulation on Water Pollution Control” put into force by being published in Official Gazette dated 31.12.2004 and numbered 25687

“Regulation on Making Amendments to Regulation on Water Pollution Control” put in force by being published in Official Gazette dated 30.03.2010 and numbered 27537

“Regulation on Conservation of Wetlands” put into force by being published in Official Gazette dated 17.05.2005 and numbered 25818

“Regulation on Making Amendments to Regulation on Conservation of Wetlands” put into force by being published in Official Gazette dated 26.08.2010 and numbered 27684

“Regulation on Control of Hazardous Wastes” put into force by being published in Official Gazette dated 14.03.2005 and numbered 25755

“Regulation on Making Amendments to Regulation on Control of Hazardous Wastes” put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537

“Regulation on Control of Medical Wastes” put into force by being published in Official Gazette dated 22.07.2005 and numbered 25883

“Regulation on Making Amendments to Regulation on Control of Medical Wastes” put into force by being published in Official Gazette dated 30.03.2010 and numbered 27537

“Regulation on Control of Soil Pollution and Sites Contaminated with Point Sources” put into force by being published in Official Gazette dated 08.06.2010 and numbered 27605

“Regulation on Health and Safety at Construction Works” put into force by being published in Official Gazette dated 23.12.2003 and numbered 25325

2918 numbered "Highway Traffic Law"

2863 numbered "Law of Conservation of Cultural and Natural Assets and Related Regulations"

2872 numbered "Environmental Legislation and Related Regulations"

3213 numbered "Mine Law"

4342 numbered "Pasture Law and Related Regulations"

4857 numbered "Labor Law and Related Regulations"

5403 numbered "Soil Conservation and Land Use Law and Related Regulations"

6831 numbered "Forest Law and 5192 numbered Law on Making Amendments to Forest Law and Related Regulations"

APPENDICES:

APPENDIX:1 Location Map

APPENDIX:2 1/25,000 Scaled Topographical Map

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APPENDIX:4 Geological Maps

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- **b-**Geological Map and Cross-Sections of Regulator Site
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APPENDIX:20 Water Analysis Results

APPENDIX:21 Pictures Showing the Project Site and Its Vicinity

APPENDIX:22 1/100,000 Scaled Environmental Plan, Plan Notes and Provisions

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