TUZ GÖLÜ UNDERGROUND NATURAL GAS STORAGE FACILITY CAPACITY EXPANSION PROJECT

Rev.No.	Date	Description	Prepared	Checked	Approved	BOTAŞ
G	06-06-17	Issued for review	B.E. / A.S.Y.	F.A.	M.Ş.	
F	23-05-17	Issued for review	B.E. / A.S.Y.	F.A.	M.Ş.	
E	17-04-17	Issued for review	B.E. / A.S.Y.	F.A.	M.Ş.	
D	10-03-17	Issued for review	B.E. / A.S.Y.	F.A.	M.Ş.	
C	15-02-17	Issued for review	B.E. / A.S.Y.	F.A.	M.Ş.	
B	13-02-17	Inter-discipline check	B.E. / A.S.Y.	F.A.	M.Ş.	
A	06-02-17	Discipline internal check	B.E. / A.S.Y.	F.A.	M.Ş.	
SIGNATURE						

BOTAŞ

BOTAŞ PETROLEUM PIPELINE CORPORATION

ÇINAR ENGINEERING CONSULTANCY CO.

Document Title

TUZ GÖLÜ UNDERGROUND NATURAL GAS STORAGE FACILITY CAPACITY EXPANSION PROJECT

EXECUTIVE SUMMARY

Document No.					Rev. No.	Total pages (without attachments)
Org. Code	Doc. Type	Disc. Code	Geog. Area	Ser. No.		
CNR	REP	ENM	EXS	17/001	G	53

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PICTURES

LIST OF TABLES

LIST OF ABBREVIATIONS

BOD	:	Biological Oxygen Demand
BOTAŞ	:	BOTAŞ Petroleum Pipeline Corporation
ÇINAR	:	ÇINAR Engineering Consultancy Inc.
cm	:	Centimeter
COD	:	Chemical Oxygen Demand
CWAA	:	Central Waste Accumulation Area
DO	:	Dissolved Oxygen
DSİ	:	State Hydraulic Works (Devlet Su İşleri)
EC	:	Electrical Conductivity
EIA	:	Environmental Impact Assessment
ESIA	:	Environmental and Social Impact Assessment
EMP	:	Environmental Management Plan
ERT	:	Emergency Response Team
GIS	:	Geographic Information Systems
Ha	:	Hectare
HAZID	:	Hazard Identification
HAZOP	:	Hazard Operability
hm^3	:	Cubic hectometer
HS	:	Health and Safety
HSE	:	Health and Safety, Environment
km	:	Kilometer
m	:	Meter
MoEU	:	Ministry of Environment and Urbanization
OHSAS	:	Occupational Health and Safety Assessment Systems
PROJECT	:	Tuz Gölü Underground Natural Gas Storage Project
PS	:	Pump Station
SEPA	:	Special Environmental Protection Area
SIA	:	Social Impact Assessment
SS	:	Suspended Solids
ST	:	Storage Tank
TDS	:	Total Dissolved Solids
TG UNGS	:	Tuz Gölü Underground Natural Gas Storage
TGP	:	Tuz Gölü Project
UGS	:	Underground Gas Storage
WB	:	World Bank
WWTP	:	Wastewater Treatment Plant

1. INTRODUCTION

This Environmental and Social Impact Assessment (ESIA) report was prepared by ÇINAR Engineering Consultancy Inc. with the purposes of evaluating the possible environmental and social impacts for Tuz Gölü Underground Natural Gas Storage Facility Expansion Project. This expansion project will increase the capacity of the existing storage project in the same area which was taken into operation recently. The existing project was also financed by WB resources and has an ESIA in place. In addition, ÇINAR Engineering Consultancy Inc. has been providing ESIA monitoring services for the existing project and therefore this ESIA had valuable inputs from the monitoring data. ÇINAR Engineering Consultancy Inc. also prepared an Environmental Impact Assessment report for the Expansion Project to fulfill the national EIA Regulation requirements and received “EIA positive” decision of Turkish Ministry of Environment and Urbanization on March 10, 2017.

1.1. Aim

In this report, it was aimed to assess environmental and social impacts which will occur in construction, drilling, leaching and auxiliary activities of the units outlined above during capacity expansion of Tuz Gölü Underground Natural Gas Storage Project. In addition, suggestions regarding minimizing these impacts and/or making positive the impacts will be made after the reviews, assessments and analyses in the report. Aims of this report can be listed as below;

- Explaination of the capacity expansion works of Tuz Gölü Underground Natural Gas Storage Project,
- Definition of the environmental and social the features at the project areas,
- Studies on probable factors to be caused to the environmental impacts at the project areas in parallel of the same project investigations and experienced studies,
- Explanation of the results of the probable environmental impacts and effects to the current social status on around of the project areas during the project works,
- Suggestions on decreasing of the negative environmental and social impacts,
- Explanation of planned works on increasing of the positive environmental and social impacts,
- Explanation of necessary measures to be taken on environmental and social impacts during the project works,
- Explanation of obtained and formed baseline data,
- Explanation of the performed analysis and measurement results,
- Definition of the health and safety conditions during the project works and
- Explanation of the results of social investigation studies.

In addition to existing project;

- 48 storages with 5 billion Nm^3 storage capacity,
- 1 surface facility,

- 1 natural gas branchman line (21 km, 40''),
- 1 fresh water line (130 km, 52 - 56''),
- 1 brine discharge line (45 km, 52 - 56''),
- Connection lines between wells,
- 3 pump stations and
- 5 water storage tanks will be established within the boundaries of the project area.

1.2. Scope

The scope of the report covers the investigation of the activity area with regards to the ESIA approach, ensuring the compliance with national and international laws and also inspection, monitoring and evaluation of environmental effects of the construction, drilling, leaching and operation activities to be carried out at project area and its surrounding under the headings presented below;

- Soil Management,
- Air Quality Management,
- Waste/Hazardous Waste Management,
- Wastewater Management,
- Water Management,
- Noise Management,
- Chemical and Hazardous Material Management,
- Salt Water (Brine) Management,
- Formation Wastes and Drill Mud Management,
- Flora - Fauna Management,
- Public Health, Occupational Health and Safety Management,
- Ecological Restoration and Reinstatement Management and
- Social Assessment and Management.

1.3. Material and Method

While conducting the environmental and social impact assessment of the Tuz Gölü Underground Natural Gas Storage Facility (TG UNGS) Capacity Expansion Project literature review, monitoring data from ongoing supervision works of original project and field research data were used to evaluate the impacts of the projects within the ESIA study area. To be more specific, the ongoing monitoring activities involve wide range of experts from different professional disciplines (Environmental Engineer, Flora and Fauna Experts, Geology and Hydrogeology Engineer, Agricultural Engineer, Landscape Architect, Sociologist), and extensive data collected was used in the preparation of TG UNGS Expansion ESIA.

In order to identify the area that will be affected by the project, the environmental, economic and social impacts of the project were evaluated holistically. Some of these effects are direct, others are indirect; “Project Impact and Research Area” was selected by taking into account following factors; air quality, noise, flora, fauna, agriculture and forest areas, etc.

When both parameters are evaluated, the impact area was determined approximately as 150 meters for EPDK licensed area and as 250 meters for pipelines and surface facilities.

Impact area studies were conducted in the planned pipelines (freshwater line, brine discharge line, natural gas branchman line), within provincial boundaries including the facilities and units-under construction of the planned TG UNGS Expansion Project, surface facilities and underground gas storage (UGS) sites, pump stations and storage tanks (PS-ST) and EPDK licensed area.

Floristic surveys were performed in two stages, namely, office (desktop studies) and land surveys. Within the scope of the office surveys, the data on vulnerable points in this area previously surveyed by the flora specialist, obtained from the land surveys related to Tuz Gölü Basin, and plant lists containing the flora species that are mentioned in the original project's EIA Report and have importance in the project's area of influence were checked, and the lists were updated.

Land surveys, site walks have been carried out by the experts of ÇINAR (biologist, herpetologist, ornithologist, marine biologist and flora experts) during the flora and fauna investigation studies of national EIA process of the capacity expansion project but due the winter conditions, additional flora and fauna investigation studies could not performed in scope of the WB ESIA process. Vegetation season field studies have been performed by the same biology team between the 26th and 28th of May. Fauna and flora experts will be evaluate the expansion areas for the existence of critical species and also impacts of the water transfer from Hirfanlı Dam and discharging activities into the Tuz Gölü in the direction of the data obtained from this site study. After the site study, obtained results will be given in the final ESIA report to be submitted in the second quarter of June.

In addition, the digitization of the project areas of planned capacity expansion project has been achieved by making use of the topographic maps and the KMZ files prepared by the Geographic Information Systems (GIS) Department of ÇINAR and all of these routes have been individually marked on the topographic maps.

1.4. Description of Tuz Gölü Natural Gas Storage Capacity Expansion Project

Project will establish a 400% more capacity than the current project. Project will consist of five phases those are;

- Preparation works,
- Installation of the pipelines, construction of the pump stations, storage tanks and surface facilities,
- Drilling and leaching activities,
- Operation phase and
- Post-Operation phase.

During the preparation works of the project, construction corridors of the pipelines and project areas of the main and auxiliary units (camp sites, energy transmission lines, access

roads, etc.) will be determined in scope of the feasibility studies in parallel of the current project (1st Phase). Three main pipelines will be established those are fresh water line for the fresh water needs during the leaching operation, brine discharge line for discharges of the brine which sourced from the leaching operation into Tuz Gölü Basin and natural gas branchman line for the gas storage activities for the operation phase and also pump stations, storage tanks and surface facilities will be constructed during the pipeline works (2nd Phase) and drilling activities will be carried out before the leaching operation (3rd Phase). Operation activities will be started by BOTAŞ after the completion of the storage caverns (4th Phase) and transportation and reinstatement works will be planned and performed at end of the project (5th Phase).

Capacity expansion project will be similar with the current ongoing project and can be detailed in basic; fresh waters will be taken from the water intake structure of the first pump station established on the coast of Hirfanlı Dam and transported to the surface facilities and drilling sites within 130 km installed length fresh water line (∅: 52 - 56'') via the pump stations and storage tanks for the leaching operation. During the leaching operation, occurred brines will be discharged into the arid zones of Tuz Gölü via 45 km installed length brine discharge line (∅: 52 - 56'') and its diffusors. After the completion of the caverns, natural gases will be taken from the one of the main gas line of Turkey (Kayseri – Konya – Seydişehir Natural Gas Main Pipeline) within 21 km installed length natural gas branchman line (∅: 40'') to storing in the caverns. Pipes will be buried along the pipeline routes in 3 – 3.5 m depth from the surface in approximately 28 – 40 m width construction corridor. Installations of all pipelines will be planned onto 250 m width both sides of the existing pipelines at the land acquisitioned sections (in total 500 m wide). All pipeline installations will be completed in 18 months from the starts of the project according to the planning.

Main and auxiliary units those are named as surface facilities will be used for the main distribution center for the fresh waters, brines and natural gases during the leaching and gas storing operations. Surface facilities will be constructed onto approximately 650 x 800 m rectangular area and included the pipelines, pumps, brine pools, gas circling (compressors, measuring stations, heating and cooling units, filters, separators, pressure control units, regeneration units and chimneys etc.) equipment and buildings. Main units for the leaching operation at the surface facilities will be completed in 18 months from the starts of the project according to the planning and construction of the gas circling units will be ongoing at the surface facilities for another 2 years.

Three pump stations constructed onto the fresh water line will be provided the sufficient pressure for the fresh water supply and five storage tanks will be used for the fresh water storage during the leaching operation same as the current project. All constructions of the pump stations and storage tanks will be completed in 18 months from the starts of the project according to the planning.

Drilling activities will be ongoing during the construction works of the pipelines and main

units. After the completion of drilling activities, leaching operations will be performed in scope of the solution mining techniques. One drilling operation will be completed in 2 – 3 months and leaching operation at a drilling site will be ongoing approximately 24 – 28 months.

Energy transmission lines and access roads of the project will be established at the commencement of construction phase of the TG UNGS Expansion Project. Generally, existing access roads will be used during the construction works of the project and new access roads will be opened after the approval of the government states and also BOTAŞ, if needed. Energy transmission lines will be planned in parallel of the current transmission lines and also it is planned that existing transmission lines will be used according to the power needs of the pump stations on the fresh water line, if being applicable.

All installation, construction, drilling and leaching works will be completed for 7 years in total and operating phase will be started part to part after the completion of the gas storage caverns.

As an aim of this report, potential environmental and social impacts of the capacity expansion project will be investigated in scope of these explanations given in this report.

1.5. Definition of the Project Impact Area / Project Setting

TG UNGS Expansion Project is planned within the borders of Aksaray Sarıyahşi, Ağaçören, Ortaköy, Eskil and Merkez districts, Konya Emirgazi district and Ankara Evren district on the middle of Internal Anatolia Region of Turkey same as the current project. Main and auxiliary facilities and structures are generally covered with agricultural land and pasture areas and also water intake structure will be near Hirfanlı Dam. However, diffuser point of the brine discharge line will be at the arid areas on the south of Tuz Gölü same as the current ongoing project.

Considering the planned facilities and units, it is conceived that the most important area that can be affected from the project is town of Sultanhanı because the majority of the surface facilities and well fields are located on the land belonging to town of Sultanhanı bounded by Aksaray province and Central district.

Project impact areas will be similar with the impact areas of the existing underground gas storage project. Agricultural lands, pasturelands, field and village roads, main roads between the districts will be mainly affected and also Ankara – Aksaray and Aksaray – Konya Highways will be affected in minor level due the construction activities of the pipelines during 18 months and then impacts will be continues during the construction phase of the surface facilities and drilling sites and also leaching and first gas filling operations. Project pipelines and units will not be passed on the middle or a part of the village, district or provinces except the Yukarı Neighborhood of Sapmaz Village on the route of the fresh water line and small public settlements established for the agricultural activities by the farmers at the licensed borders of the drilling sites.

For each planned unit and facility, distances of settlement areas around the Project's impact area defined in to the network of plant and transportation, are presented below.

Pipelines

Fresh Water Line

The freshwater line, which is planned for approximately 130 km length (∅: 52 - 56'') starts from the borders of Evren District of Ankara Province and reaches the planned surface facilities and well fields by following the route of Aksaray province, Sarıyahşi, Ağaçören, Ortaköy and Merkez districts.

Brine Discharge Line

Brine discharge line (∅: 52 - 56''), which is planned to be about 45 km long reaches to the planned brine discharge point within the Aksaray province and Eskil district boundaries by starting from Aksaray province and Merkez district boundaries, followed by Aksaray province and Eskil district.

Natural Gas Branchman Line

Starting from Kayseri-Konya-Seydişehir section of the Eastern Anatolia Natural Gas Main Transmission Line, the natural gas branchman line- planned about 21 km long (∅: 40'') passes through Town of Sultanhanı- located about 17 km north of the project area and it reaches to surface facilities and well fields planned within the borders of Aksaray province, Merkez district.

Pump Stations

In the context of the fresh water project a water intake structure will be installed for taking water off the coast of Hirfanlı Dam reservoir area and the water taken from the dam reservoir area shall be transported to surface facilities through 3 pump stations that will be installed on the route of fresh water line.

Water Tanks

For the continuity of the leaching process with fresh water supply, water taken from Hirfanlı Dam will be stored in 5 water tanks to be built on the fresh water line route for a case of possible interruption of water supply.

Surface Facilities/ Underground Gas Storage (UGS) Sites

Within the scope of the project, a new surface facility composed of leaching facilities (piping systems, pumps, brine pools, gas filling and discharging equipment), injection and production facilities (Ultrasonic measuring unit, gas turbine turbo compressors, piping systems, cooling and heating units, filters and separators, pressure reducers, glycol regeneration unit etc.) shall be constructed in an area of approximately 650 m x 800 m (52 ha) used for construction and operation phase. In addition, construction sites - will be used during construction and will be removed after completion of the construction, batch plants (2

mobile batch plants with a capacity of 60 m^3/hour) and material storage areas shall be constructed. Mentioned facility is located within the borders of Aksaray Province, Merkez District, Town of Sultanhani.

As a part of the project, 48 wells shall be constructed and 41 of them are planned to be located within the Aksaray province, Eskil and Merkez districts and the remaining 7 are located within the borders of Emirgazi district of Konya province. Drilling site locations can be changed a little bit after the feasibility studies and seismic investigations.

Impact area of the project does not contain any healthcare institution, industrial area and facility continuing to operate. The areas where facilities and units planned to be constructed within the context of TG UNGS Expansion Project, comprised of agricultural lands and pasture areas; rural small settlement units located in the close proximity of the project area.

1.6. Rationale for the Project

Nowadays, as a result of energy demand arising from population growth and the increase in natural gas usage correspondingly, underground natural gas storage and usage has a significant importance for Turkey. In line with this demand increase, various projects are being developed. It is aimed to prevent seasonal fluctuations which will occur in the future depending on the increase in demand for natural gas in residential sector by these planned projects.

In this context, TG UNGS Expansion Project, which is planned to be established on approximately 40 km south of Tuz Gölü by BOTAŞ Petroleum Pipeline Corporation has a significant importance. In this project, underground gas storage caverns will be made by leaching a part of large natural salt structure which is located in approximately 1,000 meters below the surface. In this regard, usage surplus of natural gas occurred especially in summer months across the country is ensured to be stored in caves/salt caverns to be carved out by withdrawing it from Kayseri-Konya-Seydişehir areas of Eastern Anatolia Natural Gas Main Transmission Line, which passes approximately 23 km to the south of the project area, with the help of a branchman line. When the project is put into practice, it will be ensured that natural gas stored in caverns will be injected to Kayseri-Konya-Seydişehir areas of Eastern Anatolia Natural Gas Main Transmission Line by withdrawing gases from the caverns with the purpose of meeting the increased demand for gas across the country in peak periods.

First 6 storages in ongoing “Tuz Gölü Underground Natural Gas Storage Facility”, which consists of 12 caverns each of which has 630,000 Nm^3 physical capacity and under construction in current situation, will be put into use in 2017, and 500 million Nm^3 storage capacity will be reached in that stage. 6 storages of second group will be completed in 2020 and it will reach 1 billion Nm^3 storage capacities in total.

TG UNGS Expansion Project will consist of 48 storages with 5 billion Nm^3 capacity, 1 surface facility and 1 natural gas branchman line, in addition to existing facility which

consists of 12 storages to have 1 billion Nm^3 capacity and surface facilities, and it is planned to establish a water line, brine discharge line, connection lines between wells, pump stations, water storage tanks and concrete plants as auxiliary units. There may be increase or decrease in the numbers of mentioned auxiliary units depending on the needs of the facility and changing conditions.

It is projected that 500 persons will work in construction stage of the project and 100 persons in total will work in operation stage including Tuz Gölü Underground Natural Gas Storage Facility project. Assessments regarding the type of waste to be generated during land preparation, construction and operation processes, environmental impacts and measures to be taken are given in Section 6.

Status of the Current (Original)Tuz Gölü Underground Natural Gas Storage Project

In the framework of the works identified above, the drilling works of 12 UGS sites were completed. The leaching processes have been completed for 3 caverns and are ongoing in 3 caverns in first 6 leaching operation phase, where regular measurement is performed by sonar imaging method in order to check the leaching process and to facilitate the engineering design of the leaching process in advanced stages.

2. LEGAL FRAMEWORK

The construction and operational phases of the TG UNGS Expansion Project will be realized in strict compliance with a large number of national and international laws and regulations.

The legislative amendments and the structural changes in the Ministry that have taken place since the date when the final EIA Report was created and the interaction between these changes and the project along with the details regarding the policies and the legal framework which shall be strictly complied with during the construction and operational periods, are elaborated below.

2.1. Turkish Environmental Legislation

The Ministry of Environment and Urbanization operates in close cooperation with other ministries as well as relevant entities, governmental and non-governmental organizations (NGOs). Following the institutional restructuring in Turkey, the ministries and the governmental bodies in charge of environmental management are as follows:

- Ministry of Health
- Ministry of Culture and Tourism
  - General Directorate for Cultural Assets and Museums
- Ministry of Food, Agriculture and Livestock
  - General Directorate of Agricultural Research and Policy
  - General Directorate of Food and Control
  - General Directorate of Agrarian Reform
- Ministry of Energy and Natural Resources
  - General Directorate of Mining Works
  - General Directorate of Mineral Research and Exploration (MTA)
  - Turkish Electricity Generation Company
  - Turkish Electricity Transmission Company
  - Turkish Electricity Distribution Company
- Ministry of Transport, Maritime Affairs and Communications
  - General Directorate of Highways (KGM)
- Ministry of Forestry and Water Affairs
  - General Directorate of State Hydraulic Works (DSİ)
  - General Directorate of Water Management
  - General Directorate of Nature Preservation and National Parks

2.1.1. The Environmental Impact Assessment (EIA) Procedure in Turkey

The First Regulation on Environmental Impact Assessment in Turkey was promulgated in the Official Gazette dated 07.02.1993 and numbered 21489. The regulation was later revised on 23.06.1997, 06.06.2002 and 16.12.2003. The latest version of the EIA Regulation was published in the Official Gazette dated 25.11.2014 and numbered 29186. The objective of this regulation is to regulate the administrative and technical procedures and principles to be complied with throughout the EIA process.

2.2. International Treaties Recognized by Turkey

Turkey has signed many international treaties and conventions in order to protect environment and biodiversity. Major international treaties in respect of which compliance may be required as part of this project are listed below:

- "Biodiversity Convention" as ratified by Law No 4177 of 29.08.1996 and published in the Official Gazette No 22860 of 27.12.1996,
- "Convention on the International Trade of Endangered Species of Wild Animals and Plants" as published in the Official Gazette No 22672 of 20.06.1996,
- "Convention on the Protection of Wildlife and Habitats in Europe" (BERN CONVENTION) taking effect upon its publication in the Official Gazette dated 09.01.1984 and numbered 18318 after ratification under Cabinet Decree No 84-7601,
- Convention on the Preservation of Wetlands of International Significance Especially As the Habitat of Water Birds" (RAMSAR Convention) as ratified by Cabinet Decree No 94/5434 of 15.03.1994 and published Official Gazette No 21937 of 17.05.1994,
- "International Convention on the Protection of Birds" as ratified by Law No 797 of 01.12.1996 and published in the Official Gazette No 12480 of 17.12.1996,
- "Convention on the Protection of World Cultural and Natural Heritage" as published in the Official Gazette No 17959 of February 14, 1983.

It will be ensured to protect these species and hand down the next generations by complying with the Biodiversity Convention, CITES, BERN, RAMSAR Conventions and International Convention on the Protection of Birds.

In addition and as an aim of ESIA Report of the capacity expansion project has been prepared in scope of environmental assessment, natural habitats, cultural resources, dam safety, involuntary resettlement, etc. policies categorized in World Bank Operational Policy / Bank Procedures. Project impacts have been explained in the report according to mainly policies followed by the World Bank below;

- OP 4.01 – Environmental Assessment
- OP 4.04 – Natural Habitats
- OP 4.11 – Physical Cultural Resources
- OP 4.37 – Safety of Dams
- OP 4.12 – Involuntary Resettlement for Social Policies

2.3. Institutional Arrangements

In order to provide an efficient co-ordination;

- BOTAŞ,
- Construction Contractor and Consultants,
- Independent Environmental Monitoring Company to be hired by BOTAŞ and
- Ministry of Environment & Urbanization (MoEU), EIA Monitoring and Control Department and its associated units

have to work in coordination in both technical and managerial matters. Organization Chart for the information flows and the responsible parties in BOTAŞ and its Contractor is given ESIA report.

BOTAŞ Management (refer to the chain in the chart) together with the department that will be responsible for the construction activities will ensure that all construction related activities of Contractor(s) comply with approved ESMP (as a part of ESIA). To achieve this, BOTAŞ will regularly monitor and evaluate the Contractor's field activities and performance through auditors.

Environmental Engineer and also social expert of BOTAŞ directly connected to Underground Storage Manager will be responsible for coordinating and supervising the monitoring activities. BOTAŞ will also carry out an independent auditing program through an Environmental & Social Monitoring Company, which will inspect the field activities of Contractor(s) and directly report to BOTAŞ.

BOTAŞ Contractor(s) will be responsible for the adoption of the ESIA and ESMP during the construction phase, implementation of all mitigation measures stated in ESMP and required to be in compliance with the ESMP together with the project's environmental standards.

BOTAŞ will hire an "Environmental and Social Monitoring Company" for independent monitoring the BOTAŞ Contractor(s) activity. Environmental and Social Monitoring Company will weekly review and comment on the weekly reports written and presented by the Contractor(s), inspect the work sites, review the environmental performance of the project and the Contractor's field activities, carry out environmental control analyses and data collection as defined in ESMP, and report the findings to BOTAŞ in weekly basis.

BOTAŞ and WB will decide the reporting arrangement during the project appraisal.

3. DEFINITION AND SPECIFICATIONS OF THE PROJECT

3.1. The Location of the Project Area and Units

Within the scope of the TG UNGS Expansion Project; surface facilities, UGS sites, pipelines, pump stations and water storage tanks will be constructed as activity/service facilities. In this regard, 48 storages with 5 billion Nm^3 capacity, 1 surface facility and 1 natural gas branchman line will be constructed within the scope of main units in addition to existing facility which consists of 12 storages to have 1 billion Nm^3 capacity, and 1 fresh water line, 1 brine discharge line, connection lines between wells, 3 pump stations, 5 water storage tanks and 2 mobile concrete plants will be constructed as auxiliary units (See in Figure 3.1.1.).

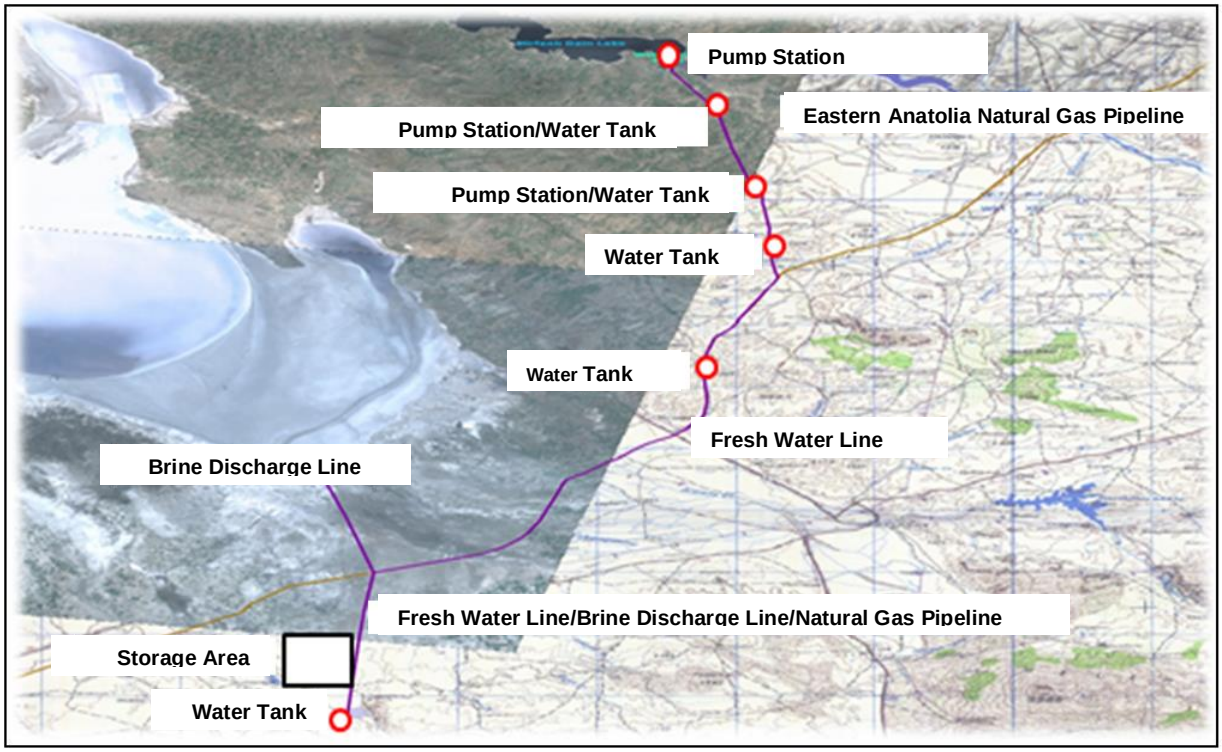

Figure 3.1.1. Activity Units Planned Within the Scope of Tuz Gölü Underground Natural Gas Storage Facility – Capacity Expansion Project

3.2. Design of the Project Area

The Tuz Gölü Basin is the most favorable place for gas storage in salt formations because of the following factors,

- Geographical location,
- Proximity to the Kayseri-Konya-Seydişehir Natural Gas Pipeline, 40 inches,
- Availability of pure salt masses at the proper depth in the area and
- Minimum level of seismic activities in Turkey.

Within the scope of the Tuz Gölü Underground Natural Gas Storage Facility, whose EIA was approved in 2003 and whose construction is ongoing (with some units taken into operation), several procedures have been fulfilled within the framework of technical feasibility, such as, seismic inspection of the area (see in Figure 3.2.1.) by BOTAŞ, laboratory testing of salt layers to define their mechanical characteristics, hydrological work for water supply and brine discharge.

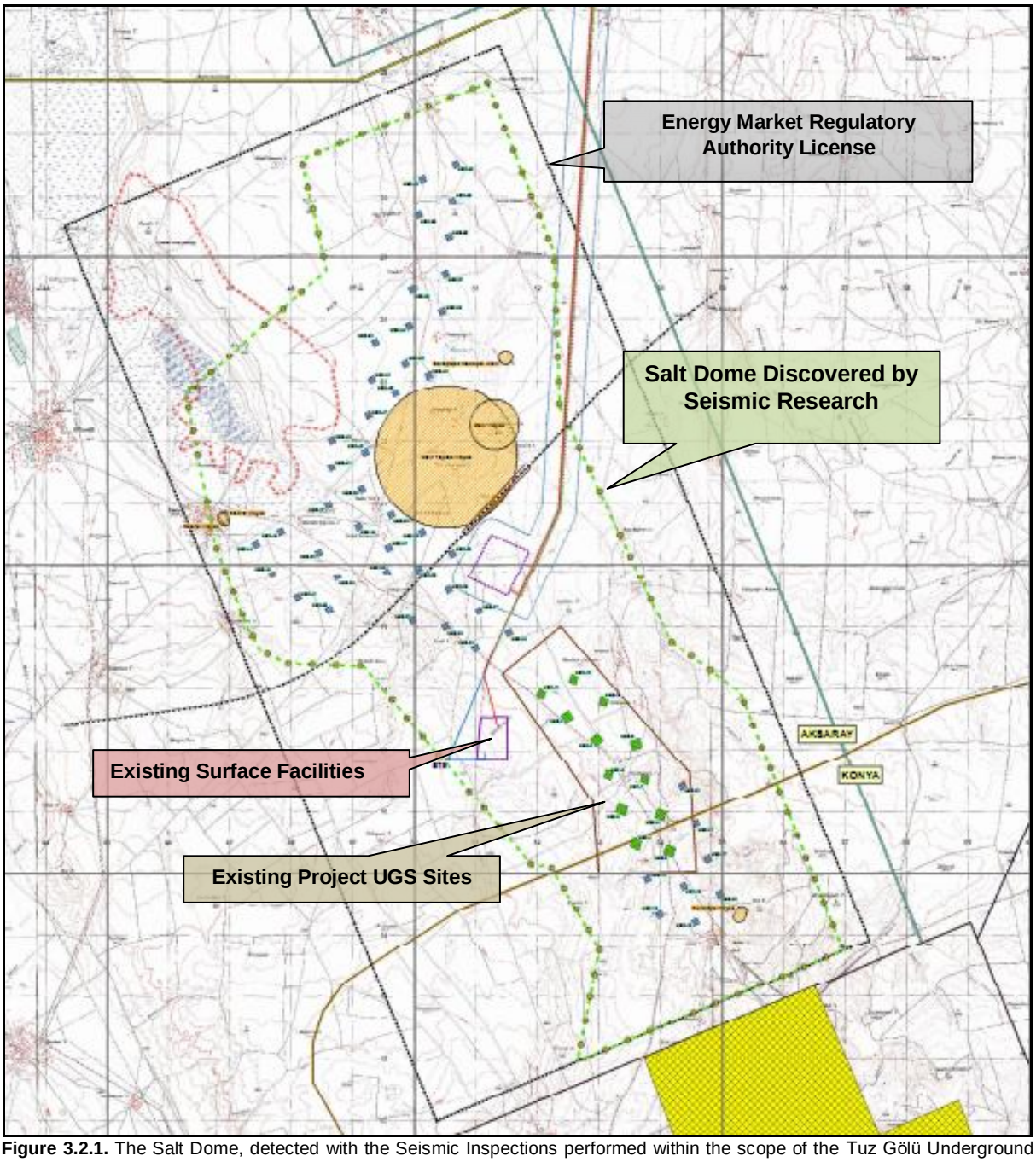

Figure 3.2.1. The Salt Dome, detected with the Seismic Inspections performed within the scope of the Tuz Gölü Underground Natural Gas Storage Project, and the Facilities

The storage method, the dimensions, number, capacities and characteristics of the caverns to be opened within the scope of the planned capacity expansion project and the Tuz Gölü Underground Natural Gas Storage Project, whose construction is ongoing, are given in Table 3.2.1.

Table 3.2.1. Information on the Tuz Gölü Underground Natural Gas Storage Project and the Planned Capacity Expansion Project

Basic Information on the Project	Tuz Gölü Underground Natural Gas Storage Project, whose EIA was approved and whose construction is ongoing	Planned Capacity expansion Project	Total
Storage Type	Salt Formation / Salt Cavern	Salt Formation / Salt Cavern	-
Depth of Entry to Salt	Between 500 m and 860 m	Between 500 m and 860 m	-
Salt Dome Depth	>1,500 m (drilling), 1,500 – 2,000 m (seismic)	>1,500 m (drilling), 1,500 – 2,000 m (seismic)	-
Number of UGSs/Caverns	12 Caverns	48 Caverns	60 Caverns
Average Volume of a Cavern (Net)	~ 630,000	~ 630,000 – 750,000 m^3	-
Working Gas Volume	~ 1 billion m^3	~ 5 billion m^3	~ 6 billion m^3
Maximum Injection Flow Rate	~ 30 million m^3/day	~ 30 million m^3/day	~ 60 million m^3/day
Maximum (Total) Backward Production Flow Rate	~ 40 million m^3/day	~ 40 million m^3/day	~ 80 million m^3/day
Transmission Line	Kayseri-Konya Natural Gas Transmission Line	Kayseri-Konya Natural Gas Transmission Line	-
Situation	Under construction	Planning phase	-

It is estimated that the construction phase of the project will last 7 years and its economic life will be 30 years. As shown in Table 3.2.1., with the planned capacity expansion project, where the first gas storage will be in 2020, the Tuz Gölü Underground Natural Gas Storage Project will reach a total of 6 billion Nm^3 of working capacity at the end of 2023.

3.3. Alternatives of the Technology and Project Location

The underground storage of natural gas which is a second alternative along with the storage of natural gas in liquid or gas states in tanks above the ground is distinguished in terms of providing storage capacity in large quantities with lower cost. The underground storage of natural gas in liquid and gas states is crucial in terms of balancing seasonal gas withdrawal, meeting sudden gas withdrawal, providing continuous gas supply, reducing the number of discontinuous clients and fulfilling purchase and sale commitments.

In consequence of the researches made, it has been proven that underground storage activities are better and more superior than above-ground storage facilities because of the below-mentioned reasons;

- In the underground storage activities; abandoned petroleum and gas reservoirs, abandoned mines, aquifers, hard rock and salt caverns/caves are used for the purpose of storage and building and operating of underground storage facilities are much more economic than aboveground storage facilities which are relatively larger than the other.
- The natural gas which will be stored by means of the underground storage activities are preserved in a safer environment against the accident risks which will occur due to operation (occupational accidents, safety faults etc.) and environmental hazards such as earthquake, bad weather conditions, fire, blowing up, explosion, sabotage.
- Underground storage facilities of natural gas provide advantage in spatial terms since storage activities are carried out underground and they are much more appropriate in environmental terms than aboveground facilities. (Figure 3.4.1.).

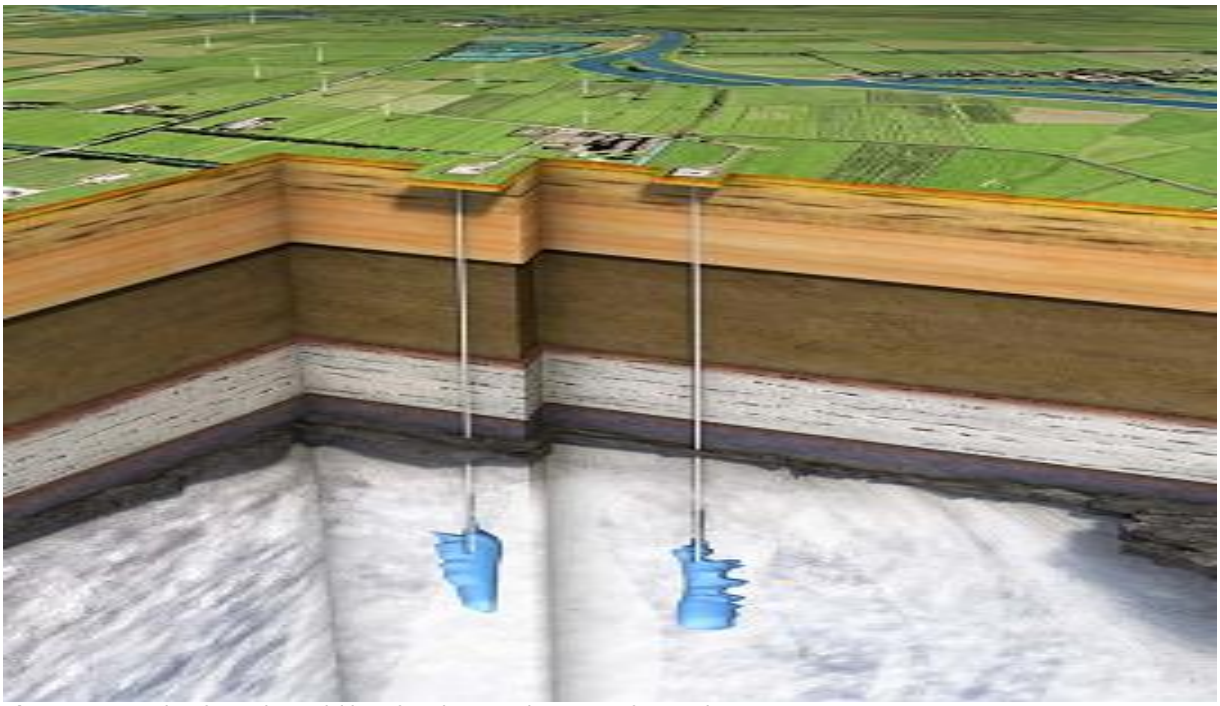

Figure 3.4.1. A view from The Activities of Underground Storage of Natural Gas

Natural gas is generally stored in abandoned petroleum and gas reservoirs, abandoned mines, aquifers and salt caverns/caves. The alternative places which can be used within the scope of underground storage of natural gas can be specified as;

- Hard rock caverns,
- Aquifers,
- Abandoned mines,
- Spent petroleum and gas reservoirs and;
- Salt caverns.

As in case of original Tuz Gölü Underground Natural Gas Storage Project, salt caverns will be used based on the features of the area in underground storage of natural gas within the scope of the TG UNGS Expansion Project, and leaching processes in the caverns which will be formed within the project will be gradually carried out in phases with the method of Solution Mining Process – Water Supply and Leaching of Cavern.

3.4. Planned Economic Social and Infrastructural Activities under the Project

In line with the planned social and infrastructural activities within the scope of Tuz Gölü Underground Natural Gas Facility Capacity Expansion Project;

- Meeting the water needs of staff working in the construction and operation phases in the melting process of UGSs/caverns, the water resource to be used in construction works and the water supply and wastewater treatment systems for discharging wastewater,
- Brine discharge line for the discharge of salt water resulting from the leaching process of UGSs/caverns and related systems,
- Natural Gas Branchman Line and associated systems that will transmit the gas which will be stored in to-be created caverns,
- Electricity lines for the electricity required for the activities to be carried out during the construction and operation stages of the planned facilities,
- Camp sites and social facilities in order to meet the accommodation, social and health needs of 100 personnel expected to work in the operation phase and of 500 personnel expected to work in the construction phase of the Project.
- Lighting, security and communication systems to be used in construction and operation phase, and
- Creation of service roads to access the Project sites is planned.

In order to meet the water needs of the personnel who will work in the construction and operation phase, as it has been the ongoing Tuz Gölü Underground Natural Gas Storage Project, water needed shall be purchased with tankers from the Municipality of Sultanhanı. In addition, within the scope of Capacity Expansion Project, two underground water wells are planned to be opened in the case of any need, and necessary permits will be obtained in accordance with the Law on Underground Water No.167. With regard to to-be formed domestic wastewater; the wastewater treatment plant based on the biological treatment system shall be used in operation phase of the Project. After the treatment, if effluent characteristics are observed as appropriate, it will be discharged to-be determined receiving environments such as the seasonal streams and natural drainages after wastewater discharge permits are obtained. Following of obtaining agricultural irrigation water permits, treated water will also be used for irrigation of landscape areas.

The energy required during the construction and operation of the planned TG UNGS Expansion Project will be provided from Şereflikoçhisar substation for Pump Stations (PS)

and storage tanks (ST). For surface facilities and UGS sites, required energy will be supplied from Aksaray substation.

Within the scope of the project, the accommodation, social and health needs of the personnel will be covered by the campsite as shown in Picture 3.5.1 that has lighting, security and communication systems used in the existing project and by campsites with similar features that will be established within the scope of the TG UNGS Expansion Project.

Picture 3.5.1. A view from campsite on Tuz Gölü Underground Natural Gas Storage Project (TG UNGSP) under construction.

Within the context of the project, the existing roads used in the original Project under construction for transportation purposes, will be utilized. The necessary task for enhancement and restoration will be carried out in above mentioned roads.

In addition, the aims of the planned Project are balancing the seasonal gas withdrawal of Turkey; meeting sudden gas withdrawals; ensuring uninterrupted gas supply; reducing the number of discontinuous customers and fulfilling purchase and sale commitments. In this context, on a national scale, natural gas storage and capacity building activities are of great importance for the Turkish economy.

4. CHARACTERISTICS OF PROJECT SITE

4.1. Flora and Fauna

Within the scope of the TG UNGS Expansion Project, flora and fauna species found in the project area including the pipelines routes are provided in detail below.

FLORA

The project site is situated within the borders of the Iranian-Turanian Phytogeographical Region. The Iranian-Turanian Phytogeographical Region is quite well characterised in terms of climate, flora and vegetation. This region, where hemicryptophytes and chamaephytes are dominant in physionomic terms, has very low similarity with neighboring regions from floristic aspect.

The Iranian-Turanian Phytogeographical Region is as a whole an independent region being the evolution and gene centre of many species as well as other high taxons like tribus, variety and section.

It is regarded as the richest region of the eastern Holarctic Kingdom in terms of non-tree-like xerophytes. The Iranian-Turanian Phytogeographical Region is also the centre, where many monotypical varieties as well as great varieties like Astragalus, Acantholimon, Cousinia comprising many species are originated.

Species list and phytogeographical areas of species and subspecies which were identified on the project sites during the flora studies and submitted in the draft ESIA Report will be revised according to the site survey results conducted in May and also submitted in final ESIA Report.

FAUNA

Fauna species show seasonal variations, and since it may take one or more years to establish the fauna inventory of an area, species given at the fauna lists have been based on site survey, observations and information from local people, biotope characteristics of the region and the current occurrence areas. Fauna lists contain those species that where seen during site survey, have not been observed during site survey, but have been determined according to the literature researches.

In this scope, ÇINAR Fauna Specialist conducted land surveys on the routes of the pipelines, surface facilities and UGS sites were located. Observations were made, through transaction method, on the areas where the species in the plant species list updated in the office surveys were located as well as at the intersection points of the project sites to be constructed mentioned in this report. Fauna elements were examined, using determinative parameters such as marks and traces (e.g., footprint, feces, etc.). In the examinations carried out in the period when seasonal restrictions were intense, fauna elements and traces were encountered in small quantities. Interviews with the local community were conducted to verify and/or expand the available information.

In additionally; due the seasonal restrictions, the flora and fauna studies for the vegetation season (2017) was not performed by the Experts completely at preparation time of this ESIA Report and these studies have been completed May 2017. The results will be integrated in the final ESIA Report.

4.2. Landscape Characteristics

When the areas where the main units and ancillary facilities related to the project will be built, are examined in terms of landscape, it is observed that these areas generally have almost uniform land structure in terms of geomorphological aspects, have very weak texture in terms of forest vegetation and terrestrial steppe vegetation is predominantly dominating.

4.3. General Geology

The Tuz Gölü basin, where the project area is located, is a North West (NW) - South East (SE) basin cross located within a cross-land structural depression. It was surrounded by Ankara - Galatian volcanic in the North; Kırsehir Kristalin Complex (Kırsehir Massif) in the East; Taurus Mountains (Bolkar Mountains Complex) in the South and Southwest; Sivrihisar-Bozdag massif in the West. In the basin of Tuz Gölü, it is observed that thickness increased up to 10 km from the Upper Cretaceous by now. It was revealed by the researchers that in the deep parts of the basin, units such as shales, sandstones, conglomerates and limestones- generally associated with each other in lateral and vertical directions have subsided while terrestrial and shallow marine units have subsided in the corner part. In shallow marine and terrestrial environments, conglomerates and sandstones- high energy products have been deposited, and shale, limestone, gypsum and anhydrite have formed during calm periods (Arıkan, Y., 1975).

4.3.1. Activity Area Geology

New drilling areas planned for capacity expansion within the scope of the project and the main surface area of the project are located completely on Miocene aged Insuyu formation (lacustrine limestone marl, conglomerate, sandstone, claystone and volcanic intercalations). In the planned brine discharge line and natural gas branchman line routes, clastic rocks belonging to Insuyu formation (lacustrine limestone marl, conglomerate, sandstone, claystone and volcanic intercalations) and pebble, sand, silt, limestone and carbonaceous killer belonging to the Quaternary Tuz Gölü formation, are surfacing.

4.3.2. Hydrogeological properties

When the examination of the underground water resources around the Tuz Gölü (Tuz Gölü), it is observed the mentioned resources are mainly located in scope of Eşmekaya reeds on the south side of Tuz Gölü and the reed-swamp areas at the southwestern side of Tuz Gölü. Eşmekaya reeds are located at a distance of 22 km approximately, to the northwest of the project area. There are also source formations as the result of the faulting in scope of Peçenek formation (sand-pebble) and the alluvium near Peçenek stream located at Tuz Gölü D-GD location. It is thought most of the sources within Tuz Gölü's sub basin are dried.

4.3.3. Hydrological Properties

While the new drilling areas, surface facility area, some auxiliary surface facilities (water storage tanks), brine discharge line, natural gas branchman line and a large part of the fresh water line planned in scope of TG UNGS Expansion Project are within Konya Closed Basin which is reserved throughout Turkey, a small part of the fresh water line and some planned auxiliary surface facilities (pump stations, water storage tank) stay within Kızılırmak basin.

There is no significant surface water other than the dried stream bed with few seasonal flows in the region where the surface facility area and new drilling areas, which are planned in scope of the project capacity expansion, are located.

4.3.4. Hydrological - Hydrogeological Assessments

Along the project routes at the east of the Tuz Gölü and Peçeneközü Basin, the main formations which have aquifer characteristics are widespread Mesozoic aged marbles, Cretaceous aged granites extending on the eastern edge of the Peçeneközü basin in the northwest - southeast direction, Pliocene aged sand and pebbly units and Quaternary aged alluvial deposits. Mesozoic aged marbles have a structure with numerous fracture - crack and there is no spring discharge from this unit, but the units in the lower elevations are fed by groundwater flow. Cretaceous granites have a structure with numerous fracture - crack near the surface and especially at higher elevations. However, the depth of these cracks is not so much and since their lengths and relationship with each other are not broad, they have aquifer characteristics only in regional scale. Groundwater recharge in the East of the Tuz Gölü Basin and in the Peçeneközü Basin occurs with precipitation and permeation of surface flow. The recharge areas of the groundwater in the Peçenek basin are alluvial permeable levels of Pliocene and marbles and granites forming the northwest - southeast boundary of the basin.

Sultanhanı plain in the southern part of the Tuz Gölü Basin along the project routes, the important groundwater bearing units are Quaternary aged alluvium and limestone levels of Neogene aged units. Sand and pebbles of the Quaternary aged alluvium are the important groundwater storages of the plain. In addition, limestones with abundant crack - fracture in the Neogene aged units form important aquifers in the basin. In addition, these limestones have carstic characteristics. Groundwater recharge on the Obruk-Sultanhanı plain occurs with precipitation and permeation of surface flow.

In conclusion, the discharge of the salt water that is to be generated due to the leaching of the salt caverns into Tuz Gölü will not affect the current quality of the lake adversely as it will have the same content with Tuz Gölü and will not be discharged directly into Tuz Gölü. It should be noted that a detailed analysis regarding the quality of the discharged brine was conducted and the results are presented in the EIA report of the original project in year 2003. Moreover, Tuz Gölü, which is subject to continuous water loss and therefore faces the risk of drying out, is envisaged to be not affected adversely from the discharge of the salt water presenting characteristics similar to Tuz Gölü as being resulted from the salt caverns

extending until the ones under Tuz Gölü and thus having the same characteristics with Tuz Gölü. Therefore, the increase in the quantity of the salt water to be discharged in parallel with the increase in the quantity of the fresh water per unit time required for the leaching operations will not result in adverse impacts on Tuz Gölü.

4.4. Land Structure and Soil Properties

The main and auxiliary units to be established in scope of the project stay within the borders of Aksaray province, Sarıyahşi, Ağaçören, Ortaköy, Eskil and Merkez districts, Konya province, Emirgazi district and Ankara province, Evren district and it is seen as the result of the carried out environmental survey studies that, the facilities and structures are generally located within the agricultural areas and pasture areas. Mainly beet, clover and sunflower are grown in the areas.

4.5. Cultural Assets and Protected Areas

There are 2 protected areas in Aksaray province. These are: (i) Tuz Gölü Special Environmental Protection Area (ii) Ihlara Valley Special Environmental Protection Area. Ihlara Special Environmental Protection Area has a bird's eye distance of 57 km to the Project Area and no influence is expected. Approximately 46.5 km part of planned fresh water line, 23.5 km of planned brine discharge line, the brine discharge point and natural gas branchman line's approximately 10.5 km part stays within Tuz Gölü Special Environmental Protection Area, and regarding the mentioned areas, required permits are going to be obtained by making applications to the Ministry of Environment and Urbanization and Natural Heritage Protection General Directorate, before starting the construction works after the planned capacity expansion project ESIA process.

In addition, during the national EIA process of the TG UNGS Expansion Project, Experts from the Cultural Assets Protection Agency performed site walk to investigation of the cultural assets on the pipeline routes and also at the licensed drilling location areas. There is not any critical impact found at the planned project areas to be sourced from project works of the capacity expansion. According to the investigation results;

- Körü Mound at Aşağı Sapmaz Village and Kuru Mound at Baymış Village have been discovered by the Experts of Protection Agency and these mounds will be registered by them.

- Küllütepe Mound at Emirgazi Disctrict and Adalının Mound at Emirgazi Disctrict have been determined on the route (in 500 m corridor) at beside of the pipelines.

Construction activities will be performed sensitively on around of these mounds and information to be given to the authorities according to the requirements Law No. 2863 on the Conservation of Cultural and Natural Assets (as amended by Law No. 5226) and OP 4.11 policy of World Bank.

5. BASELINE STUDIES

In this report, performed studies are explained on the probable impacts to the air, water, soil, flora, fauna, protection zones and social activities during the ongoing Tuz Gölü Underground Natural Gas Storage Project. In scope of the current project, three main areas are most impacted from the construction and operating works at the project sites given below;

- Hirfanlı Dam at Water Intake Structure,
- Project surface facilities, drilling and leaching sites and
- Tuz Gölü Basin.

In this stage, performed studies and analysis will be given for probable and expected effects during the project under 3 titles these are;

1. Current Gas Storage Project (Ongoing Project) / 3rd party Monitoring Studies,
2. National EIA Studies for TG UNGS Expansion Project and
3. ESIA Process for TG UNGS Expansion Project.

5.1. Current Gas Storage Project

In scope of the 3rd party monitoring studies of current ongoing Tuz Gölü Underground Gas Storage Project, impacts to the receiving areas on around of the project sites are determined with the conducted analyses sampled from Hirfanlı Dam water at PS1 water intake site, groundwater at UGS sites, brines at diffuser and spread areas of Tuz Gölü in monthly bases and analysis reports are regularly submitted to BOTAŞ within the monthly environmental monitoring reports together with the explanations.

Surface Water Sampling from Hirfanlı Dam Water at PS1 Site

Water samples are taken from the spherical coordinates; 0575407-East, 4321517-North of Hirfanlı Dam Reservoir at water intake structure of PS1 site by Experts of ÇINAR to determination of the possible impacts of the project periodically. In the scope of the Hirfanlı Dam water quality monitoring studies, depending on the drinking water quality of the water supply, water of Hirfanlı Dam analyses have been carried the following parameters: Dissolved Oxygen (DO), Oxygen Saturation, pH, Electrical Conductivity (EC), Turbidity, Fecal Coliform, Total Coliform, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Nitrite Nitrogen, Nitrate Nitrogen, Ammonium Nitrogen, Zinc, Nickel, Cadmium, Lead, T. Phosphorus, Mercury, Kjeldahl Nitrogen, Suspended Solids (SS) and Color.

Brine Sampling at Brine Discharge Area

Brine samples are taken by the experts of ÇINAR and ÇINAR Environmental Laboratories from the diffuser point (0543614-East, 4253345-North) of the brine discharge line and nearest (0543730-East, 4253373-North) and farthest (0543835-East, 4253682-North) ponds to diffusors of the brine discharge line to determination of the discharged brines and spread brine quality and characteristics. Discharged brine quality are monitored in every month since starting date of the leaching operations by ÇINAR and probably impacts to Tuz Gölü Basin

are followed with the help of the analysis results. In the scope of the brine quality monitoring studies, discharged brine analyses have been carried the following parameters: pH, Electrical Conductivity (EC), Salinity, Total Dissolved Solids (TDS), Suspended Solids (SS), Sulphate, Chloride, Alkalinity, Nitrate, Nitrite, Ammonium, Sodium, Magnesium, Calcium, Oil-Grease, Total Chromium, Iron, Copper, Zinc, Arsenic, Mercury and Lead.

Soil Sampling at the Brine Discharge Area

In scope of the soil analyses at the brine spread areas, soil samples are taken from the brine discharge area (0543740-East, 4253338-North). However; in the scope of the 2016 April measurements, last soil sample has been taken from surrounding area of the diffuser point of the brine discharge line to determine impacts of the brine on the soil structure.

Groundwater Sampling at UGS Sites

In addition to total analyses Water samples have been taken from nearest well to UGS 8 site at spherical coordinates 0553338-East, 4216722-North point by the Experts of ÇINAR to determination the probable impacts of the Project to the groundwater quality.

According to the groundwater quality monitoring studies and contents of the chemicals used in drilling operation, groundwater from well of the settlement analyses are carried the following parameters: pH, Dissolved Oxygen (DO), Oxygen Saturation, Electrical Conductivity (EC), Salinity, Sulfate, Chloride, Total Dissolved Solids and Sodium.

Noise Measurements at the Project Areas

Noise level control measurements are conducted in every month by the Noise Expert of ÇINAR at the project areas where potential noisy areas are on around of the surface facilities and also camp sites in scope third party monitoring and measurement activities.

Air Quality Measurements at the Project Areas

In scope of the third party monitoring and measurement activities, PM_{10} and settled dust measurements are conducted at the project areas two months continuously in a year by the Experts of ÇINAR.

5.2. Studies in National EIA Process of TG UNGS Expansion Project

Environmental assessment studies (air, water, soil and noise pollution load analyses) were carried out to determine the current condition in scope of the project area, influence area and around in order to create data for the TG UNGSP Expansion Project.

The works to determine the current condition consists of PM_{10}, subsided dust measurements, soil analysis, groundwater analysis and noise measurements. In scope of the works to determine the current condition, below mentioned analysis and measurements were carried out:

- PM_{10} measurements at 4 points,

- Measurement for the dust subsiding in soil at 4 points,
- Current noise measurement at 5 points,
- Heavy metal analysis in soil at 2 points and
- Groundwater analyses at 2 points.

All the measurements and sample analyses were carried out by ÇINAR Environmental Measurement and Analysis Laboratory.

5.3. Studies in ESIA Process for TG UNGS Expansion Project

In scope of the ESIA process; some analysis and measurements were conducted given below to determine the current condition of the fresh water pipeline route. The works to determine the current condition consists of PM_{10}, settled dust measurements, soil analysis and groundwater analysis.

- Settled Dust Measurement at 8 Points,
- PM10 Measurement at 8 Points,
- Soil Analyses at 10 Points and
- Groundwater Analyses at 5 Points.

All the measurements and sample analyses were carried out by ÇINAR Environmental Measurement and Analysis Laboratory as in the process of the EIA.

Settled dust and PM_{10} measures are conducted at PS1, PS2, PS3 and ST3 sites, at Sapmaz Village and Yenikent Town, Pigging Station and at the southeast of Sultanhanı.

In addition, soil and groundwater samples have been taken at different sections of the pipelines with random sampling method.

6. POTENTIAL IMPACTS OF THE PROJECT AND THE MEASURES TO BE TAKEN

Potential environmental and social impacts of the TG UNGS Expansion Project can be studied in 5 phases;

1. Preparation works of the capacity expansion project,
2. Installation of the pipelines, construction of the pump stations, storage tanks and surface facilities,
3. Drilling and leaching activities.
4. Operation phase and
5. Post-Operation phase.

6.1. Preparation Works of the Capacity Expansion Project

Preparation works will be performed before the starts of the capacity expansion project together with the feasibility studies at the project areas. Pipeline routes, pump and storage tank stations, main and auxiliary units, drilling areas, new energy transmission routes and access roads will be determined at the project sites in parallel of the office works of the project. Temporary camp sites will be established during the preparation works and also project's start-up works such as equipment transportation and storages, infrastructure and superstructure works, route marking works, fuel and oil station works, top soil stripping works, etc. will be started. As results of these, the initial environmental impacts in the preparation phase will be;

- Dust emission sourced from the vehicles movements,
- Organic, recyclable and probable hazardous waste producing,
- Wastewater accumulation in sewage tanks and
- Noise impacts,

Listed environmental impacts will be minimized together with taken measures at the project sites. In this context, vehicles movements will be minimized if not necessary, current energy transmission lines and access roads will be used, organic and recyclable wastes will be transported to the waste collection points of the municipalities, wastewaters will be taken by the municipality's septic trucks and probable noise pollution will be prevented at the project sites.

In additionally, all contracts will be made between BOTAŞ, the contractors and licensed companies on consulting and monitoring activities, waste/wastewater disposal, air/noise measurements, fuel/oil supply, etc. will be completed and also social assessment and requirements of the project will be started at this stage.

6.2. Installation of the Pipelines, Construction of the Pump Stations, Storage Tanks and Surface facilities

Main environmental and social impacts are estimated for this phase of the project, because all pipeline and construction works will be carried out by the contractors at this phase.

Excavation and installation of the pipelines, preparation works of the project areas, establishing of the camp sites, installation of the energy transmission lines and main access road establishment will be performed at this section of the project. Negative environmental and social impacts should be minimized and also positive impacts of these should be improved at this section of the project. Therefore, main environmental works and social studies will be carried out by BOTAŞ, the contractors and subcontractors.

Excavation operations, excavated material transportations, vehicle movements and the other construction works will be caused to the probable dust emission on the pipelines, construction areas and also transportation routes of the project like the current ongoing project. In that case, access roads on the pipeline routes, construction areas and stabilized sections of the transport routes will be regularly watering by the sprinkler trucks against to the heavy dust pollution. However; the contractor shall be carefully against to the settled dust problem in the agricultural lands on around of the pipeline routes and construction areas. In additionally, dust, flue gas and exhaust emissions will be regularly checked via the air quality measurements by the licensed companies.

Probable high environmental noise problem occurred during the pipeline installation and construction activities will be checked with the periodically noise measurements on around of the project works. Noise shields and isolators will be used by the contractors for the high tonnage work machines, generators and the other noisy equipment against to the noise pollution.

Produced wastes during pipeline and construction works will be accumulated temporarily in the portable waste containers along the pipeline routes and construction areas. Central Waste Accumulation Area (CWAA) will be established in the surface facilities to temporary accumulation of the separated wastes (recyclable wastes, inert wastes, hazardous wastes, etc.) up to the disposal time during this phase of the project. Wastes will be accumulated in the waste containers at the working areas and transported to CWAA in daily basis. CWAA will include the recyclable waste rooms, inert waste area, hazardous waste room and also environmental and safety materials such as O/W separator, spill kit, fire extinguishers, etc. same as the current ongoing project. Waste amount register will be updated by the contractor in daily basis.

- Organic wastes will be carried to the waste collection point or intermediate waste transfer stations of the municipalities or determined waste points at the project's construction areas in daily basis.
- Recyclable and non-hazardous wastes will be sent to the contracted and licensed companies,
- Inert wastes will be sent to the permitted disposal facilities,
- Hazardous wastes, waste oils, waste vegetable oils and medical wastes will be disposed by the contracted and licensed disposal companies.
- Excess excavation soil piles will be transported to the permitted dump sites.

- The other wastes such as waste batteries, accumulators, electronic wastes and inert tires will be disposed according to the relevant regulations.

500 people will work during the construction works in the scope of TG UNGS Expansion Project. According to the information received from the official website of TURKSTAT, the amount of water withdrawn per person will be 180 lt / day-person. Assuming that the water to be used shall be transformed into wastewater by 80%;

It is calculated that 500 people x (180 lt/day-person x 80/100) = 72 m^3/day for the construction works of the project.

For the domestic wastewater to occur at the facility; the wastewater treatment plant based on biological treatment system to be used on operation phase will be used, the wastewater will be discharged into the recipient ambiences such as seasonal creeks and natural drainages to be identified pursuant to discharge permissions to be taken in case that the effluent qualities are in conformity after the wastewater is treated. Within the context of discharging the wastewater into the recipient ambiences as a result of treating the domestic wastewater in package treatment plant, the 4th Regional Directorate of DSI (State Water Works) will be consulted. Moreover, the treated water will be possibly used for irrigation of landscapes pursuant to the agricultural irrigation permissions.

Portable toilets will be used for the hygienic needs of the workers during the pipeline works and accumulated wastewaters in the tanks will be disposed by the municipality's septic trucks.

The cleaning water in the scope of TG UNGS Expansion Project will generate from washing and cleaning works in camping sites, workshops and other working areas together with concrete washing area on concrete batching plants and truck mixer and concrete washing waters on project sites. The washing and cleaning waters on camping, workshops and working areas shall be connected to oily water collection system or direct infrastructure system which will be set up in parallel to the main infrastructure with specially designed closed systems.

The oily waters to be collected in appropriate areas in these parts shall be passed through the oil traps which will be established separately or commonly and will be taken to common domestic wastewater treatment facility pursuant to quality assessment to be made with laboratory analysis, in case of deemed necessary.

Along with the project construction activities and operation periods, the rain waters falling into project sites and being drained shall be moved away from the construction area with rain water collection channels to be established on and around construction area. They will be discharged from the balancing and settling pools to natural drainages to be set up at the end of collection and accumulation channels for preventing the possible sediment carriage from the construction areas to the surrounding of the project areas.

However, if the cultural assets which have to be put under protection are encountered during the construction phase of the project, the construction activities will be stopped and a protection zone will be created within the scope of protection of cultural heritage. Then, the nearest civil administration or the museum's directorate will be informed respectively in accordance with the Cultural and Natural Heritage Protection Act No. 2863. In accordance with the investigations, the project revisions will be made regarding the project sites and pipeline routes if necessary.

Social impacts will be regularly monitored by BOTAŞ, Consultant and the Contractors and full-time social expert will be assigned by BOTAŞ and the Contractor. In addition, social experts of the Consultant will visit the public on around of the project areas in every month. Formed informing, request and complaint mechanism will be improved with the results of the social assessments. In additionally, employment needs of the project for the non-technical personnel will be fully met from public settlements on around of the project areas.

In the scope of the reinstatement studies, in order for the minimization of the visual impact of the pipelines and restoration of the area, the topsoil that was stripped before will be laid back following the necessary leveling and cleaning (rocks, project construction wastes, etc.) activities and the plowing of the areas tightened with vehicle movements.

6.3. Drilling and Leaching Activities

Impacts of this phase will be similar to the impacts of the construction phase. However, there will be additional impacts due to formation of drill mud and formation wastes. It has been experienced while the monitoring activities at the current ongoing project that; special waste and effluent types will be occurred during this phase such as drilling mud and formation wastes, insoluble sludge wastes of brines (salty waters), insoluble effluents and mud waters, etc. Environmental impacts of these waste and effluents and taken measures for decrease of the negative impacts have been explained in ESIA Report. Portable toilets will be used for hygienic needs of the workers during the drilling and leaching works and occurred wastewaters will be disposed by the municipality's septic trucks.

And more impacts are expected to occur at Hirfanlı Dam and Tuz Gölü due the fresh water intake and brine discharge activities, respectively. Possible impacts on the Hirfanlı Dam and Salt Lake have been explained in below and also ESIA report under the title of "Specific Environmental Impacts".

Impact of Fresh Water Usage on Hirfanlı Dam

During the leaching process of expansion project, nearly 60 million m^3/year fresh water will be pumped to the salt caverns from the Hirfanlı Dam. In order to interpret the effect of pumped fresh water on overall water storage capacity of Dam, the Level-Area-Volume relation data and Hirfanlı Dam's last 10 years (2007-2016) monthly average water levels are obtained from DSI and used in calculations (Figure 6.3.1. and Table 6.3.1.)

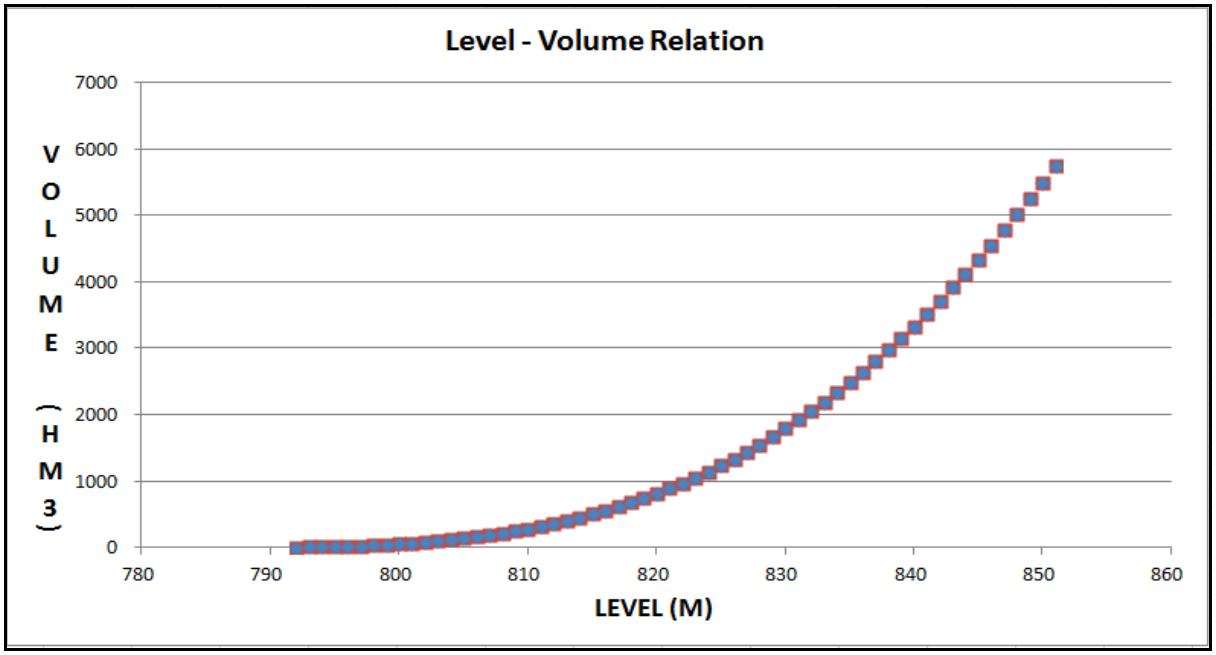

Figure 6.3.1. The Level-Volume Relation of Hirfanlı Dam

As seen in below table there is no drastic change in the water level of Hirfanlı Dam throughout the whole year due to seasonal changes.

Table 6.3.1. The Long Years Monthly Average Water Levels Of Hirfanlı Dam

Year / Month	Jan	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
2007	844.54	844.12	844.14	844.24	844.14	844.30	844.18	843.77	843.37	843.33	843.38	843.28
2008	843.31	842.90	842.82	843.21	843.47	843.47	843.47	843.47	843.47	843.47	843.47	843.47
2009	842.98	843.06	843.55	844.24	844.91	845.38	845.34	845.37	845.29	845.41	846.03	846.69
2010	847.51	848.33	848.60	848.98	849.89	850.17	850.13	849.55	849.25	849.51	849.77	849.94
2011	850.05	849.95	850.02	849.77	850.00	850.12	850.13	849.73	849.38	849.20	849.72	849.88
2012	850.23	850.20	849.89	849.60	849.81	849.71	849.79	849.10	848.23	848.15	848.13	848.13
2013	848.29	848.58	84882	849.12	849.30	849.81	849.88	849.56	849.28	849.13	849.15	849.55
2014	849.44	849.61	849.69	849.81	849.93	849.91	849.70	849.30	848.76	848.41	848.56	848.68
2015	848.92	848.89	849.25	849.60	849.85	849.83	849.60	849.09	848.59	848.38	848.29	848.42
2016	848.58	848.58	848.94	849.17	849.31	849.25	849.03	848.56	848.32	847.83	847.61	848.25
Total Average Value	847.39	847.42	847.57	847.77	848.06	848.20	848.13	847.75	847.39	847.28	847.41	847.63

Due to the leaching process in project nearly 5 hm^3/month of water will be pumped from the Hirfanlı Dam and the effect of this water usage monthly on the total water storage capacity (volume) of dam is given in Table 6.3.2. below.

Table 6.3.2. The Effect of Water Usage on Volume of Hirfanlı Dam

Volume / Month	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual Total / Average
Total Volume of Dam (hm3)	4859.06	4867.77	4903.07	4950.61	5018.16	5049.69	5033.22	4944.96	4861.18	4834.82	4865.18	4916.49	4925.35
Pumped Water (hm^3)	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	60,00
% Ratio (Used Water / Total Volume)	0.103	0.103	0.102	0.101	0.100	0.099	0.099	0.101	0.103	0.103	0.103	0.102	1.22

As a result, the effect of pumped fresh water on monthly average volume of dam is between 0.099% - 0.103% where as the used water is only effecting the 1.22% of volume of dam when the average annual volume of dam is considered. In the region between the period May to October the temperature values are above total annual average temperature and it is seen that there is no significance difference in the effect of used fresh water seasonally through the year.

In addition to the above studies, an additional site visit was carried out to investigate whether the water intake process of BOTAŞ from the Hirfanlı Dam had any social impact on irrigation activities there. All the settlements around the Hirfanlı Dam and the Kesikköprü Dam downstream were visited and a survey was conducted with local people. It was aimed to obtain information about how agriculture is done in these settlements (irrigated or dry agriculture), which crops are planted, if irrigated agriculture is carried out, how the land is being irrigated and where the water is provided from. At the same time, it was also asked whether they have information about the water intake process of BOTAŞ at the Hirfanlı Dam and observed any impacts about it (Picture 6.3.1.).

Picture 6.3.1. Interview with Acıkuyu Village Member

According to the information obtained from the interviews, only in some periods there is a decrease in water level, which is thought by users to be caused by climatic conditions. It is also indicated by users that there has been a decrease in rainfall in recent years and that drought has been experienced. The details of this investigation are given ESIA report under the title of “Specific Environmental Impacts”.

Impact of Brine Discharge to Tuz Gölü

During the leaching process of expansion project, nearly 60 million m3/year brine will be discharged to Tuz Gölü. In order to interpret the effect of this discharge to Tuz Gölü, the lake level observations station (E16G019) monthly average water level values of DSİ between 2007-2015 is obtained and used. On the other hand, the relation of Water Level-Area-Volume for the Tuz Gölü is obtained and calculated by a series of surface analysis carried out by GIS analysis where the results are presented at Figure 6.3.2. and Table 6.3.3. given below.

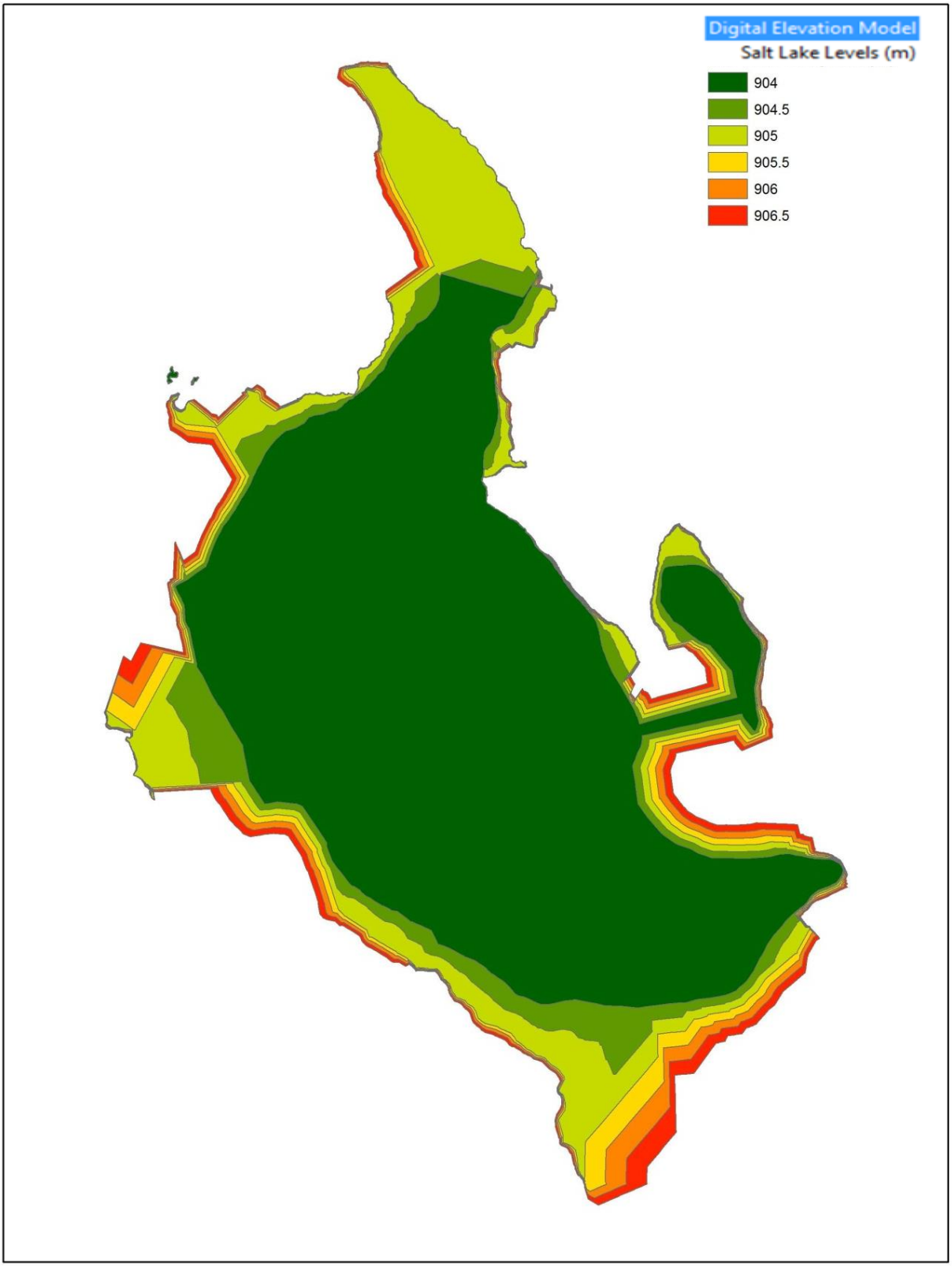

Figure 6.3.2. Surface Analysis Digital Elevation Model (DEM) of Salt Lake Levels

Table 6.3.3. The Salt Lake Water Level-Area-Volume Relation

Water Level Range (m)		Area (m^2)	Volume (m^3)
903.5	904.0	1,131,812,280	565,906,140
904.0	904.5	1,271,942,547	1,201,877,413
904.5	905.0	1,523,984,692	1,963,869,759
905.0	905.5	1,597,700,159	2,762,719,839
905.5	906.0	1,664,640,489	3,595,040,084
906.0	906.5	1,727,023,549	4,458,551,858

According to the official data of lake level observation station since 2007; the Salt Lake level changes between 904.20 m and 905.90 m with an average water level of 905.02 m. As a result, the effect of discharge of 60 million m^3/year brine to the Salt Lake for six years is calculated annually and given in Table 6.3.4. below.

Table 6.3.4. The Brine Discharge Effect on Salt Lake Annual Water Level

Average Water Level		1st Year	2nd Year	3th Year	4th Year	5th Year	6th Year
Water Level (m)	905.02	905.07	905.11	905.15	905.19	905.22	905.26
Volume (m^3)	1,995,823,763	2,055,823,763	2,115,823,763	2.175,823,763	2,235,823,763	2,295,823,763	2,355,823,763
Brine Addition (m^3)	-	60,000,000	60,000,000	60,000,000	60,000,000	60,000,000	60,000,000
Change in water level (m)	-	0.05	0.09	0.13	0.17	0.20	0.24

As it is seen, the change in Tuz Gölü water level due to brine discharge is between 0.05-0.24 m which is in the normal water range (904.20-905.90 m) of Tuz Gölü, even with an estimate of zero evaporation.

In the region, according to Şereflikoçhisar Meteorological Station hydrologic water budget close to Tuz Gölü surface evaporation is approximately 84% per year. Considering that amount of evaporation; it can be thought that the added brine to Tuz Gölü will drop down to 9,600,000 m^3/year. Then we obtain the following table given below (Table 6.3.5.) for the case of effect with evaporation where the water level change in Tuz Gölü changes between 0.01-0.05 m which is also in the normal water range (904.20-905.90 m) of Tuz Gölü.

Table 6.3.5. The Brine Discharge Effect on Salt Lake Annual Water Level with Evaporation

Average Water Level		1st Year	2nd Year	3th Year	4th Year	5th Year	6th Year
Water Level (m)	905.02	905.03	905.04	905.05	905.05	905.06	905.07
Volume (m^3)	1,995,823,763	2,005,423,763	2,015,023,763	2,024,623,763	2,034,223,763	2,043,823,763	2,053,423,763
Brine Addition (m^3)	-	9,600,000	9,600,000	9,600,000	9,600,000	9,600,000	9,600,000
Change in water level (m)	-	0.01	0.02	0.03	0.03	0.04	0.05

In addition, according to the pollutant type and amounts to be transferred and accumulated in Tuz Gölü Basin via the water transfers from Hirfanlı Dam and also discharges of brines, some parameters such as Zinc (Zn), Lead (Pb) and Mercury (Hg) that analyzed in both basins was calculated according to the worst case scenario (analyzed maximum pollutant values in all times/yearly minimum water volume in Tuz Gölü) as below (Table 6.3.6.).

Table 6.3.6. Mass Balance Calculation Table for Some Pollutant Parameters To Be Accumulated In Tuz Gölü Basin that Regularly Measured In Both Basins (Hirfanlı – Tuz Gölü)

PARAMETERS	Sourced From Hirfanlı Dam			Sourced From Brine Discharges		
	Zinc	Lead	Mercury	Zinc	Lead	Mercury
Analyses Values (mg/L) (Maximum Values in All Times)	0.03	0.00056	0.016	1.5	0.133	0.219
Yearly Transferred Water Amount (Billion Liters)	60	60	60	60	60	60
Pollutant Amount in Yearly Transferred Water Amount (kg)	1800	33,6	960	90000	7980	13140
Yearly Minimum Volumes of Discharge Basin (Tuz Gölü) (Billion Liters)	565,906	565,906	565,906	565,906	565,906	565,906
Rate of Transferred Water Between Basins to Total Volume (%)	0,01%	0,01%	0,01%	0,01%	0,01%	0,01%
Pollutant Amount Accumulated in Tuz Gölü Basin (kg/year)	0,19	0,00	0,10	9,54	0,85	1,39
Pollutant Amount Accumulated in Tuz Gölü Basin During the Project (kg/ 6 years)	1,15	0,02	0,61	57,25	5,08	8,36

According to the mass balance calculation table; it can be easily seen that, pollutant amounts sourced from Hirfanlı Dam (via water transfers between both basins) will be accumulated in Tuz Gölü Basin very less than discharged brines during the project as given below;

- 2% Zinc (Zn) from Hirfanlı Dam according to brine discharge,
- 0.42% Lead (Pb) from Hirfanlı Dam according to brine discharge,
- 7.31% Mercury (Hg) from Hirfanlı Dam according brine discharge.

In additionally; impacts of discharged brines were determined to compares of the measured analysis values of some pollutant parameters in discharged brines at April 2017 (Table 6.3.7., Table 6.3.8. and Table 6.3.9.).

Table 6.3.7. Analysis results of pollutant parameters in discharged brines into Tuz Gölü Basin at April 2017

Parameter	Test Result	Uncertainties	Test Method
Total Chromium (mg / L)	<0.001	% +/- 8.30	TS EN ISO 17294 – 1/2
Iron (mg / L)	<0.005	% +/- 8.40	EPA 6020 A
Copper (mg / L)	<0.005	% +/- 7.80	TS EN ISO 17294 – 1/2
Zinc (mg / L)	<0.005	% +/- 8.20	TS EN ISO 17294 – 1/2
Arsenic (mg / L)	<0.0005	% +/- 13.1	TS EN ISO 17294 – 1/2
Mercury (mg/L)	<0.0001	% +/- 21.7	EPA 6020 A
Lead (mg/L)	<0.0005	% +/- 2.80	TS EN ISO 17294 – 1/2

Table 6.3.8. Analysis results of pollutant parameters in Tuz Gölü during the EIA Process

Parameter	Sample 1	Sample 2
Total Chromium (mg / L)	<0.002	<0.002
Iron (mg / L)	4.7	0.38
Copper (mg / L)	0.4	<0.002
Zinc (mg / L)	0.2	0.1
Arsenic (mg / L)	0.37	0.136
Mercury (mg/L)	<0.002	<0.002
Lead (mg/L)	0.235	<0.002

Table 6.3.9. Total Pollutant Accumulation Rate due the Water Transfers between Basins and Brine Discharges into Tuz Gölü according to worst case scenario (analyzed maximum pollutant values in all times/yearly minimum water volume in Tuz Gölü)

Parameter	Zinc	Lead	Mercury
Total Pollutant To Be Accumulated (kg/year)	9.73	0.85	1.49
Total Pollutant Value in Tuz Gölü (kg/year)	113,181.20	132,987.91	1,131.81
Accumulation Rate	8.6×10^{-5}	6.4×10^{-6}	0.001
Percentage of Impact per Year	**0.01**	**0**	**0.13**

As to these compared results; pollutant impacts at Tuz Gölü basin due the water transfers between the basins and also discharged brines are clearly seen in lowest level generally according to measured parameters of Tuz Gölü and it could be expected being close to minimal during the project.

6.4. Operation Phase

Probable dust emission occurred at the operation phase will be sourced from the vehicle movements in the access roads of the project and these routes will be regularly watering by the sprinkler trucks against to the possible dust pollution. In addition, dust, flue gas and exhaust emissions will be regularly checked via the air quality measurements by the licensed companies.

Compressors shall be used in order to compress the natural gas to be stores underground and to store into the underground wells within the project and natural gas shall be used in the compressor as fuel (26,000 m^3/day). It is anticipated that the emissions of nitrogen oxide (NO_x) and carbon monoxide (CO) shall occur after the combustion from the natural gas to be used as fuel in the compressors planned to be used.

However, due to the fact that within the project compressors shall work only 40-50 days in a year and 25 ppm (0.025 kg/m^3) emission amount is at low level, formation of greenhouse gas within the project is at insignificant levels. Compressors to be used within the scope of the Capacity Expansion Project will be selected in accordance with all national and international standards.

Probable high environmental noise problem occurred during the operation phase will be sourced from the gas circling equipment such as compressors, generators, etc. and checked with the periodically noise measurements on around of the facilities. Noise shields and isolators will be used by BOTAŞ if needed against to the noise pollution.

Produced wastes during operation phase will be temporary accumulated in the portable waste containers at the facility and;

- Organic wastes will be carried to the waste collection point of the municipalities in daily basis.
- Recyclable and non-hazardous wastes will be sent to the contracted and licensed companies,
- Hazardous wastes, waste oils, waste vegetable oils and medical wastes will be disposed by the contracted and licensed disposal companies.

100 people will work in operation phase and according to the information received from the official website of TURKSTAT, the amount of water withdrawn per person will be 180 lt / day-person. Assuming that the water to be used shall be transformed into wastewater by 80%;

It is calculated that 100 people x (180 lt/day-person x 80/100) = 14.4 m3/day for operation phase.

For the domestic wastewater to occur at the facility; the wastewater treatment plant based on biological treatment system to be used on operation phase.

Along with the project construction activities and operation periods, the rain waters falling into project sites and being drained shall be moved away from the construction area with rain water collection channels to be established on and around construction area. They will be discharged from the balancing and settling pools to natural drainages to be set up at the end of collection and accumulation channels for preventing the possible sediment carriage from the construction areas to the surrounding of the project areas.

Social impacts will be regularly monitored and full-time social expert will be assigned by BOTAŞ during the operation phase.

6.5. Post-Operation Phase

All equipment and material transportation works will be started at the end of the operation phase and reinstatement works will be conducted at the same time. Environmental impacts at this phase will be similar as the preparation work stage of the project.

Social impacts will be ongoing at this phase and social experts of BOTAŞ will manage the social impacts of the project during the abandoning and reinstatement works.

7. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

Environmental & Social Management Plan (ESMP) has been prepared included the titles such as mitigation measures, monitoring plan, legal framework, institutional responsibilities, social affected groups and plan has been given in ESIA Report for TG UNGS Expansion Project together with the details.

All Contractors who will take part in the Planned Capacity Expansion Project will be prepared their ESMPs in parallel with this plan mentioned above. As stated in Section 2.3., in the scope of the ESMP, BOTAŞ will regularly monitor and evaluate the Contractor's field activities and performance through auditors.

8. HEALTH AND SAFETY

8.1. Current Activities on Health and Safety

At the current ongoing project, the contractor prepares the Monthly HSE report includes; HSE monitoring, trainings, environmental management, camp management, landscaping, etc. Prepared reports submit to BOTAŞ on the first week of the next month to explain the HSE activities during the month. In the scope of the Capacity Expansion Project, Prepared HSE report will be prepared including the some titles given as an example below;

- Project and Project Site Information
- Aim of HSE
- HS and Environmental Monitoring
- HSE Training,
- Housekeeping,
- HSE Man-hours in the month
- HSE awareness and trainings (regular trainings, orientations, toolbox)
- HSE Statistics
- HSE Management in the Project
- Site HSE Management Process

8.2. Measures to Be Taken on Health and Safety

During the land preparation and construction stage of the capacity expansion project, it is possible to sort each effect on the human health, business accidents in the construction activities and potential health problems.

The construction activities will be carried out in accordance with the clauses of “Regulations of Health and Security on the Construction Works” issued by the Ministry of Labor and Social Security and published in the Official Gazette dated 23 December 2013 and numbered 25325 including the minimum health and security conditions to be taken particularly in construction places.

8.3. Emergency Response Plan (ERP)

Emergency Response Plan (ERP) shall be formed in the scope of the Facility against any emergency state; particularities to pay attention and to determine shall be determined in the plan and by giving required trainings to the employees in these topics, their compliance to ERP and acting in the direction of this plan shall be provided.

Emergency Response Plan in the Facility shall also contain below stated subjects;

- Work Safety and First Aid Plans and
- Protection-security and safety plans for the Facility and its surrounding against sabotage and attacks.

Required training shall be taken in ERP Emergency Responses and trainings, vehicle, equipment maintenance and controls shall be done periodically.

Emergency Response Plan General Coordination Chart is given in Figure 8.3.1.

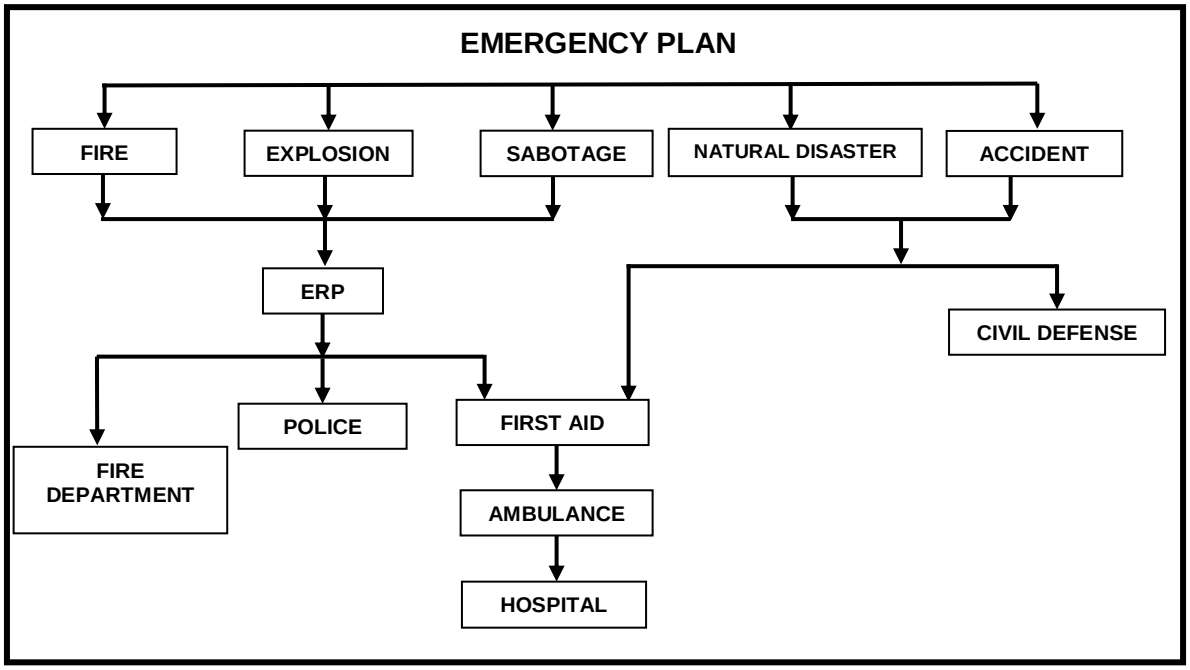

Figure 8.3.1. Emergency Response Plan Coordination Chart

8.4. Hazard Identification (HAZID) and Hazard Operability (HAZOP)

In scope of the TG UNGSP an HAZID Review (Hazard Identification) was performed by a team of experienced and multidisciplinary engineers allowing the identification of main Hazards related to the design and operating condition of the project. In the scope of Capacity Expansion Project, HAZID and HAZOP studies will be carried out with reference to the original project and also depending on detailed engineering studies.

The aim of this Hazard Identification (HAZID) Review study was to check the Facilities design from a safety point of view and to identify potential hazard, which could arise during the Leaching, De-Brining and Gas Operation phase of the Tuz Gölü Underground Gas Storage Expansion Project.

In this context, the following items will be evaluated as samples studies;

- Leakage of nitrogen at cavern area during leaching,
- Geological gas leakage during leaching,
- Over pressure in degassing tank during leaching,
- Crystallization in brine pipeline system,
- Incorrect assessment of geotechnical behaviour,
- Uncontrolled gas leakage during de-brining,

- Power failure during gas injection and withdrawn,
- Natural and environmental risks (Fire, earthquake, lightning, flooding and etc.)
- Interruption during gas injection and withdrawn operations,
- Tank overflow in pump stations and storage tanks,
- Wrong/incorrect position of valves during normal condition,
- Pipe blocked by solid particles,
- Electricity failure problems and etc.

The HAZID review is a method which is structured and based on “guide words” for the identification and analysis of risks.

A HAZID review combines:

- The identification of the risks,
- Their Analysis and
- A brainstorming session based on the hazards listed in the pre-established checklist. Using the checklist’s key words, the team is asked to identify a series of specific initiating events that could lead to a hazardous situation then spot possible causes, likely effects and associated safeguards.

After this identification, the team systematically evaluates the following:

- The effects and potential consequences of these initiating events on the facility and its environment,
- For each hazardous situation thus identified, the prevention measures that aim to eliminate or reduce the occurrence of its causes and the means of detection/protection that aims to reduce its potential consequences and
- The adequacy of these measures in relation to the hazardous situation in question and their effectiveness.

9. SOCIAL IMPACT ASSESSMENT

Social Impact Assessment carried out within the context of the project's ESIA studies reveals how the socio-economic, demographic and cultural structure of communities living in the affected region can be affected by the project and what can be done to minimize the negative impacts.

The social study area consists of the settlements which are very close or within the license area determined for the Tuz Gölü Underground Natural Gas Storage Facility Capacity Expansion Project. Focus group discussions with mukhtar and local people were carried out in Besci Quarter, Güneşli Quarter, Tömü, Mağrul and Bucak Plateaus. The interviews conducted in the field study were discussed with consideration of the possible social impacts of the project, the concerns of the local people and the local authorities regarding the project.

It is thought that the project will have social impacts that can be detailed under many different headings such as community safety, public health, labor influx, socio-economic, land take and resettlement etc. The evaluations were made by comparing the experiences about current project obtained from the interviews and the expectations and thoughts of PAPs about the capacity expansion project. Although the current project does not seem to have a significant negative impact on the people living here, it has been observed that concerns and worries about the new project have been settled. The people living here has no other source of income than the agriculture and animal husbandry, and it is observed there is no specialization in any profession, the age average is high, and most of the people do not have the possibility to carry out another job.

The project will require both permanent and temporary acquisition of land and thus is anticipated to have land based impacts. While the pipelines (gas, brine water and freshwater pipelines) will require temporary easement rights to be established, lands for well locations and other above ground facilities will be permanently acquired. The current licensed area of BOTAŞ (where wells and operational facilities will be located) will constitute majority of the lands which will require permanent acquisition. Within the boundaries of this area are both public and private lands, it was found out during the interviews that, many people residing within small settlements in these boundaries do not have titles for the houses which have been constructed mostly on public lands. This indicates that they will not be able to claim rights according to national law in the case of resettlement due to the construction of well areas. Although this does not constitute a problem in terms of compliance with local legislation, illegal users are required to be compensated according to WB policies, whether or not they have legal rights. This is the most important gap between WB policies and local legislation in assessing the social impact of the project.

The social impacts expected to occur within the scope of the project and how they will be mitigated and who will be the responsible party are summarized in the following table.

Social Impact	Mitigation Measure	Responsible Party
- Cultural differences with the workers coming to the local area - Conflicts between the workers and local people	Trainings will be provided by the project to introduce the cultures and social habits of the region to the foreign workers and to prevent possible conflicts between local people and workers.	- BOTAŞ - Construction Constructor
Dust (causing damages on planted crops and harmful to public health)	Dust emissions will be reduced through the regular watering of roads, especially unpaved ones.	- BOTAŞ - Construction Constructor
Traffic problems such as exceeding speed limits and causing danger for communities	- Trainings should be provided for Project workers including traffic rules, speed limits and possible risks for communities - All project vehicles must be monitored continuously for compliance with speed limits and traffic rules	- BOTAŞ - Construction Constructor
Lowered life standards of people who are forced to migration, financial losses, spreading of negative opinions against the project	Avoiding the resettlement or removing of the people who live there as much as possible. If it is not avoidable, providing resettlement assistance or allowance, cash compensation or other additional supports to ensure that they are not encountered difficulties in sustaining their lives	- BOTAŞ - Construction Constructor
Loss of land, structures, crops and trees due to permanent or temporary acquisition of lands and loss of livelihoods	-Full compensation at replacement cost for land (for landowners), for structures, standing crops, trees etc. (for both owners and users of land regardless of their legal status) Providing livelihood restoration assistance in the form of; provision of machinery and equipment for improving farming, provision of skills training, employment opportunities etc. - Providing resettlement assistance such as transitional support, transportation support, man force support etc.	- BOTAŞ - Construction Constructor
Pollution	Measures to prevent pollution which is given in EIA report should be followed.	- BOTAŞ - Construction Constructor
Noise and visual impacts caused by the construction activities	The precautions stated in EIA Report should be taken to prevent the noise and visual impacts.	- BOTAŞ - Construction Constructor
Safety problems for workers	- Health and Safety Awareness Trainings should be provided to workers periodically throughout their employment - World-wide accepted safety rules should be followed to prevent possible accidents or risks	- BOTAŞ - Construction Constructor
Loss of common lands such as pasture lands	Alternative pasture lands should be shown or accessibility of pasture lands should be ensured by leaving passages and access zones during the construction of pipelines	- BOTAŞ - Construction Constructor

As a part of the social safeguard policies of World Bank, the Project will adopt a stakeholder engagement approach that will be implemented as of project design and continue throughout the project cycle. The Expansion Project has already initiated consultations with local stakeholders including local authorities and local community under the national EIA requirements. BOTAŞ will continue to engage and involve all stakeholders during project planning, implementation and monitoring stages. BOTAŞ will have a designated expert that will administer stakeholder engagement activities along with the implementation and ensure that its Consultants and Contractors also adopt this approach which is outlined in detail in the Stakeholder Engagement Plan developed as a part of this ESIA report.

Social management together with the stakeholder engagement within the capacity expansion project should include major principals as given below;

- Establishing the positive, non-dependent relationships between the project and local public,
- Bringing of the potential benefits of the project to the best possible state and
- Reducing the most negative social impacts caused by the project.

Some stakeholder engagement activities have been already carried out and the continuity of these activities will be ensured in construction, operation and closure phases. Public Participation Meetings in accordance with national EIA Regulations were held on 21st and 22nd of November 2016. Three separate Public Participation Meetings were held in Ankara, Konya and Aksaray since the project is within the boundaries of these three provinces. National and local institutions / organizations, local authorities, BOTAŞ officials and PAPs participated in the meetings. Also, focus group discussions and interviews were conducted with PAPs during the baseline and impact assessment studies of ESIA on December 2016. The main issues/concerns raised during the Public Participation Meetings were as follows;

- How the expropriation procedures within the scope of the project will be carried out,
- Whether the areas to be expropriated have been determined or not,
- How construction and excavation works will be carried out in project area,
- Possible damages to dry and irrigated farming lands,
- Present damages to private lands due to the vehicles used during construction,
- Water conveyance line to be used within the scope of the project will serve local community,
- Whether the project will have impact on underground waters, and
- How top soil will be protected during construction works.

Considering that most of the issues raised at the meeting are concerned about the impacts on the livelihoods, it is important that the project activities are planned in such a way as to minimize the livelihoods in the region and the negative impacts on the settlements. All subjects discussed, as stated above, in public participation meetings were addressed in

ESIA Report, and also social impacts of the project are explained in detail in the relevant chapters.

Besides the consultations below, focus group interviews were conducted with local people in the project-affected settlement during the field visit for baseline data collection and social impact assessment studies, and semi-structured in-depth interviews were also conducted with Mukhtar's on December 2016. Both women and men in the settlements are participated in focus group meetings, since no specific disadvantaged group have been identified. Among the issues/concerns emerged from consultations, the most important ones that should be taken into consideration were;

- Whether the settlements within the license border will be removed or not
- Worries about the removing of their houses by the project since most of them have no title deed of houses
- Concerns that the expropriation prices will not be enough to cover the debts they have received for their current agricultural activities

The raised concerns and issues will be detailed in relevant chapters. It is clearly seen that PAPs have worries about the resettlement and livelihood issues. Mitigation measures determined for each social impact in the report will be implemented and monitored regularly to ensure that no adverse impact is occurred on living standards of local people. Also, Stakeholder Engagement activities will continue throughout the life of the Project starting from the scoping stage until decommissioning. BOTAS has prepared a SEP to clearly determine the methods and materials that will be used within the scope of the engagement starting from the scoping stage of the project until the operation and closure stages.

10. CUMULATIVE IMPACT ASSESSMENT

The cumulative impacts arise from the adding up of the project impacts to the impacts of the current or planned projects. While each and every project causes major and minor impacts, the cumulative impacts imply the overall direct and indirect impacts resulting from two or more projects in the same locality. The cumulative impacts of the planned activities have to be taken into consideration. The impacts that occur due to each and every project may not seem important in itself, however, the total loss, in other words, the cumulative impacts can be extremely important.

Within the context of the Tuz Gölü Underground Natural Gas Storage Facilities Capacity Expansion Project, the cumulative impacts of the underground natural gas storage projects are called in this cumulative impact assessment as below:

- Tuz Gölü Underground Natural Gas Storage Project : ***Ongoing Project***
- Tuz Gölü Underground Natural Gas Storage Facilities Capacity Expansion Project : ***Capacity Expansion Project***
- ATLAS Petroleum Gas Co. Natural Gas Storage Project : ***Private Project***

In this context, the physical characteristics of the underground natural gas storage projects are given Table 10.1.

Table 10.1. The physical characteristics of the underground natural gas storage projects being implemented in the Tuz Gölü Basin by BOTAŞ and ATLAS

Physical Characteristics	BOTAŞ		ATLAS
	Ongoing Project	Capacity Expansion Project	Private Project
The Time required to Create Caverns (month)	77	66	96
The No. of Caverns to be Leached	12 caverns (In groups of 6)	48 caverns (In groups of 6)	12 caverns (In groups of 2)
The Volume of Each Cavern (m^3)	630,000	630,000 – 750,000	630,000
The Point of Fresh Water Withdrawal	Hirfanlı Dam Lake (via pipeline was constructed)	Hirfanlı Dam Lake (via pipeline to be constructed)	Hirfanlı Dam Lake (via pipeline to be constructed)
The Quantity of the Fresh Water Required (million m^3/year)	15	45	10.8
The Point of Discharge	Tuz Gölü arid zone (via a constructed pipeline)	Tuz Gölü arid zone (via pipeline to be constructed)	Tuz Gölü arid zone (via pipeline to be constructed)
The Volume of the Salt Water to be Discharged (million m^3/year)	Tuz Gölü 15 (contains ~1,760,000 m^3 of salt)	Tuz Gölü 45 (contains ~5,300,000 m^3 of salt)	Tuz Gölü 10.8 (contains ~1,260,000 m^3 of salt)

Reference: The EIA Report of the above mentioned project by ATLAS and the EIA Reports of the Ongoing Project and Capacity Expansion Project of BOTAŞ

In an effort to estimate the maximum potential impacts as part of the Cumulative Impact Assessment studies, the construction activities (the leaching and the discharge operations)

of all projects are considered to be undertaken simultaneously and the impacts that might arise consequently are listed below;

- The impacts of the simultaneous fresh water withdrawal from the Hirfanlı Dam Lake throughout the leaching operations within the scope of either of the projects on the dam lake and the other users (villagers and farmers),
- The impacts of the simultaneous discharge of the salt water on the receiving environment which is Tuz Gölü,
- The impacts that might occur during the fresh water withdrawal and the brine discharge operations on the flora and fauna species found in the project sites and their immediate vicinities.

Furthermore, the associated principles described in the Tuz Gölü Special Environmental Protection Area Water Resources Management Plan Project / Section 9 Water Resources Management Plant and its Principles also suggest that the external supplements to Tuz Gölü contribute significantly to the sustainability of Tuz Gölü. The respective principles are;

- Keeping the water level in the lake under control through the controlled release of the water from the Mamasın Dam. Water of Melendiz Brook which is one of the most important rivers feeding Tuz Gölü with its surface flow has to be released from Mamasın Dam and the water level in the lake will be kept under control.

- The volume of Tuz Gölü varies between 565,906,140 m^3 and 3,595,040,084 m^3, and assuming the average water level of Tuz Gölü where evaporation will take place, the total amount of the water to be discharged during the leaching phase is calculated to cause 1-5 cm increase in the level of the lake. The salt water discharged into Tuz Gölü is expected to result in a very small increase in the water level.

In accordance with the issues specified above, it can be concluded that the discharge of the salt water arising from the leaching operations into Tuz Gölü as part of all projects either at the same time or at different times during the construction works, in case the negative impacts occur, they will be prevented through monitoring and auditing practices. In addition, as stated in the Section 6.3. of Executive Summary, amount of fresh water used for leaching operation does not make a significant difference on the Hirfanlı Dam volume.

As part of the cumulative impact assessment studies, the last issue to be addressed is the overall impacts that might occur on the flora and fauna species found on the project routes and their immediate vicinities during the construction of the facilities associated with the fresh water procurement and the salt water discharge operations. The Flora and Fauna of the ESIA Report of the Capacity Expansion Project, the possible impacts that might arise during the establishment of the project units within the scope of the Capacity Expansion Project and the measures to be taken are assessed. Through these measures (topsoil management, stop working seasonally at sensitive spots and etc.), the temporary impacts on the flora and fauna species will be minimized.