



Environmental and Social Impact Assessment for Adana Integrated Health Campus Project

Final Draft ESIA Report

June 2014

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Document Title Environmental and Social Impact Assessment for
Adana Integrated Health Campus Project
Status Final Draft ESIA Report
Date 20 June 2014
Project Name ESIA for Adana IHC
Project Number E13C107

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ABBREVIATIONS

AISWDF	Adana Integrated Solid Waste Disposal Facility
AMM	Adana Metropolitan Municipality
APCV	Air Pollution Contribution Value
ASHRAE	American Society of Heating and Air-Conditioning Engineers
ASKI	Adana Water and Sewage Administration
bgl	Below Ground Level
BMS	Building Management System
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
°C	Celcius
CCTV	Closed Circuit Camera System
CIBSE	Chartered Institution of Building Services Engineers
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COD	Chemical Oxygen Demand
CT	Computed Tomography
D&T	Diagnostic and Treatment
dBA	Decibel
DMI	State Meteorological Works
DSI	State Hydraulic Works
EBRD	European Bank for Reconstruction and Development
EC	Electrical Conductivity
EHS	Environmental Health and Safety
EHSS	Environmental, Health and Safety and Social
EIA	Environmental Impact Assessment
EN	European Norms
EOX	Extractable Organic Halogen
EPRP	Emergency Preparedness and Response Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ETL	Energy Transmission Line
EU	European Union
EUNIS	European Nature Information System
FIs	Financial Institutions
FRH	High Security Forensic Psychiatric Hospital
G	Ground Absorption
GDP	Gross Domestic Product

GIS	Geographical Information System
GLC	Ground Level Concentration
GW	Gigawatt
h	Hour
hm	Hectometer
HR	Human Resources
HTP	Health Transformation Program
HVAC	Heating Ventilating and Air Conditioning
HWMS	Health Care Waste Management System
Hz	Hertz
IAPCR	Industrial Air Pollution Control Regulation
IBAs	Important Bird Areas
IBC	International Building Code
ID	Identification Badge
IEC	International Electro-technical Commission
IFC	International Finance Corporation
IHC	Integrated Health Campus
ILO	International Labor Organization
IPA	Important Plant Areas
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature
KBAs	Key Biodiversity Areas
kg	Kilogram
km	Kilometer
kPa	Kilopascal
kV	Kilovolt
kW	Kilowatt
Leq	Equivalent Sound Level
Lp	Sound Pressure Level
lt	Liter
LTV	Long-Term Value
Lw	Sound power level
Lw''	Sound Power Level Per Area
m	Meter
m ²	Square Meter
m ³	Cubic Meter
MAK	Central Game Commission
mEq	Milliequivalent

MEUP	Ministry of Environment and Urban Planning
MFWW	Ministry of Forestry and Water Works
mg	Milligram
MH	Main Hospital
MoH	The Ministry of Health
MRSA	Methicillin-Resistant Staphylococcus Aureus
MTA	Mineral Research and Exploration
MTA	General Directorate of Mineral Research and Exploration
MW	Megawatt
NFPA	National Fire Protection Association
NGO	Non-Governmental Organization
NNE	Nort-NortEast
NTS	Non-Technical Summary
OG	Official Gazette
OHS	Occupational Health and Safety
OHSAS	Occupational Health and Safety Management System
PAH	Poly Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PETDER	Petroleum Industry Association
PIR	Passive Infrared
PM	Particulate Matter
PM ₁₀	Particulate matter with diameter of 10 µm or less
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PR	Performance Requirement
PS	Performance Standard
RAMAQ	Regulation on Assessment and Management of Air Quality
RCM	Roadway Construction Noise Model User's Guide
RFID	Radio Frequency Identification System
RH	Physical Therapy and Rehabilitation Hospital
RMGG	Regulation on the Monitoring of Greenhouse Gases
RWPC	Regulation on Water Pollution Control
S	South
sec	Second
SEP	Stakeholder Engagement Plan
SPO	State Planning Organization
STV	Short-Term Value
SW	Southwest
TAEK	Turkish Atomic Energy Authority

TAG	Tarsus-Adana-Gaziantep
TAP	Portable Battery Manufacturers and Importers Association
TCDD	Turkish State Railroad System
TEIAS	Turkish Electricity Transmission Company
TIA/EIA	International Industry Association/Electronics Industry Association
TL	Transmission Loss
TOKİ	Housing Development Administration of Turkey
TPH	Total Petroleum Hydrocarbon
TPV	Total Pollution Value
TSE	Turkish Standards Institution
TSI	Turkish Statistical Institute
UNDP	United Nations Development Program
UTM	Universal Transverse Mercator
WHO	World Health Organization
WMP	Waste Management Plan
WPCR	Water Pollution Control Regulation
WWF	World Wildlife Fund
WWTP	Wastewater Treatment Plant
µg	Microgram

1.0 INTRODUCTION

1.1 Background and Objective

An Environmental and Social Impact Assessment (ESIA) study has been conducted for the Adana Integrated Health Campus Project (IHC or Project) located in the Yüreğir District of Adana Province situated in the Southern Part of Turkey. The Project will be developed on a 328,820 m² area at the location shown in Figure 1-1. ADN PPP Sağlık Yatırım A.Ş. (ADN PPP A.Ş.) will undertake the construction, operation and maintenance phases of the Project. ADN PPP A.Ş. is comprised of the following six companies: 1) Rönesans Holding A.Ş., 2) Rönesans Medikal Yatırımları A.Ş., 3) Meridiam Eastern Europe S.a.r.l., 4) Sıla Danışmanlık Bilişim Eğitim İnşaat Taahhüt Ticaret ve Sağlık Hizmetleri Ltd. Şti., 5) TTT Sağlık Hizmetleri Eğitim İnşaat Sanayi Ticaret A.Ş. and 6) Şam Yapı Sanayi ve Ticaret Ltd. Şti.



Figure 1-1: Project location with site boundaries shown with yellow shaded area and yellow lines

The 1,550 bed capacity Integrated Health Campus will have the following components: a 1,300-bed Main Hospital (MH), a 150-bed Physical Therapy and Rehabilitation Hospital (RH) and a 100-bed High Security Forensic Psychiatric Hospital (FRH). The MH will include two General Hospitals (total

of 584 beds), an Oncology Hospital (182-bed), a Cardiology and Cardiovascular Hospital (185-bed), a Women/Maternity and Pediatrics Hospital (349-bed) and the Hospitals' common Diagnostic and Treatment Center. Further details of the Project are provided in *Chapter 2: Project Description*.

ADN PPP A.Ş. is seeking financing from multinational financial institutions (FIs) to fund the development of the Project, and is currently discussing the Project with European Bank for Reconstruction and Development (EBRD) and International Finance Corporation (IFC). In order to meet the requirements of these FIs, ADN PPP A.Ş. has commissioned ELC Group Consulting and Engineering Inc. (ELC) to undertake the ESIA study.

The purpose of the ESIA study is to describe the Project, identify the environmental and social impacts that will or may occur as a result of the Project and determine mitigation measures that can be taken to avoid and/or minimize the adverse impacts and maximize benefits. This document represents the Final Draft ESIA report which has been prepared in line with the FI requirements.

1.2 National Environmental Impact Assessment Requirements

Until recently, impact assessments were not required to be undertaken for hospital projects since they were scoped out of the 2008 Turkish Environmental Impact Assessment (EIA) Regulation (Official Gazette date/number: 17.07.2008/26939). This regulation has recently been revised so that under the new EIA Regulation (Official Gazette date/number: 03.10.2013/28784) EIA studies need to be undertaken for large hospital projects (defined as 500 beds and above). Correspondence with the Ministry of Environment and Urban Planning (MEUP) conducted as part of the ESIA stakeholder engagement process revealed the following condition for hospital project EIA requirement: "It will be appropriate to exempt hospital projects from the new EIA Regulation if it can be documented that the bidding process for these hospital projects has been included in the public investment program and has been completed before the effective date of the new EIA Regulation". The official correspondence with the MEUP is included in Annex A. In this context, the necessary communication was conducted by ADN PPP A.Ş. with the MEUP in order to provide the appropriate Project information and the bidding process. As a result, the MEUP issued an official letter (also presented in Annex A) stating that the provisions of the new EIA Regulation are not applicable for the Project. Apart from the main hospital components previously discussed, there will be a trigeneration plant used as an auxiliary facility within the scope of the Project. The trigeneration plant will have an 8.6 MW thermal input which is lower than the 20 MW threshold that would have triggered the EIA Regulation requirements. For this reason, the trigeneration plant will be exempt from the requirements of the EIA Regulation.

1.3 ESIA Requirements

ADN PPP A.Ş. has approached international lenders for project financing which have required an ESIA study for identifying potential environmental and social impacts and risks of the Project and developing mitigation measures appropriate to the nature and scale of the Project. The mitigation measures need to be included in the accompanying Environmental and Social Management Plan (ESMP). The ESIA report and the ESMP will then be used as a basis by the lenders for the environmental and social appraisal of the Project. The ESIA study has been conducted to meet the requirements of the following international standards:

- IFC Performance Standards on Social and Environmental Sustainability (1 January 2012)
- EBRD Performance Requirements (May 2008)

- IFC General Environmental, Health and Safety Guidelines (30 April 2007)
- IFC Environmental, Health and Safety Guidelines for Healthcare Facilities (30 April 2007)
- EBRD Sub-sectoral Environmental and Social Guidelines for Health Services and Clinical Waste Disposal (October 2009)

In addition to these standards, the Project must comply with Turkish environmental and social legislations. The relevant European Union (EU) Directives are also applicable to the Project as per the EBRD requirements. The applicable national laws and regulations have been compiled in a regulatory framework document provided in Annex B, including a brief overview of key EU Directives that may be relevant to the Project.

1.4 Key Steps in the ESIA process

1.4.1 Overview

The integration of environmental and social considerations into the project cycle is an essential part of all projects that aim to contribute to sustainable development. An ESIA process is accepted as being the most effective way of achieving this integration. ESIA is a systematic process that predicts and evaluates the impacts of a project on various aspects of the physical, biological, cultural and socioeconomic environment. This is followed by the identification of appropriate mitigation measures to avoid, reduce, remedy, offset or compensate for adverse impacts relevant to the nature and scale of the project. The key steps of the ESIA process are presented in Figure 1-2.

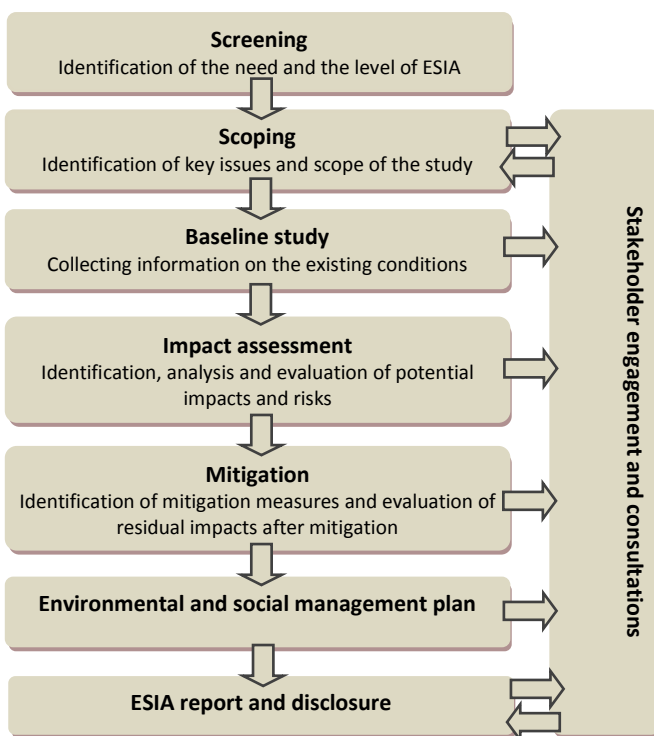


Figure 1-2: ESIA process

Information provided in the following sections describes the key steps outlined above and presents the approach adopted by the present ESIA study.

1.4.2 Screening

The first step in the ESIA process is the screening stage which determines whether an impact assessment is required to be undertaken for a specific project. This is in general determined by referring to the FIs categorization lists, including types of activities and if the project activity is found to be included in these lists, then an ESIA is undertaken. As ADN PPP A.Ş. has approached EBRD and IFC as potential lenders, it was indicated that an ESIA study would be needed to meet the requirements of these lenders.

1.4.3 Scoping

Scoping is a crucial step in an ESIA process that identifies the key issues to be addressed in the ESIA study. Scoping involves defining the impact topics that should be addressed in the assessment as well as those of little or no relevance to the project. Scoping is the stage at which consultations with stakeholders are initiated, which is an important part of the ESIA process.

The following topics are important in undertaking the scoping and assessment study:

Project's Area of Influence (Aoi) Identification: The Aoi was defined as follows:

- The area likely to be affected by (i) the Project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the Project; (ii) the impacts from unplanned but predictable developments caused by the Project that may occur later on or at a different location; or (iii) indirect Project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent. The major areas, facilities and communities potentially to be affected by the Project are listed below:
 - Project area covering the Main Hospital (including four hospitals and Diagnostic and Treatment Center), Physical Therapy and Rehabilitation Hospital, High Security Forensic Psychiatric Hospital and the trigeneration plant. This area includes the existing 400-m long road passing through the Project area, which will be removed as part of the clover-leaf road junction project and the State Hydraulic Works (DSI) land;
 - Energy Transmission Line (ETL) passing through the Project area to be relocated
 - Waste disposal areas/facilities which are planned to be used during the construction and operation phases of the Project including:
 - Excavated material disposal area
 - Adana Metropolitan Municipality Domestic Wastewater Treatment Plant
 - Class II Landfill Facility of Adana Integrated Solid Waste Disposal Facility
 - Medical Waste Sterilization Unit of Adana Integrated Solid Waste Disposal Facility
 - Licensed waste disposal facilities
 - Surrounding communities and facilities that are part of the social area of influence as explained in Section 4.4 of *Chapter 4: Scope of the ESIA and Stakeholder Engagement*.

- Associated facilities or businesses that are not funded as part of the project and may be separate legal entities yet whose viability and existence depend exclusively on the project and whose goods and services are essential for the successful operation of the project. At this point, it is important to mention that the clover-leaf road junction project to be constructed by the Adana Metropolitan Municipality near the Project site has not been considered to be an associated facility related to the Project. The reason is that the planned clover-leaf road junction is not part of the Project scope, as is stated in the official letter provided by the MoH (Annex A). Moreover, there is a correspondence letter (also Annex A) between the General Directorate of Highways of the Ministry of Transport, Maritime Affairs and Communication and the 5th Regional Directorate of Highways indicating that the clover-leaf road junction project is planned to ease the traffic load in the upcoming years. Therefore, there are no associated facilities that are defined in this project.
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. Three projects were identified close to the Project area that were under construction or at the planning stage that would be part of the cumulative impact assessment scope. The first project was ongoing school constructions north of the Project area during the ESIA preparation stage, the second one was the planned clover-leaf road junction and the third one was the ETL relocation. Cumulative impacts for these projects were not assessed in the ESIA study for the following reasons:
 - The constructions of the two school buildings (high school and vocational school) have been completed and as reported by the construction company, the high school school building has already been transferred to the Adana Provincial Special Administration at the end of December 2013. As a result, there will be no overlap with the construction activities of the Project.
 - It is not clear at this stage when the construction of the clover-leaf road junction will start. Due to the fact that the timing and duration of a potential overlap was not known during the preparation of the ESIA, cumulative impacts were not assessed.
 - It is not clear at this stage when the ETL relocation will take place. It is the responsibility of the Adana Provincial Directorate of Health to coordinate with the Turkish Electricity Transmission Company (TEIAS) and undertake necessary work for the ETL relocation. Adana Provincial Directorate of Health has already started communication with TEIAS. The latest official correspondence letter dated 01.04.2014 that was submitted by the Adana Provincial Directorate of Health to TEIAS (presented in Annex A) indicates that site visits have been conducted and it has been agreed to relocate the ETL. The letter further mentions that the ETL relocation project has been prepared and submitted for approval to TEIAS.
- Traffic routes to be used during construction and operation phases which may result in an increase in traffic movements during construction and operation phases.

Based on ESIA stakeholder consultations with the MoH and Adana Provincial Directorate of Health, it is not clear at this stage whether hospitals will be closed or what the extent of new arrangements

will be in the existing hospitals. In case of closure of any hospital, the hospital to be closed will be included in the Aol.

Aspects of the environment: The environmental aspects include the physical environment (e.g. geology, hydrology, hydrogeology, soils, air, noise, vibration, light), the biological environment (e.g. aquatic and terrestrial habitats and flora/fauna, protected areas), the cultural environment (e.g. archaeological sites), the socioeconomic environment (e.g. people, employment, income), and health and safety of the patients and workers.

Types of impacts: Types of impacts resulting from the Project include the following:

- impact outcome: beneficial or adverse
- time aspect: permanent impacts (e.g. loss of land), temporary impacts (e.g. dust during construction phase) and long-term impacts (e.g. noise during the operation phase)
- nature of impact: direct impacts arising from the project (e.g. air, noise pollution), indirect impacts as a consequence of other changes that occur by the project (e.g. influx of population due to workforce), and induced impacts (e.g. industrial development stimulated by the project)
- non-routine impacts (e.g. earthquakes, accidental events)
- cumulative impacts arising from further planned development of the project or any other existing/planned projects

A scoping study has been conducted as part of the ESIA study and a Scoping Report was issued in October 2013. The report is based on the review of the available project documentation provided by ADN PPP A.Ş., environmental and social information collected through secondary sources and field surveys, and review of international standards. The results of the scoping study are presented in *Chapter 4: Scope of the ESIA and Stakeholder Engagement*.

1.4.4 Baseline Data Collection

The next step of the ESIA process is the collection of data to establish the existing baseline conditions (i.e. conditions in the absence of the proposed development), whereby the impacts of construction and operation of the project can be assessed against. In undertaking the ESIA study, information on the current environmental and social baseline conditions was gathered using the following sources:

- technical reports prepared by ADN PPP A.Ş. and its consultants
- secondary data sources (existing published materials and documents, maps by the government agencies, research organizations and other relevant organizations)
- review of aerial photographs of the Project area and its surroundings
- field study results

The baseline data collection started during the scoping phase and continued to support the assessment process. Baseline studies and their results are described in the relevant chapters of the ESIA.

1.4.5 Assessment of Impacts

Assessment of likely impacts is undertaken by determining the value/sensitivity of resources/receptors that are affected, predicting the magnitude of impacts and evaluating the significance of impacts. This is followed by proposing mitigation measures for key significant impacts and assessing whether any residual impacts remain after the implementation of the mitigation measures.

Assessment of impacts was undertaken based on the results of the scoping study. The assessment evaluates environmental and social changes as a result of the project from the established baseline. The assessment reviews all of the possible impacts and determines which impacts are likely to be significant.

The impact magnitude depends on the degree and extent to which the project changes the environment and usually varies according to the project phase. There are various factors to be considered in determining the magnitude of impact, including but not limited to the following:

- area of influence
- deviation from existing baseline conditions
- sensitivity and importance of the receptors and resources
- nature, scale, extent, frequency and duration of the change
- duration and timing of the project

The impact magnitude is quantified on the basis of the factors listed above to the extent practicable. Depending on the nature of impact, the impact magnitude is predicted by mathematical models (e.g. noise, air quality) and by professional judgment for those impacts that cannot be represented by mathematical models (e.g. impacts on ecology). The criteria to determine the impact magnitude for physical, biological, and social environments are described in Table 1-1 below. When determining the impact magnitude, conservative assumptions are often used to ensure that impacts are not underestimated.

Table 1-1: Criteria used to determine the impact magnitude

Magnitude	Description
Physical Environment	
Negligible	Impacts that lead to imperceptible changes in baseline conditions
Small	Temporary or short term impacts that are localized to the immediate project area that physical environment will return to its original conditions once the impact ceases
Medium	Temporary or short term impacts that go slightly beyond the limits of the project area and/or that are above the defined regulatory limit values, however long term integrity of any resource/receptor/process is not threatened
Large	Impacts that result in an order of magnitude change on physical environment in a wider scale, that exceed the defined regulatory limit values and irreversible
Biological Environment	
Negligible	Impacts that lead to imperceptible changes in baseline conditions
Small	Temporary impacts on a number of species that are common in the area and does not affect overall population, localized habitat loss
Medium	Impacts resulting in changes in the population of the species that are common in the area, long term integrity of the population is not threatened
Large	Impacts on legally protected and rare/threatened/endangered species and there is no possibility of recovery

Magnitude	Description
Socio-economic Environment	
Negligible	Impacts that are imperceptible to communities or socio-economic values
Small	Temporary impacts that are reversible and do not affect communities or socio-economic values
Medium	Impacts to communities or socio-economic values that bring change in status but do not threaten overall stability of communities or assets
Large	Impacts to communities or socio-economic values that bring long term change in status

Criteria related to the value/sensitivity of the resources/receptors are described in Table 1-2.

Table 1-2: Criteria related to value/sensitivity of the resources/receptors

Value or sensitivity of the affected resource or receptor	Description
Physical Environment	
Negligible	Physical resources/receptors that are resistant to change
Low	Physical resources/receptors that can return to its original conditions after the impacts and that are not important to the wider physical environment
Medium	Physical resources/receptors that are important in the region and can return to original conditions naturally over time after the impacts
High	Physical resources/receptors that cannot return to their original conditions after the impacts
Biological Environment	
Negligible	Biological environment component that has no or very limited importance
Low	Biological environment component that is common to the area and not under protection
Medium	Biological environment component that is common and experiencing decline and not under protection
High	Biological environment component that is protected by national regulations and international standards and listed as rare, threatened or endangered
Socio-economic Environment	
Negligible	Assets are not significant regarding their resource, economic, cultural and social value
Low	Assets are not significant regarding their resource, economic, cultural and social value, and there are nearby alternatives to the affected assets
Medium	Assets are not significant in the overall project area but have local significant roles (asset base, livelihoods)
High	Assets are protected by national and international legislation

The significance of those impacts is decided upon once the impact magnitude and the value/sensitivity of the resource/receptor are determined. The impact significance is the product of (i) the value, importance or sensitivity of the resource or the system that might be impacted, and (ii) the magnitude of impact on that resource and system.

The impact significance has been assessed by taking into account the following:

- legislation, policies, guidelines and standards
- area of influence
- amount of resource affected

- persistence of impacts
- status of resources
- sensitivity of resources, regulatory status
- societal value

The evaluation of significance is illustrated in Table 1-3.

Table 1-3: Evaluation of significance

Value or sensitivity of the affected resource or receptor	Magnitude of impact			
	Negligible	Small	Medium	Large
Negligible	Not significant	Not significant	Not significant	Minor
Low	Not significant	Not significant	Minor	Moderate
Medium	Not significant	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

For the purposes of this assessment, impacts have been categorized as follows:

- Not significant: Impact does not require any control.
- Minor Impact: Impact can be controlled using good practice management measures.
- Moderate Impact: Impact can be reduced to a reasonable level (as low as reasonably practicable) by applying feasible and cost effective mitigation measures.
- Major Impact: This is an impact for which no further mitigation is possible and there is a requirement to provide compensation or offset measures.

Significance criteria for each type of impact are presented in the relevant chapters of this report, as needed. Impacts have been assessed for key phases of the Project from initial site preparation and advance works, through construction to operation of the IHC. Decommissioning of the Project is not assessed as the IHC is envisaged to remain in place and in operation for the foreseeable future.

1.4.6 Identification of Mitigation Measures

A principal objective of the ESIA is to identify ways of reducing the impacts of development. For this reason, subsequent to the assessment of identified impacts, mitigation measures for each impact are defined in order to avoid, minimize or remedy the significant impacts. Mitigation measures also include measures to provide environmental and social benefits. The residual impacts that are likely to remain after implementation of mitigation measures are then assessed based on the same criteria mentioned in Section 1.4.5.

Mitigation can be carried out by changes in the design, engineering modifications, and adoption of measures to address the specific impacts. During the ESIA, mitigation measures have been identified based on the Turkish regulatory requirements, EBRD and IFC requirements, and international best practice. The identified measures are discussed and agreed with ADN PPP A.Ş. and are presented in the ESMP provided in Annex C. Implementation of the measures identified in the ESMP will be monitored by ADN PPP A.Ş. during the construction and operation phases of the Project in order to ensure the effectiveness of these measures.

1.4.7 Uncertainties

This ESIA is prepared based on the Project information received from ADN PPP A.Ş. and a description of the Project is made in *Chapter 2* according to this information. The description of the Project is based on the bidding documentation and conceptual design documents made available to ELC. The detailed design of the Project is currently ongoing. Detailed studies are still to be completed related to the design of the commercial area and technical building. However, significant changes in the design of the hospitals are not expected to occur. All the hospitals and other abovementioned units will be located within the identified Project area and have been considered during the scope of impact assessment. It is not expected therefore that the present uncertainties will have a considerable effect on the identified impacts of the Project. On the other hand, in order to address the uncertainties, monitoring will be undertaken by ADN PPP A.Ş. to understand whether the identified mitigation measures are sufficient or there is a need for refinement of any mitigation measure(s).

1.4.8 Environmental and Social Management Plan (ESMP)

The ESMP is a significant part of an ESIA in which all the identified mitigation measures are outlined for the adverse impacts for each phase of the project. An ESMP has been developed as part of the ESIA study, which includes description of the mitigation measures, responsible parties for the implementation of the mitigation measures, the timing, monitoring and audit requirements. The ESMP focuses on the avoidance of impacts, and where this is not possible, presents technically and financially feasible and cost-effective mitigation measures to minimize or reduce possible impacts to acceptable levels. The ESMP of the Project is presented in Annex C of this report. The ESMP will be kept up to date with any required additional mitigation throughout the Project.

Implementation of the ESMP will be accomplished by conducting a Project specific Environmental and Social Management System (ESMS) during the construction and operation phases of the Project, which will be developed by ADN PPP A.Ş in accordance with the requirements of international standards (i.e. for quality: ISO 9001, for environment: ISO 14001 and for occupational health and safety: OHSAS 18001). A brief information on the environmental and social management is presented in *Chapter 16: Environmental and Social Management*.

1.4.9 Stakeholder Engagement

The stakeholder engagement is an integral and crucial part of an ESIA process, aiming to provide an opportunity to affected and/or interested individuals, groups and organizations to express their views and concerns about the project, which are taken into account during the assessment of impacts and identification of mitigation measures. According to international best practice, stakeholder engagement is recommended to start with the scoping phase and to continue throughout the ESIA process. EBRD Performance Requirement 10 and IFC Performance Standard 1 describe stakeholder engagement as an on-going process during the life of project involving the disclosure of information.

A stand-alone Stakeholder Engagement Plan (SEP) has been developed for the Project, to help structure a systematic communication with the stakeholders during the ESIA study. The details of stakeholder engagement activities undertaken as part of the ESIA study are presented in *Chapter 4: Scope of the ESIA and Stakeholder Engagement*. Furthermore, a Project specific website has been

established where the Project Information Document, Project Information Leaflet and comment forms are made available to the public (<http://pppadanahastanesi.com/index.html>).

1.5 Outline of the ESIA Report

The remaining chapters of the ESIA report are as follows:

- Chapter 2: Project Description
- Chapter 3: Institutional and Regulatory Framework
- Chapter 4: Scope of the ESIA and Stakeholder Engagement
- Chapter 5: Land Use and Zoning
- Chapter 6: Geology, Soils and Contaminated Land
- Chapter 7: Hydrology and Hydrogeology
- Chapter 8: Material Resources and Waste Management
- Chapter 9: Air Quality
- Chapter 10: Noise
- Chapter 11: Traffic Impact
- Chapter 12: Ecology
- Chapter 13: Socio-economy
- Chapter 14: Community Health and Safety
- Chapter 15: Labor and Working Conditions
- Chapter 16: Environmental and Social Management

The ESIA report is supported by the following annexes:

- Annex A: Official Correspondence Letters related to Turkish EIA Requirements, Clover-leaf road junction and Energy Transmission Line
- Annex B: Environmental, Health and Safety and Social (EHSS) Legislation Review
- Annex C: Environmental and Social Management Plan (ESMP)
- Annex D: Stakeholder Engagement Activities
- Annex E: Project Description Supporting Information
- Annex F: Geology, Soils and Contaminated Land Supporting Information
- Annex G: Hydrology and Hydrogeology Supporting Information
- Annex H: Waste Management Plan
- Annex I: Air Quality Supporting Information
- Annex J: Noise Supporting Information
- Annex K: ESIA Team

2.0 PROJECT DESCRIPTION

2.1 Project Overview

2.1.1 The Project Proponent

ADN PPP A.Ş. was established as a Special Purpose Vehicle (a Public Private Partnership (PPP) agreement with the MoH) upon securing the Project Construction Works and the Provision of Products and Services bid tendered by the MoH. The Project's agreement was signed between the MoH and ADN PPP A.Ş. on June 27th, 2013. Under the terms of the agreement, ADN PPP A.Ş. will be responsible for the detailed design, construction, equipping, financing, operation and maintenance of the IHC for a 28-year project period. This period covers a 3 year construction period and a 25 year operation period). The provision of medical services will be under the responsibility of the MoH. At the end of 28-year project period, the IHC will be transferred to the MoH.

2.1.2 Background

The healthcare system in Turkey prior to 2003 was characterized as a fragmented provision and financing systems with inequalities in accessing health care by different subpopulations and dissatisfaction felt by both the providers and the purchasers of the health care system. Inequalities in accessing health care was the major challenge to be dealt where only a minority of the population had access to timely and relatively high-quality health care services. This led to the need for strengthening the healthcare system in Turkey which in turn triggered the initiation of the Health Transformation Program (HTP) in 2003. The purpose of the program was to increase the quality and efficiency of the healthcare system and enhance access to healthcare facilities with the introduction of a number of reforms. The major reforms that were undertaken are summarized below:

- All public health facilities were merged under the MoH. This was the first step taken to consolidate the provision of public health care services under one authority. This merger resulted in opening up all public facilities to the entire population and was a first step towards equalizing access to health care.
- The financing of health care services has undergone a major restructuring. The social security funds which also cover social health insurance were transferred to the Social Security Institution and a new General Health Insurance Scheme (GHIS) was established in 2008 that included those previously covered under the transferred social security schemes as well as everyone joining the social health insurance system for the first time. In the run-up to the full implementation of the GHIS, the benefits provided by the (fragmented) pre-existing social health insurance schemes were equalized and currently the whole population is under the same benefits package umbrella.
- A pilot family practitioner scheme was introduced and later extended to cover the whole population at the end of 2010.
- The HTP proposed to increase the administrative and financial autonomy of hospitals. The major development in the hospital sector after 2003 focused on increasing the role of the private sector. Accordingly, a PPP Department under General Directorate of Health Investments of the MoH was established for the planning of the construction, renovation and management of health facilities in cooperation with the private sector.

Within the scope of the HTP, the MoH plans to develop 30 health campuses of different sizes and bed capacities within 22 provinces. The health campuses will serve 29 health regions in Turkey, which were determined based on the need for health services, geographical structure, patient flow, accessibility and socioeconomic conditions. For each health region, a province was identified as the center of the health region and sub-provinces to be connected to the center province. Until now, 20 health facility projects have been initiated and are currently at different stages of planning and construction. The Adana IHC Project is one of these 20 projects and will serve the 13th health region that covers Adana, Hatay and Osmaniye provinces. Among these three provinces, Adana Province is identified as the center of the 13th health region considering the population density, the ease of means of road transport, presence of health manpower, conditions and service delivery capacity of the existing health facilities.

As part of the HTP, the MoH has considered health campus planning based on the four main reasons/needs:

- Effectiveness of health services across the country;
 - expanding the variety of treatment across the country and provide easy access
 - completing regional development in the field of health
 - improving the quality of service
 - providing cost-effective health services
- Needs of society;
 - sufficient number of beds and suitability of bed quality
 - Service of specialized team on surrounding area
 - application of new treatment technologies
 - development of new concepts for treatment services (such as outpatient surgery, day hospital)
- Patients;
 - shortening the length of hospitalization
 - reducing patient transfers
 - reducing hospital infections
 - enhancing the safety of the patients
 - increasing patient satisfaction
- Workers;
 - increasing the safety and satisfaction of employees
 - increasing workforce and service quality
 - improving health service performance.

Health campuses are regarded as health complexes that incorporate various types of hospitals with specialized staff, research and development laboratories and centers, social and cultural facilities, hotel, logistic support units, high level of transport and parking facilities, accommodation and open space usage as a whole.

As mentioned above, the Adana IHC will be implemented as a PPP model which is a Built-Lease-Transfer model that includes construction of health campuses in return for a rent not exceeding forty nine years, by the successful bidders based on a preliminary design and technical standards to be provided by the MoH. The relevant legislation on PPP model is briefly discussed in *Chapter 3: Institutional and Regulatory Framework*. The PPP model is an investment and service model that is based on the long-term engagement between the government and private sector. The application

of the PPP model in the health sector involves key elements including using financial resources of the private sector in public investments, integration of rapid decision-making and decision implementation skills of the private sector into the project process, sharing the risks between the government and private sector and shortening of the construction period for the health campuses which may take up to 10 years if implemented by the public sector.

2.1.3 Need for the Project

Adana Province is located in the Mediterranean Region with a population of 2,125,635 (2012 data) and a surface area of 17,253 km². The Province is located at a distance of 85 km to Mersin Province, 99 km to Osmaniye Province, 188 km to Hatay Province, 192 km to Nigde Province and 319 km to Kayseri Province, which all are surrounding provinces. There is a high amount of daily population flux from the surrounding provinces to the Adana Province. Due to its centralized location, Adana Province is currently providing health services to both people living in Adana and people coming from the surrounding and further provinces. It has also been noted that the patient examination rates are increasing every year.

The need for health services is also increasing in parallel to the growing population in Adana Province. There are 11 state hospitals, 1 psychiatric hospital, 149 family health centers, 31 emergency stations, 1 oral and dental health center, 3 mother and child care and family planning centers, 1 public health laboratory and 4 tuberculosis control dispensary in Adana that are affiliated with the MoH. The information on state hospitals, university hospitals and private hospitals in Adana Province is given in Table 2-1. Although the average stay in hospital seems low at the state hospitals, this average is calculated taking into account the beds in the emergency and dialysis sections, in addition to the clinics. However, when the occupancy rates in clinics are considered, it is observed that the occupancy rate exceeds 100% in a great number of clinics within hospitals resulting in delays in patient treatments.

Table 2-1: Distribution of hospitals in Adana Province (2011 data)

Type of Hospital	Number of Hospitals	Number of Beds	Number of Personnel	Bed Occupancy Rate (%)	Average Stay in Hospital (days)
Hospitals affiliated with Ministry of Health (State Hospitals)	11	3,463	8,328	73	4,8
University Hospitals	2	1,735	3,720	82	5,2
Private Hospitals	12	920	3,358	59	2,1
Total or Average	25	6,118	15,406	74	4,3

Source: Adana Province Governorship website.

Although the number of beds per 10,000 people has been increasing over the years in the Adana Province (the bed capacity of State Hospitals has increased from 1,540 to 3,474 between 2007 and 2009), this value is still low when compared to values in the world and European Union, as shown in Table 2-2. In order to close the gap across Turkey and in Adana Province, it can be confirmed that there is a need for undertaking new health investments.

Table 2-2: Comparison of hospital bed capacity per 10,000 people (2010 data)

World	European Union	Turkey (2011 data)	Adana
30	55,4	26	29*

Source: Ministry of Health, Annual Health Statistics – 2011, *Ministry of Health, Inpatient Health Facility Planning Guide, 2011.

The state hospitals in Adana Province are listed in Table 2-3 with information on number of beds, total land area, closed area and closed area per bed. When the provincial and district hospitals in Adana Province are considered, the situation reveals that the buildings are old (Adana State Hospital which is one of the largest hospitals, is 117 years old) and the ward system dominates where rooms with three beds and above represent approximately 50% of the total bed capacity.

Table 2-3: State hospitals in Adana Province (2008 data)

Hospital Name	Number of Beds	Total Hospital Land Area (m ²)	Closed Area (m ²)	Closed Area per Bed (m ²)
Adana Numune Education and Research Hospital	910	107,796	50,145	55.1
Adana State Hospital	311	29,460	21,218	68.2
Adana Cukurova State Hospital*	649	45,660	43,490	67.0
Prof. Dr. Nusret Karasu Chest Disease Hospital*	187	13,087	7,391	39.5
Adana Maternity and Children Hospital**	149	8,265	10,625	71.3
Cukurova Maternity and Children Hospital**	250	19,662	10,000	40.0
Adana Dr. Ekrem Tok Psychiatric Hospital	644	137,001	20,000	31.0
Adana Ceyhan State Hospital	193	30,050	10,754	55.7
Adana Kozan State Hospital	141	50,000	5,960	42.2
Adana İmamoğlu State Hospital	30	14,960	3,300	11.0
Adana Tufanbeyli State Hospital	27	9,880	958	35.4
Adana Karaisalı State Hospital	19	3,756	1,267	66.6
Adana Pozantı 80. Yıl State Hospital	40	3,382	4,120	10.3
TOTAL	3,550	472,959	189,228	53.3

Source: Ministry of Health, Pre-feasibility Report for Adana Integrated Health Campus, March 2010.

* Two hospitals (Cukurova State Hospital and Prof. Dr. Nusret Karasu Chest Disease Hospital) were merged in 2011 and renamed as Adana Cukurova Dr. Akım Tufekci State Hospital to form a hospital with a bed capacity of 720.

** Two hospitals (Adana Maternity and Children Hospital and Cukurova Maternity and Children Hospital) merged in 2009 to form a hospital with a bed capacity of 400.

Most of the hospitals are located in Adana Province center in parallel to the high population in the Adana Province center and the status of Adana Province as serving to the other provinces in the region. These hospitals are unable to physically expand in these already condensed areas. These hospitals also do not have adequate parking and green areas. Appropriate areas are not present in these hospital buildings located in Adana Province center, for supporting the changing and evolving technology of the medical devices and equipment. Furthermore, it is difficult to effectively repair and renovate the existing physical structures because the hospitals are quite old. If renovation is considered, this will result in significant costs which may be in the range of a new hospital investment cost. Moreover, service units such as operating room, intensive care, emergency, laboratory, imaging center, polyclinics do not meet the hospital standards in terms of physical

structure and equipping. Intensive care beds are only present in four of the hospitals in Adana Province center.

Considering the above conditions, the existing hospitals cannot provide services of the required quality. Adana IHC will contribute 1,550 bed capacity, having rooms with one or two beds, to the health services.

Need for Physical Therapy and Rehabilitation Hospitals

Increasing population, improving technology, changes in health perception and expectations of people have resulted in changes in the health needs of community. The need for Physical Therapy and Rehabilitation health services is also increasing due to increasing aging and high rates of traffic and occupational accidents in the country. However, there is presently insufficient bed capacity specifically for providing active rehabilitation services across Turkey. The existing Physical Therapy and Rehabilitation Hospitals (currently 1,773 bed capacity) are able to provide physical therapy services only to the patients with little provision of rehabilitation services. In addition, existing Physical Therapy and Rehabilitation Hospitals are located in large provinces such as Ankara and Istanbul resulting in the need for patients and patients' relatives to travel to those provinces. The bed capacity of physical therapy and rehabilitation service in the Adana hospitals were 55 based on 2008 data. As part of the HTP, Physical Therapy and Rehabilitation Hospitals are planned so that people can have access to these services in their own provinces or in the near region which will help in easy access to these services, reducing treatment costs and preventing accumulation of patients in the hospitals located in large provinces. According to the planning by the MoH, a total of 3,586 bed capacity for Physical Therapy and Rehabilitation services will be introduced in the health regions across Turkey, among which 202 bed capacity is planned for the 13th health region. 150 out of 202 bed capacity will be within the scope of Adana IHC Project.

Need for High Security Forensic Psychiatric Hospitals

Currently, there are no forensic psychiatric hospitals in Turkey. There are 8 hospitals across Turkey (two of them are in Istanbul Province, the others are in Manisa, Bolu, Samsun, Adana, Elazig and Trabzon Provinces) that serve as psychiatric hospitals under the responsibility of the MoH. Psychiatric services are also provided in some of the general hospitals, university hospitals and private hospitals. Altogether, the total bed capacity in Turkey is 7,356 (2010 data) for psychiatric services including forensic, chronic, care and addiction treatments. The eight hospitals that belong to the MoH serve as regional hospitals that provide services for a number of provinces in a defined region. Patients whose diagnosis, treatment and rehabilitation cannot be provided in their own provinces, are sent to the regional hospital responsible from their province.

With regard to forensic psychiatry (including high-security forensic psychiatry), beds are only present in five of the eight psychiatric hospitals mentioned above (in Istanbul Bakirkoy, Manisa, Adana, Samsun and Elazig). Forensic psychiatry services are also provided on a regional basis as mentioned above. The total number of beds for forensic psychiatry is 668 (551 for forensic and 117 for prisoner) in Turkey which makes 0.9 bed per 100,000 people. Moreover, the Turkish Criminal Law states the following in its article 32: "A person lacking ability to perceive the legal meaning and consequences of the offense, or having considerably lost the capacity to control his actions due to insanity may not be subject to any punishment. However, security precautions are imposed for

such individuals” and in its article 57: “Decision for imposition of security precautions is given by the court about a person suffering from mental illness at the time of commission of the offense. The insane people subject to security precautions under the court’s decision are sheltered and taken under protection for treatment purposes in high security health institutions”. At present, although the 551 beds out of 668 beds do not have high-security properties, they are used for purposes as mentioned in the article 57 of the Turkish Criminal Law. In addition, due to the fact that the number of beds is insufficient, appointments are given to later dates.

Based on the above, the MoH has worked together with experts from the World Health Organization and other specific experts to identify the number of forensic psychiatry bed capacity needed in Turkey. According to the National Mental Health Action Plan (2011-2023) prepared by the MoH, it is decided to establish high security forensic psychiatric hospitals in 16 provinces with a total bed capacity of 2000, and hospitals having prisoner psychiatry beds in 5 provinces with a total bed capacity of 350. Adana IHC will contribute to the health services with a 100 bed capacity High Security Forensic Psychiatric Hospital.

2.1.4 Level of Planning Detail

A preliminary design has been provided by the MoH as part of the bidding process for Adana IHC. The detailed design of the Adana IHC is under the responsibility of ADN PPP A.Ş. according to the agreement signed with the MoH. The design is currently being studied and has not yet finalized. This ESIA study is based on the design dated October 2013. Significant changes in the design are not expected to occur, however if changes develop over time, these will be reviewed and assessed by ADN PPP A.Ş. and additional relevant mitigation measures may need to be identified and implemented as necessary if the impacts will differ from those identified in this ESIA Report.

2.2 Hospital Planning in Adana Province

As explained in Section 2.1.3, there is a need for new health infrastructure investments in Adana Province and across Turkey. In order to provide necessary health services to patients, planning has been made by the MoH for all of the identified health regions in Turkey, as indicated in the MoH-Inpatient Facility Planning Guide-Summary Book dated June 2011. According to this guide, the following plans were made for the Adana Province:

- 311-bed Adana State Hospital that is located in the city center will be renovated in its existing location to become a qualified hospital with 300-bed capacity
- 600-bed hospital design will be made in the land of Cukurova State Hospital to locate Cukurova Dr. Askim Tufekci State Hospital (600 bed capacity) in a staged approach.
- Relocation of the 187-bed Prof. Dr. Nusret Karasu Chest Disease Hospital, 910-bed Adana Numune Education and Research Hospital and 400-bed Adana Maternity and Children Hospital.
- The building of Seyhan Application Center used as an additional service building of the Adana Numune Education and Research Hospital which is planned to be turned into a 200-bed General Hospital.
- Construction of a 250-bed Maternity and Children Hospital; 520-bed Regional Hospital; 100-bed Oncology Hospital; 150-bed Physical Therapy and Rehabilitation Hospital; 100-bed High Security Forensic Psychiatric Hospital and 200-bed Cardiology and Cardiovascular Surgery Hospital.

It is understood that plans for the construction of new hospitals are consistent with the planning of the Adana IHC. On the other hand, there are changes to the information given above:

- whereby two hospitals (Cukurova State Hospital and Prof. Dr. Nusret Karasu Chest Disease Hospital) were merged in 2011 and renamed Adana Cukurova Dr. Akim Tufekci State Hospital to form a hospital with a bed capacity of 720; and
- two other hospitals (Adana Maternity and Children Hospital and Cukurova Maternity and Children Hospital) were merged in 2009 to form a hospital with a bed capacity of 400. This shows that changes occur within the Adana Province.

Apart from the above information, consultations were conducted with the MoH and Provincial Directorate of Health as part of the ESIA consultation process in order to understand the current planning for the potential closure of existing hospitals. Based on these consultations, it is not clear at this stage whether a hospital or hospitals will be closed in the region, or what the new arrangements will be for existing hospitals (either downsizing the bed capacities or revision of some of the units). It is expected that specific care service stations will be established in the Adana Province. However, it was indicated by the consultees that these issues can be only identified in the long-term.

2.3 Project Alternatives

2.3.1 'No Project' Scenario

The 'no project' scenario considers the situation of not developing the Project. As a result, there will be no new investment for the healthcare system and no provision of health services with better quality. Given the demand of improved and modern healthcare facilities with sufficient bed capacities in Adana Province, the Project needs to be implemented to meet the demand and satisfy the objectives of the healthcare planning across Turkey.

2.3.2 Project Site Alternatives

Different site locations were evaluated for the Adana IHC based on the information obtained from discussions with Mayor of Adana. The discussions were undertaken as part of the ESIA stakeholder engagement process. The Mayor stated that the Adana Metropolitan Municipality (AMM) was involved in the site selection process conducted by the MoH. Suitable locations were searched in terms of zoning and environmental considerations. Three locations were initially considered that included:

- An area in the Kurkcüler region located at northeast of Adana Province
- Existing Adana Dr. Ekrem Tok Psychiatric Hospital
- Vicinity of the old Adana State Hospital

These locations and the finally selected Project location are shown in Figure 2-1.

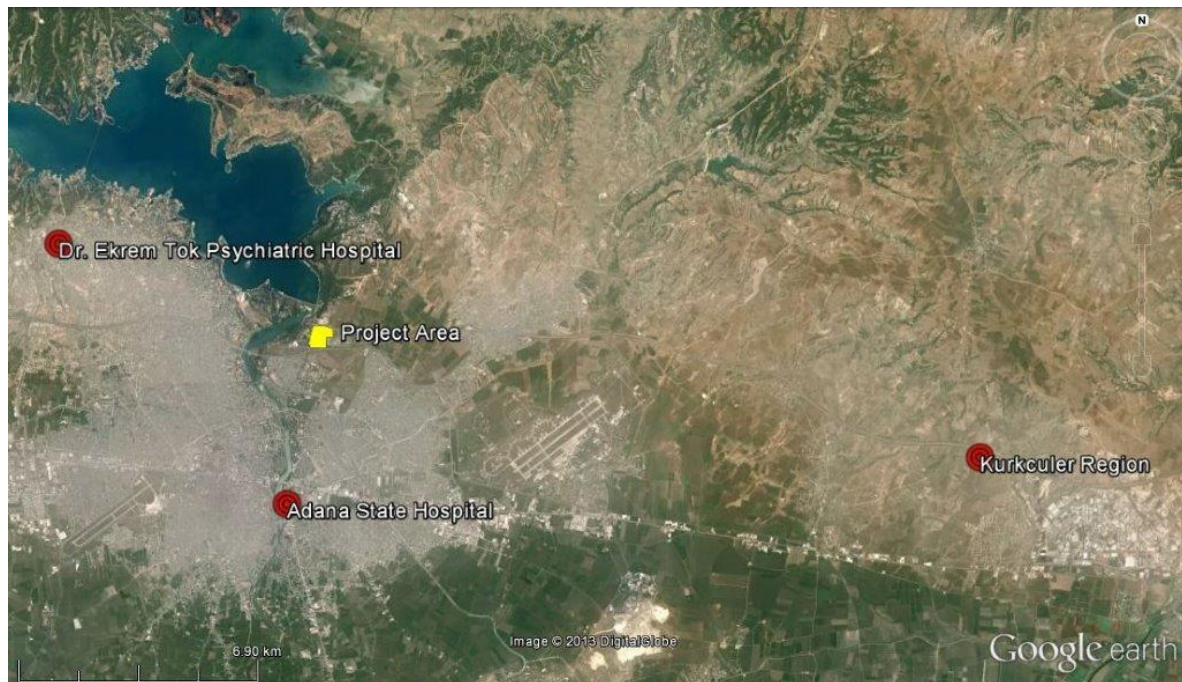


Figure 2-1: Locations initially considered for Adana IHC and finally selected Project location (in yellow)

It is understood based on the pre-feasibility study prepared by MoH for the Adana IHC that a location in Dagci Village (of Kurkcüler Town – likely to be the similar location stated by the Mayor) was initially considered. As stated in the official letter by the Treasury (issued to Adana Financial Office, dated 30.03.2011 – numbered 009952), this location was changed to the current location in Yüreğir District due to the fact that the site in Dagci Village was located far away from the province center. It was identified that provision of public transport and similar services, and infrastructure services in Dagci Village area would not be sufficient for supporting the Adana IHC. It was therefore concluded that it would be more appropriate to select the current site in Yüreğir District because 1) the site is easily accessible, with easy access by vehicles, afoot and other vehicles compared to the site in Dagci Village; 2) the topography/geometry of the land is more appropriate for the construction of the IHC; 3) there is sufficient area for car parking and open space usage; 4) the site is also more appropriate for the construction of facilities other than the health campus; 5) the site has a potential for coordination with other health facilities in the surroundings; and 6) the site is owned by the Treasury. The aforementioned official letter states that the selected site has also been allocated as a Health Facility Area in the zoning plans.

The Mayor also indicated that the selected site in Yüreğir District is a good location in terms of accessibility as it is located very close to the highway and to the airport; a clover-leaf road junction is currently being planned close to the IHC area that will be a positive solution for better access to the IHC and also to avoid congestions in the area. Furthermore, a metro project is currently being planned with a route that is very close to the IHC.

With the planning of the mentioned clover-leaf road junction close to the IHC site, some part of the already allocated area for the IHC will need to be used for the junction which results in a need for extra land for the IHC project to compensate the loss related to the junction. This extra land will be allocated from the adjacent land owned by the Treasury and presently being used by the 6th Regional Directorate of State Hydraulic Works (DSI). The necessary correspondence and agreement

have been made between the Treasury, MoH and 6th Regional Directorate of DSI for allocation of the required land for IHC. The 1/5,000 scaled master zoning plan that includes all necessary area for the Project has been approved by AMM Board with an official decision letter dated 13.11.2013. The approved master zoning plan was disclosed for a period of one month that started on 26.11.2013. Based on the AMM Board decision dated 12.02.2014, three objections were made to the plan which were not accepted by the AMM Board. As reported by an officer in the Zoning Planning Department of AMM, the zoning plan has been approved.

2.4 Project Components and Design

2.4.1 Overview

The Project comprises of the development of an integrated health campus with a total capacity of 1,550 beds consisting of three hospitals. These are the 1,300-bed Main Hospital (MH), 150-bed Physical Therapy and Rehabilitation Hospital (RH) and 100-bed High Security Forensic Psychiatric Hospital (FRH). In addition to the hospitals, there will be a commercial area for health support facilities, a technical unit building, one helipad and a trigeneration plant. The layout of the hospitals and other units are shown in Figure 2-2 and Figure 2-3. The illustrations of the hospitals are presented in Annex E-1.



Figure 2-2: Layout and view of the hospital components

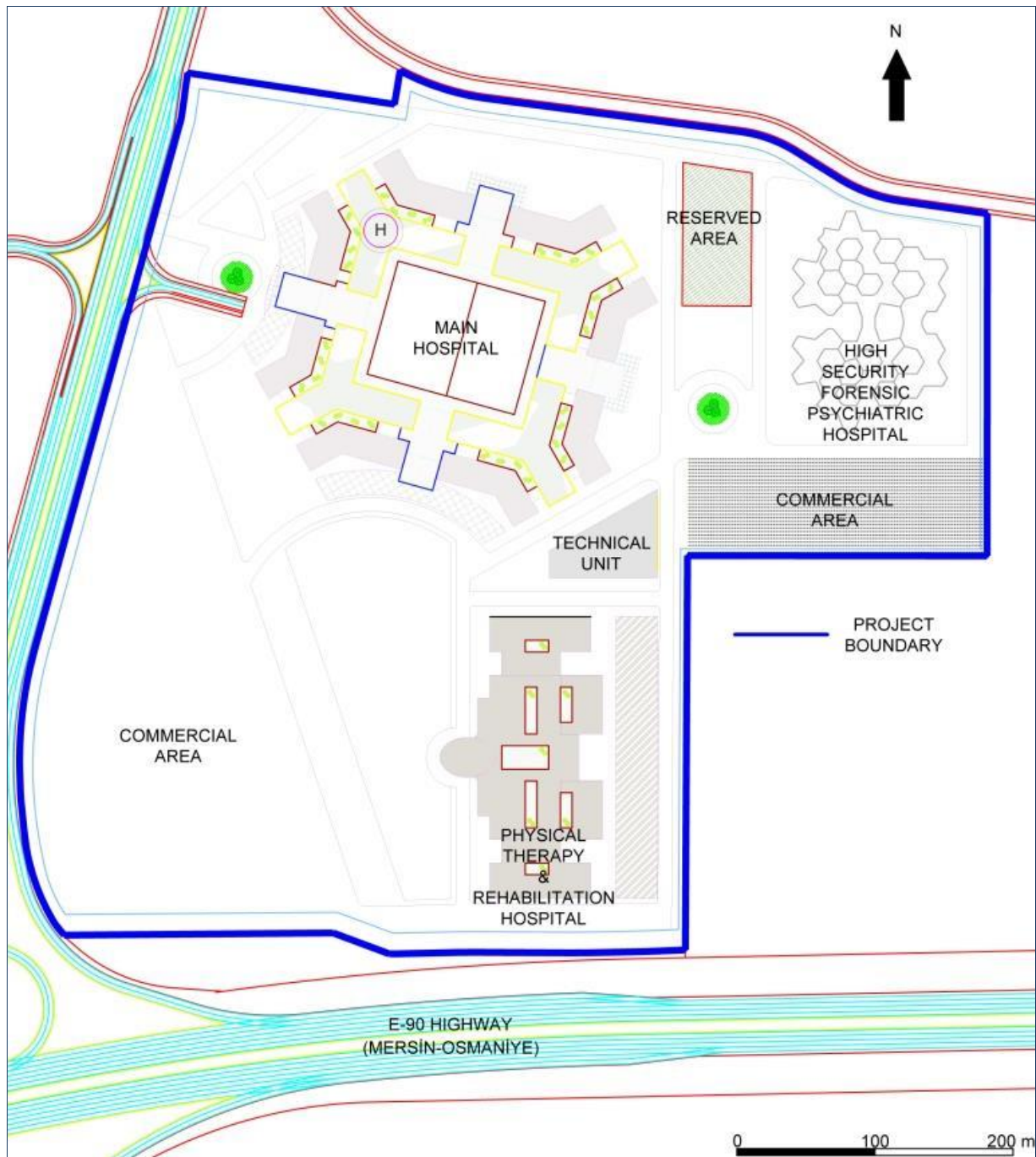


Figure 2-3: Layout of the hospitals

2.4.2 Main Hospital (MH)

MH will consist of four patient tower blocks surrounding a common core where a “Diagnostic and Treatment (D&T) Center” will be located. The four tower blocks will include the following specific hospitals with a total 1,300 bed capacity:

- 182-bed Oncology Hospital & 185-bed Cardiology and Cardiovascular Hospital
- 349-bed Women/Maternity & Pediatrics Hospital
- 285-bed General Hospital
- 299-bed General Hospital

The distribution of bed capacities in the MH in different units are given in Table 2-4.

Table 2-4: Distribution of bed capacities in the MH

Hospital Unit	Number of Beds
Acute Care Unit	952
Intensive Care Unit	180
Suite Room	32
Prisoner Ward	14
Trauma	10
Bone Marrow Transplantation Unit	20
Labor Delivery Recovery Postpartum	27
Neonatal Intensive Care Unit	35
Iodine Treatment	8
Burn Unit	22
TOTAL	1,300

The D&T units will include the angiography unit, day surgery rooms, robotic medicine dispensing unit, total parenteral nutrition unit, genetic diseases central, advanced pathology unit, thalassemia laboratory, hyperbaric unit, In-Vitro fertilization unit, transfusion center, radiology, radiation oncology, nuclear medicine, chemotherapy, emergency service, endoscopy, surgery rooms, pre/post-surgery rooms, sterilization unit and hemodialysis unit. In addition, there will be 38 polyclinics.

The total construction area of the MH will be 351,852 m² (including closed car parking area and shelter area), with a hospital area of 232,824 m². A total of 3,900 cars will be able to park in the 117,000 m² closed car parking area. The shelter area will cover 2,028 m².

The MH will have 11 floors and 2 basement floors. A typical cross-section of the MH is shown in Figure 2-4.

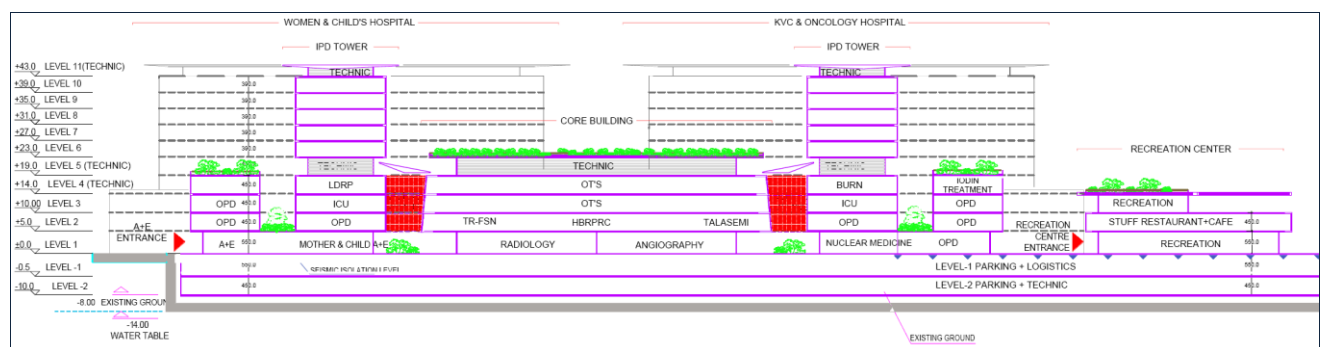


Figure 2-4: Typical cross section of the Main Hospital

2.4.3 Physical Therapy and Rehabilitation Hospital (RH)

The Physical Therapy and Rehabilitation Hospital will have a capacity of 150 beds. The D&T units will include inpatient therapy areas, radiology, prothesis-orthesis laboratory, 25 beds rehabilitation acute care, 20 physician room module, gait laboratory, psychotherapy, diet, spinal cord injury rehabilitation, traumatic brain injury, rehabilitation public areas and rehabilitation support areas.

The total construction area of the RH will be 48,865 m² (including closed car parking area), with a hospital area of 35,365 m². A total of 450 cars will be able to park in the 13,500 m² closed car parking area.

The RH will have 3 floors and 2 basement floors. A typical cross-section of the RH is shown in Figure 2-5.

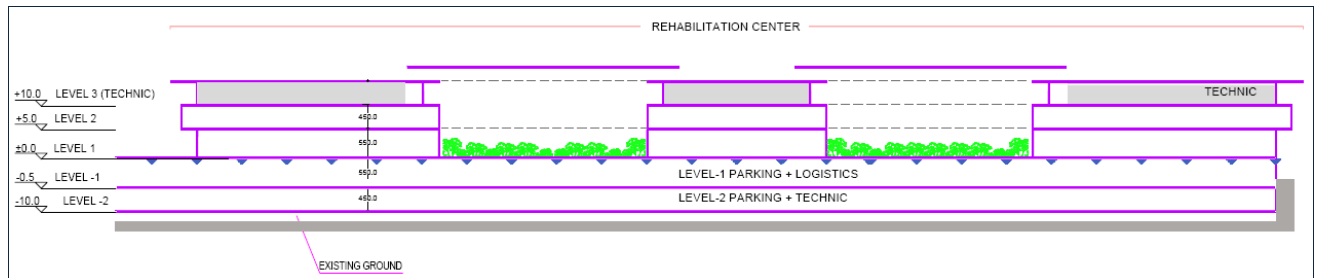


Figure 2-5: Typical cross section of the Physical Therapy and Rehabilitation Hospital

2.4.4 High Security Forensic Psychiatric Hospital (FRH)

The High Security Forensic Psychiatric Hospital will have a capacity of 100 beds.

The total construction area of the FRH will be 33,746 m² (including closed car parking area), with a hospital area of 24,726 m². A total of 300 cars will be able to park in the 9,000 m² closed car parking area.

The FRH will have 3 floors. There will be different inpatient sections within the FRH that includes clinics arranged according to gender and different security levels as below:

- Adolescent security service (for the rehabilitation and treatment of children between the age of 14 to 18, who are mostly drug substance dependents)
- Psychiatry prisoner service
- Psychiatry high-security service
- Psychiatry medium-security service
- Psychiatry low-security service

The design of the FRH is currently at an early stage. The security of the FRH will be managed by the gendarme (branch of the Turkish armed forces), however this issue will be discussed in more detail during the project development, as reported by ADN PPP A.Ş. The responsibilities of ADN PPP A.Ş. related to the FRH will be as those described in the main contract with the MoH and as summarized in section 2.5.1.

MoH Sample Project Approach

The MoH has prepared a study together with a team from Bakirkoy Psychiatric Hospital (located in Istanbul Province), as a sample project for FRHs that are being planned to be constructed across Turkey. Information presented below has been collected from that study¹ and the design of the FRH within the scope of Adana IHC is expected to cover the issues mentioned below.

¹ Türk Adli Psikiyatri Hastaneleri (Yatan Hasta Klinikleri) Örnek Tasarımı Proje Özeti (Turkish Forensic Psychiatric Hospital (Inpatient Clinic) Exemplary Design Project Brief, Turkish Ministry of Health PPP Program

Context of Planned Hospitals

The structure of the FRH is being designed as a spreading structure rather than rising that includes shared spaces such as administration, polyclinics and technical areas. The relation of the FRH with the surrounding environment is specially designed taking into account the security of the patients and the neighbors. The environments where FRHs are to be located, are either hospital campuses or urban settings. In case of Adana IHC, the FRH will be located within an integrated health campus, which serves to a holistic treatment oriented concept for the personnel and patient, and the patient's relatives as a result of being in contact with the other health units within the campus. Furthermore, it is highly important that FRH be located within the city for the transportation of patients and personnel, and avoidance of stigma, which is one of the most important elements of FRH planning. Due to being located in an urban setting, FRH within the Adana IHC will also meet the above mentioned issues. A typical 3D-layout of an FRH with a 100-bed capacity is shown in Figure 2-6.



Figure 2-6: Typical 3D layout of an FRH with 100-bed capacity (Source: Turkish Forensic Psychiatric Hospital (Inpatient Clinic) Exemplary Design Project Brief, Turkish Ministry of Health PPP Program)

Bed Capacities in FRH

A feasible arrangement in FRH is not deemed possible when the bed capacity is below 80-90 due to different security levels and differentiation between women and men. When the bed capacities are in the range of 100-200, it becomes possible to share the rehabilitation, entrance, visitor and some personnel areas in a clinic, which in return increases the feasibility and provides economic benefits. In the hospital scale; the indoor sports hall, administration, electro-convulsive therapy center and polyclinic become the shared areas of all clinics. The prisoner clinics might not be able to benefit from these shared areas.

In general, male patients outnumber the female patients by a ratio of 7 to 1. Different ratios are tested among the security levels to determine the type, capacity and total number of clinics. An ideal clinic has 20 beds. The number of doctor, nurse and personnel in a clinic is approximately 14.

Area distribution

A 100 m² average total indoor area (including clinic and other indoor service areas) per patient is considered to be the norm in psychiatry. In clinics, this area may vary from 75 to 85 m². The important criterion is to provide a minimum of 20 m² open area per patient. The total open area can be considered as 100 m² per patient, however this depends on the plot conditions. In this way, it comes to an average where indoor areas and open spaces are equivalent. An average of 400 m² yard area is considered for each clinic. The difference in the security levels does not require major changes in the total area that is needed. The program distribution in the total indoor area of a clinic includes approximately 30% rehabilitation; 20% treatment personnel; 20% patient bedroom; 3% administration; 15% entrance, visitors and security areas. The remaining 10-15% is allocated to service places. Each clinic has at least one private outdoor/yard area that are at an equivalent ratio with the rehabilitation areas.

Layout strategies in FRH

The layout strategies in the FRH are made according to three grades which include urgency, publicity and security. Urgency grade includes a special status. Areas requiring urgency (such as emergency room or quarantine) or areas requiring special furnishing (such as surgery room or isolation room) are within the scope of urgency grade. Publicity includes privacy, and common spaces and public spaces. There is privacy in a patient's bedroom, and the clinic yard has also privacy compared to an open public space. The security grade includes both disasters such as fire, and the security of patients, personnel and the public.

The forensic psychiatry units are healthcare facilities in which units are dissociated from each other. Moreover, forensic psychiatry units have an emergency character due to the patient transfer and should be placed in the highest security area. On the other hand, low psychiatry clinics are in the same program with acute psychiatry clinics and they can share the common rehabilitation areas, so while the security level decreases, the degree of publicity increases.

Typical layouts of different floors (ground level, 1st floor and 2nd floor) of an FRH with a 100-bed capacity (similar to FRH within the scope of Adana IHC) is presented in Annex E-2.

Generic Clinical Function

The patients' areas do not have any other user other than the assigned treatment staff in a generic clinic. Patient bedroom areas are distinctly separated from the daily life and activity areas, however they are all in visual integrity. Visitor areas are separated from the patient areas for security, however they are not completely separated from the clinic. Intensive care areas are under the permanent supervision of the nurses. All areas have connection with the clinical base.

The stay duration in the high security healthcare facilities are in the range of 6 months to 5 years. The facility almost becomes a home to the patients. The average stay in acute psychiatry clinics is 21 days, however therapy is extended over a period of time. In order to prevent any external effects or interventions, and the possibility of the patient escaping or harming himself or suiciding; the patient circulation is to be kept separate from the personnel and visitor circulation. There are different footprints for patients, doctors and nurses, and personnel and visitors inside the FRH. For

patients, footprints also differ according to the security level (high, medium and low security), intensive care, prisoner and adolescent.

Personnel should be able to walk around during the day between the clinics without being exposed to outside weather conditions and the inner life of the other clinic. Services (cleaning, food, etc.) shall be provided in the same way and swiftly.

Intensive care areas are arranged for single person that have direct surveillance from personal observation and indirect surveillance with camera. It is a principle that all corridors are surrounded by windows to allow observation.

Security

There are different security measures in the FRH that include walls, fences, remote control steel doors, iron railings, closed circuit camera systems (CCTV), security buildings and security staff. Typical schematic representation of these security measures at different security levels in the FRH are presented in Annex E-3. In addition, the relationship between the security, vegetation, borders, privacy and socialization are schematically presented in Annex E-4.

Therapy Areas

Psychiatric treatment areas require indoor/outdoor areas where socially effective different activities can be arranged. Point corners are created in the patient corridors furnished as living space and in the daytime living spaces; and the opportunities for socializing and resting are provided. Natural ventilation is provided in these places.

For cases when the illness is at peak; special care areas such as intensive care, isolation rooms, electro-convulsive therapy center are important areas that require special furnishing and also require natural and mechanical ventilation and sufficient lighting.

There are special places (such as painting, music, group therapy, dance, sports, sculpture, handwork, weaving, movie, TV corner, library, wood workshop, etc.) within the clinic for occupational therapy for congregate use. These areas may vary according to the size of the hospital.

Personal quality of life

The patient rooms are single suits with a bathroom and cover in average a total area of 20 m². It is a principle that each room has an outward opening window (opens to the garden) to get natural air and lighting. Specially designed furniture and non-breakable glass are used in the rooms to prevent people from harming themselves.

2.4.5 Commercial Area

There will be commercial areas within the Adana IHC which are planned to include health support facilities such as pharmacies, doctors' offices, ophthalmic hospital, day chemotherapy and a medical hotel. The planning of the commercial area is currently ongoing and the types of units to be

located in the commercial area will be clarified as the design proceeds. There will be no commercial shopping mall complexes within the commercial area.

2.4.6 Technical Unit

There will be a technical unit building to house a trigeneration system in the ground floor with a capacity of 8.6 MW thermal input that will consist of two gas engines using natural gas. The technical unit building will also have one basement floor. The design of the technical unit building is currently ongoing.

2.4.7 Helipad

There will be one helipad located at the top of the MH building (on Tower-2) making it directly connected with Accident & Emergency Department and Burn Unit by a vertical connection. The helipad will serve the ambulance helicopters which are directly under the service of the MoH. There is currently one ambulance helicopter assigned by the MoH for Adana Province. As reported by ADN PPP A.Ş., an average of 1 cycle/day and on peak, 3 cycles/day are expected (depending on the severity and priority of the possible incident) for Adana IHC helipad.

2.4.8 Design Standards of the Hospitals

The design of the hospitals will meet the following standards as a minimum:

- “Circular on the Minimum Technical Standards that should be met in Existing and New Health Facilities” issued by the MoH, Department of Construction and Maintenance (last update: 30.10. 2012)
- “Minimum Design Standards for Turkey’s Health Facilities, Guidebook for the Year 2010”, issued by the MoH, Department of Construction and Maintenance
- “MoH, PPP Program, Adana Health Campus, Technical Specifications” provided by the MoH during the bidding process that includes technical specifications for the following:
 - Part 1: Technical Specifications for Architectural and Construction Works – provides technical specifications for the concept scheme design and for construction works
 - Part 2: Mechanical and Plumbing Technical Specifications
 - Part 3: Electrical Technical Specifications

Technical specifications provided by the MoH (Technical Specifications hereafter) cover environmental, health and safety (EHS) based design criteria and infrastructure requirements as presented in Annex E-5.

2.4.9 Infrastructure

Plumbing system

Plumbing systems are requested to be designed in accordance with Turkish Standards Institution (TSE) Standards, and the requirements of Local Codes, Standards, and Authorities requirements, as stated in the Technical Specifications during the bidding process. Plumbing systems and equipment necessary for a complete and properly functioning hospital are expected to be installed including but not limited to the following:

- Domestic hot and cold water systems
- Drainage, sanitary waste and vent system
- Drainage - storm water systems
- Natural gas systems
- Fuel oil systems
- Medical gas and vacuum systems

Heating, Ventilating, and Air Conditioning (HVAC) System

As stated in the Technical Specifications, the HVAC system shall provide heating and cooling for every occupied space in the hospital and for all equipment and storage space that requires temperature and humidity control. The hospital HVAC systems are expected to operate at the extreme weather conditions and after catastrophic events such as earthquakes. The HVAC systems are requested to be designed in accordance with the following standards, as per the Technical Specifications:

- American Society of Heating and Air-Conditioning Engineers (ASHRAE) HVAC Design Manual for Hospitals and Clinics 2003 (the manual describes airborne infection control issues in healthcare facilities which are the only places where nosocomial infections can be acquired)
- TSE Standards

Systems and equipment necessary for a complete and properly functioning HVAC system in a hospital are expected to be installed including but not limited to the following:

- Central Energy Plant
- Plant Steam System
- Plant Chilled Water System
- Low Temperature Surgery Chilled Water System
- Hospital Steam Systems
- Hospital Hot Water Heating System
- Air Handling Units and Systems
- Fan Coil Systems
- Air Distribution Systems
- Building Management System
- Exhaust Systems
- Supplemental Cooling Systems
- Control Systems

Electrical systems

The electrical systems are requested to be designed in accordance with the applicable sections of the following standards, codes, regulations, and recommendations, as stated in the Technical Specifications:

- TSE
- National Fire Protection Association (NFPA)
- International Electro-technical Commission (IEC)
- Chartered Institution of Building Services Engineers (CIBSE)
- International Industry Association/Electronics Industry Association (TIA/EIA)

- Local authorities (Electricity, Telecommunication, Fire, etc.)

The electrical services will include the following systems as per the Technical Specifications:

- Normal power distribution
- Emergency power distribution
- Uninterruptable power supply system
- Isolated power system
- Grounding and earthing system
- Lightning protection system
- Electric heat trace/snow melt
- Indoor and outdoor lighting system
- Exit and emergency lighting system
- Automatic fire detection and alarm system
- Automatic voice evacuation and firefighting telephone system
- Security, closed circuit television system (CCTV) and access control system
- Master clock system
- Nurse call and code blue system
- Telemedicine system
- Public address system
- Telephone system
- Data communication system
- Audio-visual system

2.4.10 Fire Safety

Health facility operations are exposed to life and fire safety risks, as they are accessible to the public. The IHC is being designed in accordance with the Turkish Regulation on the Fire Protection of the Buildings (Official Gazette Date/No: 19.12.2007/26735). The Technical Specifications has also covered requirements related to fire protection to be integrated into the design to include the following:

- Compartmentalization: The standards for fire compartmentation between floors and between compartments will be 1 hour (60 minutes) fire resistance. Sub-compartments and identified fire hazard rooms will be half an hour (30 minutes).
- The fire separation shall be reviewed with local officials during the design process to verify compliance with local codes and regulations. The final compartmentation shall represent the regional firefighting principals.
- Sealants: Intumescent sealants to be used to plug smaller gaps around services penetrations in compartment walls and floors.
- Smoke Barriers: Proprietary mineral wool products as Rockwool to be used to maintain fire separation between compartment floors and walls, and to protect around services penetrations.

In addition to the above, Fire Suppression Systems shall be provided throughout the hospitals as required by Turkish and local codes, and the Fire Alarm System shall be designed and installed in accordance with the requirements of NFPA72 and local codes, as per the Technical Specifications.

ADN PPP A.Ş. has assigned a fire consultancy company for the identification of necessary life and fire safety design criteria. As reported by ADN PPP A.Ş., the overall design, construction and

operation of Adana IHC will be based on Turkish Regulation on the Fire Protection of the Buildings, and Turkish and European (EN) standards. However, when local standards are not sufficiently detailed and are incomplete, internationally accepted life and fire standards (NFPA standards, IBC Codes and EN standards) will be applied. For this reason, mapping of Turkish requirements for life and fire safety will be conducted by ADN PPP A.Ş. in order to identify the insufficient areas and incorporate them into the design based on the international standards.

2.5 City Planning and Components near the Project Area

There is an existing zoning plan prepared by AMM which covers the Project area. The Project area is indicated as a “Health Facility Area” where the site selection has been based on a selection process that considered several factors including accessibility and infrastructure conditions as described in Section 2.2.2. The details related to the zoning plan are provided in *Chapter 5: Land Use and Zoning*.

Near the Project area, there are two components that are important to mention in order to understand the general planning around the Project area. One of the components is the planned removal of the shanty houses as part of the general framework of urban transformation projects within the Adana Province. The second component is related with transportation and includes the clover-leaf road junction project and metro line expansion project planned by AMM as part of the improvement of transportation infrastructure and mass transportation, respectively within Adana Province. All of these components are included in the zoning plans and under the jurisdiction of public authorities and outside the scope of the Project.

When the existing overall planning in the Adana Province is reviewed, it can be seen that the infrastructure and transport systems require significant improvements, traffic is an important problem and there are signs that the past urban planning resulted in urban sprawl. In accordance with the “AMM 2010-2014 Strategic Plan”, improvement of the transportation systems (particularly north-south and east-west directions) and undertaking urban transformation projects in order to transform the housing pattern that has no zoning status into an organized status are the priority targets of AMM. AMM and TOKI have signed a protocol in May 2006 and initiated the implementation of the urban transformation projects at selected locations in the province. The Strategic Plan also indicates that duplicating the urban transformation project within the planned period (2010-2014) is one of the targets. The planned removal of the shanty houses are therefore based on prior decisions that are related to improvements for better urban planning. Completion of the Transportation Master Plan within the strategic plan period, distributing and maintaining mass transportation services into the province in a well-balanced way including the implementation of the 2nd stage metro line are also part of the AMM targets. Related to these targets, planning of the clover-leaf road junction was previously planned to ease the traffic load in the upcoming years as indicated in the official correspondence letter of General Directorate of Highways given in Annex A.

2.6 Construction Stage

2.6.1 Overview

The planning of the Project is still ongoing. Construction is estimated to start in the last quarter of 2014 and take up to 36 months. The tentative construction schedule is given in Table 2-5.

Table 2-5: Tentative construction schedule

Works to be undertaken	1 st year				2 nd year				3 rd Year			
	1 st quarter	2 nd quarter	3 rd quarter	4 th quarter	1 st quarter	2 nd quarter	3 rd quarter	4 th quarter	1 st quarter	2 nd quarter	3 rd quarter	4 th quarter
Infrastructure and Mobilization												
Preparation of Implementation projects and their approval												
Construction of Main Hospital												
Construction of Physical Therapy and Rehabilitation Hospital												
Construction of High Security Forensic Psychiatric Hospital												
Construction of Technical Unit												
Infrastructure Works												
Automation and Furnishing Works												
Landscaping and Reclamation												
Testing and Commissioning												
General Cleaning and Disinfection												

The construction work timeframe is proposed to be up to 10 hours per day (between 08:00 and 18:00), and 7 days per week. The construction site facilities (including offices, camping area, cafeteria, resting areas, infirmary, workshop, material storage areas) will be located inside the Project area. The types of construction buildings are given in Table 2-6. All construction site facilities shall be constructed in accordance with the specifications and regulations of the Turkish and FI EHS standards. ADN PPP A.Ş. shall ensure that accommodation of workers and provision of basic services to workers are managed in line with the guidance note on worker's accommodation published by IFC and EBRD (Worker's Accommodation: Processes and Standards). The construction area will be enclosed with fences. There will be entrance and exit gates to control vehicles getting into the site. Maximum driving speed in the construction site will be set as 30 km/h. There will be no blasting activities during construction works. There will be no requirement for additional land other than the defined Project area.

Table 2-6: Types of construction buildings

	Area (m ²)	Number	Capacity	Total area
Site Buildings				
Management office	350	2	40	700
Sub-Contractor's Office	97	1	5	97
Employer Office	264	1	16	264
Laboratory and site Office	98	1	3	98
Infirmary	67	2	2	134
Workshop	260	2		520
Storage Area	260	2		520
Camping Buildings				
Family House (4 people)	238	1	4	238
Family House (6 people)	264	2	12	528
Engineer Dorm (14 People)	230	2	28	460
Foreman Dorm (16 People)	257	3	48	771
Worker Dorm (2-storey)	701	8	1,152	5,608
Worker Rest Area	93	2		186
Engineer Rest Area	93	2		186
Cafeteria (with cooking area)	650	1		650
Cafeteria (without cooking area)	350	1		350
Laundry	60	2		120
Total		36	1,244	11,523

2.6.2 Construction Equipment

The types and quantities of construction equipment with respect to various construction works are detailed in Table 2-7.

Table 2-7: Construction equipment deployment

Works	Equipment/machine	Number	Working Duration (days)
Excavation	Truck	30	180
	Excavator	12	180
	Bulldozer	2	90
	Grader	2	90
	Loader	1	90
	JCB	3	180
	Roller	1	30
Main construction	Tower Crane	6	240
	Mobile Crane	6	240
	Concrete mixer	20	240
	Mobile concrete pump	3	240
	Stable concrete Mixer	2	120
	JCB	2	300
Fine construction	Mobile concrete pump	2	200
	Concrete finish pump	2	200
	Concrete mixer	15	180
	Mobile Crane	16	240
Transportation of materials	Truck / semi-trailer truck	20	180
Asphalt works	Asphalt Truck	20	30
	Finisher	2	30
	Roller	5	30

2.6.3 Construction materials/quantities

The construction material required for the Project will include ready-mixed concrete, aggregates, iron and asphalt which will be transported to the site via roads from local suppliers. It is anticipated that approximately 10,000 m³ of aggregate, 250,000 m³ of concrete, 3,000 tons of asphalt and 25,000 tons of iron will be imported for the Project. As necessary, onsite temporary laydown areas for imported materials will be appropriately selected to avoid potential disturbance and run-off. Appropriate management practices for these materials will need to be adopted, as discussed in *Chapter 8: Material Resources and Waste Management*. A concrete plant is not planned to be established during construction.

2.6.4 Excavated Soils to be Disposed

It is anticipated that approximately 600,000 m³ of excavated material will be generated that will require off-site disposal. Excavated soils will not be reused and upon generation, will immediately be transported offsite to areas that are to be approved by the Yuregir Municipality and/or AMM, to ensure compliance with the Regulation on Control of Excavated Soil, Construction and Demolition Wastes (Official Gazette Date/No: 18.03.2004/25406).

2.6.5 Traffic and Access Management

The Project area is located close to the E-90 Highway and adjacent to Dr. Mithat Ozsan Boulevard that is connecting the city and the Cukurova University. The E-90 Highway and Dr. Mithat Ozsan Boulevard will be used during construction for the transportation of construction materials and excavation soils. The E-90 Highway is 3x3 lanes and Dr. Mithat Ozsan Boulevard is 2x2 lanes. There will be no need to open a new road during construction. The number of trucks visiting the construction site will be on average 200 trucks per day.

2.6.6 Workforce

The maximum workforce that is anticipated during the construction phase is 1,800 people. Workforce will be supplied locally as much as possible including local subcontractors. Appropriate pre-fabricated facilities will be provided to those employees who need onsite accommodation. Further details and conditions pertinent to management of Project labor are provided in *Chapter 15: Labor and Working Conditions*.

2.7 Operation Stage

2.7.1 Responsibilities and Organizational Management

The management of the Adana IHC will be shared between the MoH and ADN PPP A.Ş. during the operation phase. The MoH will be responsible for providing doctors and the support health personnel, and the general management of the clinical hospital activities will be undertaken by the administrative staff provided by the MoH. MoH administrative staff will be responsible for the tasks excluding those under the responsibility of ADN PPP A.Ş. as described below. Staff other than the doctors and support health personnel will be provided by ADN PPP A.Ş. ADN PPP A.Ş. will be responsible for the management of services classified as obligatory services (P1) and optional services (P2) as listed below:

- P1 - Obligatory services include building and land services, extraordinary maintenance and repair, management of common services, furniture services, ground and garden care, and other medical support services.
- P2 - Optional services include *non-medical services* including pest control, car parking, cleaning, implementation and operation of the hospital information management system, security, guidance and escort for patients/help desk/reception/carrying services, laundry, food and waste management; and *medical support services* including laboratory, imaging, sterilization and disinfection, and rehabilitation services.

2.7.2 Traffic and Access

It is estimated that 30,000 to 35,000 people per day will visit the IHC during operation. Presently, the transport system for accessing the IHC site is public buses. AMM has included in its zoning plans the construction of a clover-leaf road junction near the IHC site and expansion of the existing metro line that will have a close station to the IHC. The timing for the completion of the clover-leaf road junction and the metro line expansion is currently unknown but when they become operational, both of them will enable an easier access to the IHC and also eliminate potential traffic congestions in the area. The details on the present road network and traffic conditions are given in *Chapter 11: Traffic Impact*.

In order to understand the existing baseline conditions in detail and future conditions, ADN PPP A.Ş. has recently assigned a traffic consultant to undertake a traffic assessment study which will also identify the necessary traffic arrangements inside the IHC site. The traffic assessment study is expected to be completed by mid-September 2014.

2.7.3 Emergency Preparedness and Response

An Emergency Preparedness and Response Plan (EPRP) will be prepared by ADN PPP A.Ş. prior to operation as part of the Environmental and Social Management System to be established for the IHC. The EPRP will cover issues related to occupational accidents, fire, fuel and chemical spills, natural disasters such as flooding and earthquakes. EPRP will consider FRH in detail for all types of accidents/disasters.

2.7.4 Security

Security arrangements for the IHC are described in the Technical Specifications. Accordingly, an electronic security system will be provided in the IHC and will consist of the following elements:

- CCTV
- Access Control System
- Intrusion Detection System
- Radio Frequency Identification System (RFID)

CCTV cameras will be located at the following locations:

- Exterior entrances
- Main entrance lobbies
- Elevator lobbies
- Car parks
- Loading docks
- Pharmacy
- Service corridors
- Material storage

The access control system will include proximity card readers, key pad or a combination of both at selected entrances to the building and to areas/rooms within the building. At doorways the system will include readers, sensors, and locks. All users of the facility will be issued an identification badge (ID) with photographs in order to facilitate entry. These badges in conjunction with the access control system components will be used to gain entry to restricted areas. Examples where card readers or other access control devices are used include entrances, loading docks, critical utility areas, plant rooms, storage areas, parking garages, elevator lobby call buttons, and telecommunication rooms.

The intrusion detection system will consist of wall or ceiling mounted passive infrared (PIR) sensors, security alarms, and break-glass sensors. PIR sensors will be provided in specific areas within the buildings including pharmacy areas, material storage, financial offices, and retail areas.

The RFID system uses wireless and semiconductor based technology as a means of identifying and tracking items. It requires a transponder tag, tag programming equipment and a tag reader. When an RFID tag passes within a range of a reader, the tag is detected and interrogated for its

information contents. The RFID technology will be used for child abduction security system and physical asset tracking system.

The security system shall be designed to have a minimum of 20% spare capacity.

The security for the prison ward inside the MH will be under the responsibility of the Gendarme. As described previously in section 2.4.4, the security of the FRH will be managed by the Gendarme as well; however this issue will be discussed in more detail during the project development, as reported by ADN PPP A.Ş.

2.7.5 Operational Equipment

Medical equipment will be supplied from foreign and domestic suppliers.

2.7.6 Operational Employment

The workforce requirement during the operation phase is anticipated to be approximately 4,500 in total, with 2,500 health service personnel to be employed by the MoH, and 2,000 service employees to be employed by the service providers of ADN PPP A.Ş and ADN PPP A.Ş. itself.

3.0 INSTITUTIONAL AND REGULATORY FRAMEWORK

This chapter summarizes the institutional and regulatory framework within which the Project will be developed.

3.1 Turkish Institutional Framework

The key central, provincial and local government authorities relevant to the development and implementation of the Project are described in this section.

3.1.1 Central Government Ministries

The main government ministries with an interest in the Project are as follows:

- Ministry of Health
- Ministry of Environment and Urban Planning
- Ministry of Forestry and Water Works
- Ministry of Labor and Social Security
- Ministry of the Interior
- Ministry of Justice

These are described below.

Ministry of Health (MoH)

MoH coordinates, regulates and supervises healthcare services and takes required measures for the protection of the public health. The Ministry consists of several general directorates and certain institutions including:

- *General Directorate of Health Investments* which carries out the engineering services for the buildings to be used by the MoH and subsidiaries, prepares projects for these services and/or have them prepared, controls the construction of the buildings and conducts expropriation works for the immovable considered as to be required for the Ministry and similar work. The General Directorate is made up of five departments including *the Department of Public Private Partnership* which manages public-private partnership model health facility projects. The main roles and responsibilities of this Department include (i) determining the procedures and principles for commissioning the real persons or legal entities to be selected via a tender for constructing the healthcare facilities deemed necessary by the Higher Planning Board (*a body under the Ministry of Development*) on the lands owned by such persons/entities or owned by the Treasury, in return for the lease of such facilities to the constructing persons/entities against a predetermined amount of lease and for a certain period which cannot be more than forty-nine years; (ii) determining the leasing rate and duration; (iii) renewing the healthcare facilities in return for undertaking operation of services other than the medical services; (iv) defining the tender methods, required qualifications for the Bidders, the scope of the contracts and similar works.
- *General Directorate of Management Services* which manages the planning and improvement of human resources, personnel and administrative affairs of the MoH.

- *General Directorate of Emergency Health Services* which plans, organizes and manages the health services in emergency situations and disasters.
- *General Directorate of Health Services* which plans, regulates, and determines the standards for protective, diagnosis, treatment and rehabilitation services, regulates/makes arrangements regarding the patient rights and occupational health issues and inspects the health institutions and organizations based on the relevant legislation and policy of the MoH.
- *Public Hospitals Institution* which constitutes and operates the hospitals, oral and dental health centers and other health facilities of the Institution, and combines, separates, transfers or closes these facilities (if required). The Institution also conducts administrative and financial services and purchasing, leasing, maintenance, repair and archiving affairs of the Institution.
- *Public Health Agency* which constitutes and coordinates family physician services, determines the technical and physical features of the family health centers, community health centers and similar, prepares programs and studies against the contagious diseases and health threats and makes research to protect and improve employees' health, develop national health policies and similar.

The Ministry is represented at the Governorship level by the Provincial Health Directorates.

Ministry of Environment and Urban Planning

The Ministry of Environment and Urban Planning (MEUP) is a relevant authority for the Project in terms of environmental permits and auditing. The MEUP is made up of several directorates, including the following:

- *General Directorate of Environmental Impact Assessment, Permitting and Auditing* organizes the procedures of EIA and follow-up in coordination with Governorship structures at the local level.
- *General Directorate of Environmental Management* is the primary authority in environmental protection and monitoring procedures, holding the authority for assessment, supervision, and sanctioning in coordination with Governorship structures at the local level.
- *General Directorate of Spatial Planning* identifies the procedures and guidelines related to the preparation of all kinds of physical spatial development plans and environmental management plans in all scales; approves these plans and ensures that the plans are applied and monitored.
- *Provincial Environment and Urban Planning Directorates* represent the Ministry within each Governorship and form part of the Provincial Administration. They act in accordance with the Ministry's and the Governorship's activities with regard to environmental issues.

Ministry of Forestry and Water Works

The Ministry of Forestry and Water Works (MFWW) is a relevant authority for the Project particularly in terms of nature conservation and the need for felling of trees. The MFWW is made up of directorates including General Directorate of Nature Protection and Natural Parks, General Directorate of Water Management and General Directorate of Combating Erosion and

Desertification. The Ministry has several affiliated institutions which include State Hydraulic Works (DSI), State Meteorological Works and Turkish Water Institute. The Ministry is responsible of:

- determining policies on protection, improvement, operation, rehabilitation and maintenance of forest areas; combating desertification and erosion; reforestation and pasture improvement on forestry,
- determining policies regarding nature conservation and designation of protected areas; to protect, manage, improve, operate (or having them operated) national parks, nature parks, nature monuments, nature reserve area, wetlands, biological diversity and to protect wildlife,
- determining policies on conservation and sustainable use of water resources,
- determining policies and strategies related with monitoring meteorological events and taking relevant measures.

Ministry of Labor and Social Security

The Ministry of Labor and Social Security is a relevant authority for the Project in terms of occupational health and safety of the workers during construction phase and health personnel during operation phase. Under the organization of Ministry of Labor and Social Security, there are several divisions which are responsible from occupational health and safety including:

- *General Directorate of Occupational Health and Safety* defines standards of health and safety and coordinates all aspects associated with occupational health and safety.
- *Labor Inspection Board* functions through its labour inspectors, monitoring all activities related to health and safety at the workplace and reporting to the Ministry.
- *Regional Labor Directorates* are ministerial agencies at regional level, conducting monitoring and enforcement of labor law, particularly occupational health and safety.

Ministry of the Interior

The Ministry of the Interior is made up of the Main Service Units, Control and Consultation Units, Supportive Units, and associated institutions such as the Turkish National Police, General Command of Gendarmerie, Command of Coast Guard, General Directorate of Migration Administration and Governorates. The Ministry serves to provide homeland security and public order, unity of the country and nation, rights and freedom set forth by the Constitutional Law, and public peace and general morality. The role of the Ministry within the Project is that the security of the prisoner ward inside the MH and the security of the FRH will be managed by the Gendarme. ADN PPP A.Ş. has indicated that the role of the Gendarme and their interaction with the Project personnel will be discussed in more detail during the Project development.

Ministry of Justice

The Ministry of Justice is made up of several Directorates, Departments and Presidencies including the Presidency of Inspection Board, the General Directorate of Criminal Affairs, the General Directorate of Civil Affairs, the General Directorate of Criminal Records and Statistic, the General Directorate of Laws, the General Directorate of International Laws And Foreign Affairs, the General Directorate of European Union Affairs and the Forensic Science Institution. The Ministry has several duties including planning, establishing and improving all levels and types of judicial institutions such

as prisons and correctional facilities. The relevance of the Ministry of Justice to the Project is that there will be a prisoner ward inside the MH and a FRH which will provide service to criminals.

3.1.2 Provincial Administration (Adana Province)

The highest authority at the provincial level is the Governor, who is directly responsible to the Ministry of Internal Affairs. Governors represent central government (i.e. the Council of Ministers) at the provincial level. Provincial directorates represent their respective ministries at provincial level and form the Provincial Administration under the authority of the Governor.

3.1.3 Local Administration (Yuregir District)

Mayors and Muhtars are the heads of urban (over 2,000 inhabitants) and rural (under 2,000 inhabitants) settlements, respectively. A Mayor is the head of the municipal organization (Municipal Assembly and Municipal Council) and represents the municipality. In urban areas each neighborhood also has a Muhtar (neighborhood headman). Both Mayor and Muhtar are elected officials.

3.2 Turkish Regulatory Framework

3.2.1 Turkish Legal Framework

The legal framework in Turkey is governed by the Turkish hierarchy of norms, which defines the different categories of Parliamentary Act and controls legal precedence in cases of any conflict.

All parliamentary acts have to comply with Constitutional provisions and the constitutionality of these acts can only be contested at the Constitutional Court (*Anayasa Mahkemesi*). Parliamentary Acts are made up of Code Law (*Kanun*) and Decree Law (*Kanun Hukmunde Kararname*). Code Law forms the backbone of the Turkish legal system and is the fundamental reference point for all courts. Decree Laws are legislation prepared by the Council of Ministers and authorized by the Parliament.

Public administrative bodies, such as Ministries, are responsible for the execution of Parliamentary Acts and as such have the authority to develop secondary legislation to ensure implementation of these Acts. Secondary law includes:

- By-laws (*Tuzuk*): Ministries (and in practice the Council of Ministers) are entitled to issue by-laws. These regulatory acts are examined by the Council of State (*Danistay*) before they are issued.
- Regulations (*Yonetmelik*): These are issued by Ministries as well as other public bodies with authority of execution. Regulations have to be in compliance with the relevant decrees. Even though they occupy a lower grade than Decrees in the hierarchy of norms, they are usually substituted for Decrees and tend to form the bulk of Turkish legislative documents.
- Circular orders (*Genelge*) and Communiques (*Tebliğ*): These are legislative documents issued by administrative bodies to ensure implementation of parliamentary acts. They are considered minor legislation, though prominent in certain fields.

3.2.2 Applicable Turkish Environmental, Health, Safety and Social Legislation

The key provisions of Environmental, Health, Safety and Social (EHSS) legislation considered relevant to the Project are summarized in Table 1 of Annex B in tabular format. The key permit requirements for the Project are indicated in the table along with the relevant provisions.

Key Applicable Laws on Environmental, Health, Safety and Social Issues

The current environmental legal policy framework of Turkey is built on the *Environment Law* (Law no. 2872). This law provides a legal framework for many regulations scattered throughout the Turkish legislation that seek to clarify and elaborate its intentions, including the Environmental Impact Assessment Regulation.

Labor, health and safety issues are collectively ruled by the *Labor Law* (Law No. 4857), *Occupational Health and Safety Law* (Law No. 6331) and associated regulations.

Key Applicable Legislation for the Health Sector

The Health Services Basic Law (Law No. 3359) regulates the fundamental principles related to health services and states that "health institutions and organizations are planned, coordinated, financially supported and developed by the Ministry of Health considering the opinions of other relevant Ministries". Basic principles for the establishment of the health facilities by Public Private Partnership model were initially introduced with the Additional Article 7 (with the amendment in the Law by the *Law on the Addition of a New Provision to the Health Services Basic Law* (Law No. 5396). Based on the Additional Article 7 of the Health Services Basic Law (Law no. 3359), the *Regulation on the Construction of New Healthcare Facilities against Lease and the Renovation of Existing Healthcare Facilities against Operation of Non-Medical Services and Functional Areas of Activity* was prepared and entered into force on 27.02.2007. This regulation covers and is applicable to the healthcare facilities which are decided by the Higher Planning Board needed to be constructed, and those existing healthcare facilities which are decided by the MoH needed to be renovated, within the framework of the Additional Article 7 of the Health Services Basic Law (Law No. 3359). Additional Article 7 was then abolished with the entry of *The Law on Facility Construction, Renewal and Obtaining Service by the Ministry of Health with the Public Private Sector Cooperation Model and Amendments of Certain Laws and Decrees* (Law No. 6428) that came into force on 09.03.2013. This new Law regulates the processes in the construction or renewal of the health facilities such as land use and transfer, tendering, contracting and obtaining certain services (i.e. consultancy).

There are other several general regulations that apply to the health institutions including the *Regulation on the Operation of Inpatient Treatment Institutions* (Official Gazette date/number: 13.01.1983/17927) which defines the implementation principles of several services in inpatient health institutions and the roles and responsibilities of the personnel; and the *Regulation on Providing Patient and Personnel Security* (Official Gazette date/number: 06.04.2011/27897) which establishes procedures and principles to ensure and maintain a secure environment for the patients and personnel within the health institutions.

Of specific relevance to the High Security Forensic Psychiatric Hospitals, *the Criminal Law* (Law no: 5237) (Official Gazette date/number: 12.10.2004/25611) refers to the use of high security health

institutions for the treatment of insane people. Article 32 of the Law defines insanity and Article 57 of the Law provides information on security precautions specific to insane people. In addition, *the Law on the Execution of Penalties and Security Measures* (Law no: 5275, Official Gazette Date/Number: 29.12.2004/25685) describes high security closed penal execution institution and include provisions for the postponement of execution due to illness including insanity. The relevant articles of the mentioned laws are summarized in Annex B.

Regarding patient's rights, there is one regulation which is the *Patient Rights Regulation* (Official Gazette date/number: 01.08.1998/23420) that regulates the procedures and principles for benefiting from patient rights, protection of people from breaches and people's use of legal protection means, if needed. As explained in Chapter 2, the medical services that will be provided by the MoH and ADN PPP A.Ş. will have no responsibility regarding these services. Accordingly, it is expected that the MoH will be responsible for the patient's rights and will comply with all the requirements set forth in the *Patient Rights Regulation*. In accordance with the *Patient Rights Regulation*, a Patient Communication Unit should be established inside the Adana IHC where patients can apply if they think that their rights are violated or they have specific problems. The regulation sets provisions relevant to getting consent from the patient for medical interventions. On the other hand, the *Patient Rights Regulation* focuses on the rights of all patients in general and does not cover any specific rights for patients in a psychiatric/high security forensic psychiatric hospital. A brief information on the *Patients Rights Regulation* is provided in Annex B.

3.2.3 International Conventions Ratified by Turkey that are Relevant to the Project

Turkey has ratified several international conventions and agreements with respect to environmental conservation. Those conventions and agreements that could have relevance to the Project are listed below:

- Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto (1997) (Turkey made the Ratification Accession on 28 May 2009 and it entered into force on 26 August 2009. Turkey is party to the United Nations Framework Convention on Climate Change)
- Vienna Convention for the Protection of Ozone Layer (1985) and the Montreal Protocol on Substances that Deplete the Ozone Layer (1987)
- Bern Convention on the Conservation of European Wild life and Natural Habitats (1976)
- CITES Convention on Trade in Endangered Species of Wild Flora and Fauna (1975)
- Convention on Biodiversity - Biological Diversity (1992)
- Convention on Wetlands of International Importance (Ramsar Convention) (1971)

3.3 International Requirements

3.3.1 Overview

The ESIA has been prepared to meet the requirements of IFC Performance Standards (PSs) and EBRD Performance Requirements (PRs) as given below:

IFC Performance Standards (dated 1 January 2012)

- PS 1: Social and Environmental Assessment and Management Systems
- PS 2: Labour and Working Conditions
- PS 3: Pollution Prevention and Abatement
- PS 4: Community Health, Safety and Security
- PS 5: Land Acquisition and Involuntary Resettlement
- PS 6: Biodiversity Conservation and Sustainable Natural Resource Management
- PS 7: Indigenous Peoples
- PS 8: Cultural Heritage

EBRD Performance Requirements (dated May 2008)

- PR 1: Environmental and Social Appraisal and Management
- PR 2: Labour and Working Conditions
- PR 3: Pollution Prevention and Abatement
- PR 4: Community Health, Safety and Security
- PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement
- PR 6: Biodiversity Conservation and Sustainable Natural Resource Management
- PR 7: Indigenous Peoples,
- PR 8: Cultural Heritage
- PR 9: Financing Intermediaries
- PR 10: Informing Disclosure and Stakeholder Engagement

IFC PS 1 and EBRD PR 1 establish the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them (EBRD through PR 10); and (iii) the client's management of environmental and social performance throughout the life of the project. IFC PS/ EBRD PR 2 through 8 provide guidance on particular topic areas that maybe relevant to an assessment, such as biodiversity conservation, resettlement or cultural heritage issues. The applicable IFC PSs and EBRD PRs are discussed in *Chapter 4: Scope of the ESIA and Stakeholder Engagement*.

In addition to the IFC PSs and EBRD PRs, the following guidelines will also be applicable for the Project:

- IFC General Environmental, Health and Safety Guidelines (30 April 2007)
- IFC Environmental, Health and Safety Guidelines for Healthcare Facilities (30 April 2007)
- EBRD Sub-sectoral Environmental and Social Guidelines for Health Services and Clinical Waste Disposal (October 2009)

Furthermore, EBRD PRs require projects to comply with the relevant European Union (EU) environmental requirements in addition to the applicable national laws and regulations. The list of EU Directives that may be relevant to the Project is given in section 3.3.2.

3.3.2 Relevant EU Environmental, Health, Safety and Social Directives

The relevant EU Environmental, Health, Safety and Social Directives are listed below under different categories as defined by EU. Brief information on these directives is provided in Table 2 of Annex B.

General Provisions and Programmes

- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification)

Pollution and Nuisance

- Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (Codified version)¹
- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)²

Water Protection and Management

- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy
- Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
- Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment

Monitoring of atmospheric pollution

- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
- Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

¹Directive 2008/1/EC is replaced by Directive 2010/75/EU on industrial emissions. However, its provisions remain applicable until 6 January 2014.

²Directive 2010/75/EU replaces definitively, with effect from 7 January 2014:

- Directive 78/176/EEC on titanium dioxide industrial waste;
- Directive 82/883/EEC on the surveillance and monitoring of titanium dioxide waste;
- Directive 92/112/EEC on the reduction of titanium dioxide industrial waste;
- Directive 1999/13/EC on reducing emissions of volatile organic compounds (VOCs);
- Directive 2000/76/EC on waste incineration;
- Directive 2008/1/EC concerning integrated pollution prevention and control; with effect from 1 January 2016;
- Directive 2001/80/EC on the limitation of emissions of certain pollutants from large combustion plants.

Prevention of Noise Pollution

- Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise

Conservation of Wild Fauna and Flora

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

Waste Management and Clean Technology

- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

Safety at Work

- Council Directive 2010/32/EU of 10 May 2010 implementing the Framework Agreement on prevention from sharp injuries in the hospital and healthcare sector
- Directive 2000/54/EC of the European Parliament and of the Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work (seventh individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC)
- Council Directive 96/29/EURATOM of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation

Social Protection

- Directive 2011/24/EU of the European Parliament and of the Council of 9 March 2011 on the application of patients' rights in cross-border healthcare.

3.4 Comparison of Turkish and International Environmental Thresholds

The comparison of the Turkish and international environmental thresholds is summarized in Table 3, Table 4, Table 5 and Table 6 of Annex B.

4.0 SCOPE OF THE ESIA AND STAKEHOLDER ENGAGEMENT

4.1 Overview

Scoping is an important preliminary step in an ESIA process that identifies the key issues to be addressed in the ESIA study. Scoping allows defining which relevant issues should be addressed in the assessment and which issues are of little or no relevance to the Project. In this respect, a scoping study has been carried out for the Project to comply with the requirements of the IFC PSs and EBRD PRs. In addition, IFC General EHS Guidelines, IFC EHS Guidelines for Healthcare Facilities and EBRD Sub-sectoral Environmental and Social Guidelines for Health Services and Clinical Waste Disposal were taken into account during the scoping study.

The scoping study was performed with the following aspects in accordance with IFC PS1 and EBRD PR1:

- environmental and social risks and impacts of the Project including labor, and health and safety of the workers and the community,
- key stages of the Project including construction and operation, and for accidents and emergencies,
- all elements of the Project (including facilities, infrastructure and activities associated with the project)
- applicable laws and regulations,
- cumulative impacts from further planned development of the Project or any other existing or planned developments, as appropriate.

An ESIA scoping report has been issued in October 2013 which was based on the above mentioned international standards, review of readily available information, reconnaissance site visits conducted by the ESIA team and specific experts. Stakeholder consultations also started during the scoping phase. The scoping report has also been submitted to lenders (IFC and EBRD) for review.

Categorization of the Project

International lenders evaluate projects according to their category based on the scale and nature of potential impacts and risks. Projects are categorized as follows:

- Category A: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- Category B: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and
- Category C: Projects with minimal or no social or environmental impacts.

The Project was determined as a Category B by the lenders considering the key environmental and social issues and comparison with other IHC projects in Turkey.

The rest of this chapter presents the results of scoping and stakeholder engagement activities undertaken to date.

4.2 Scoping Results

The following topics were considered during the scoping study:

- Air quality and climatic factors
- Noise and vibration
- Geology, soils and groundwater
- Wastewater
- Waste management
- Material resources
- Terrestrial ecology
- Surface water
- Cultural Heritage
- Traffic and transport
- Socio-economic impacts
- Visual and landscape
- Tenants/users inside the Project area
- Workers/Healthcare personnel
- Community health, safety and security

Potential impacts/sources, proposed scope for the ESIA and examples of mitigation measures have been identified for each topic given above. Based on the results of the scoping study, the following potential environmental and social impacts have been identified as key issues:

- **Air quality:** Impacts during construction include dust generated from earth movements and excavation, transport of construction materials and resources including aggregates, transport of excavated soils outside the project area, vehicles movement, stockpiles, and unpaved surfaces in the working area; and emissions to the atmosphere from machinery and vehicles (i.e. generators, excavators, bulldozers, trucks, cars). Impacts during operation are particularly related to increase in emissions from road traffic and power generation from the trigeneration system.
- **Noise:** Noise and vibration impacts during construction include construction activities, operation of construction machinery and construction vehicles. Impacts during operation will be related to increase in road traffic and operation of the trigeneration system. There will also be occasional noise generation due to helicopter movements which will be very limited as indicated in *Chapter 2: Project Description*.
- **Wastewater:** Sanitary wastewater will be generated by the workers during construction and by workers/healthcare personnel and patients during operation. Contaminated wastewater may result from discharges from medical wards and operating theatres, laboratories, pharmaceutical and chemical stores, cleaning activities and X-ray development facilities. Wastewater may also result from autoclaving, microwave irradiation and chemical disinfection.
- **Waste Management:** There will be waste generation during construction activities that include excavated soils, solid wastes, construction wastes (such as steel, cables), hazardous wastes (such as waste oil, oily rags) and medical wastes which will require disposal. During operation, there will be generation of domestic wastes, general hazardous wastes and healthcare operation wastes (such as infectious wastes containing pathogens; sharps such

as needles, scalpels, knives; pharmaceutical wastes; genotoxic/cytotoxic wastes that may have mutagenic, teratogenic or carcinogenic properties; and chemical wastes generated through the use of chemicals during diagnostic/experimental work, cleaning, housekeeping and disinfection; radioactive wastes that may be generated by activities such as imaging, radiotherapy, and research laboratory procedures; waste with high content of heavy metals such as batteries, broken thermometers, blood pressure gauges; pressurized containers).

- **Traffic and transport:** The Project may have the potential to result in a traffic increase in local roads used by the Adana IHC traffic during operation which may require specific management measures.
- **Worker/Healthcare personnel health and safety:** Activities during construction (i.e. working at height, working with machinery, chemical handling) carry the risk of injury or damage to workers. Related to operation, impacts may occur through exposure to infections, diseases, hazardous materials/waste, radiation; and through fire risks related to storage, handling and presence of chemicals and flammable substances.
- **Community health, safety and security:** There will be dust and noise generation during construction activities which may affect nearby receptors. The security during construction is another aspect considering the potential for injuries/accidents to people as a result of unauthorized access to the construction site. Impacts during operation phase are related to the increase in road traffic, management of healthcare wastes and life and fire safety risks at the hospitals. Security is an important aspect for the operation phase as well related to control of entry to the hospital and for applying specific measures to manage the security in the FRH.

The scoping study considered projects close to the IHC site that are either under construction or planned in order to evaluate cumulative impacts. Cumulative impacts for the identified projects were not assessed in the ESIA study as explained in section 1.4.3.

The other topics that are considered during the scoping are also discussed in relevant chapters of the ESIA.

4.3 Applicable EBRD PRs and IFC PSs

Based on the results of the scoping study, those EBRD PRs and IFC PSs that are envisaged to be triggered by the Project are presented in Table 4-1:

Table 4-1: Applicable EBRD PRs and IFC PSs

EBRD PR	IFC PS	Applicability	Notes
PR 1: Environmental and Social Appraisal and Management	PS 1: Social and Environmental Assessment and Management Systems	Yes	In order to meet the requirements of the international lenders, there is a need to identify and evaluate the potential environmental and social impacts of the Project and to identify relevant mitigation measures, which is the scope of this ESIA study. The ESIA study included engagement with stakeholders which is also required by IFC PS1.
PR 2: Labour and Working Conditions	PS 2: Labour and Working Conditions	Yes	The Project is required to establish and maintain a sound worker-management relationship through compliance with national labor, occupational health and safety legislation and following of international guidelines on these issues.

EBRD PR	IFC PS	Applicability	Notes
PR 3: Pollution Prevention and Abatement	PS 3: Pollution Prevention and Abatement	Yes	The Project is required to identify and implement necessary pollution prevention and abatement measures for the protection of the environment and the people.
PR 4: Community Health, Safety and Security	PS 4: Community Health, Safety and Security	Yes	The Project is required to identify risks and potential impacts to the health and safety of the communities by the project activities, and to establish preventative measures to address them in a manner commensurate with the identified risks and impacts.
PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement	PS 5: Land Acquisition and Involuntary Resettlement	No	No expropriation, resettlement and/or economic displacement have occurred related to the Project. Some part of the Project area will be obtained by the Ministry of Health (MoH) from the adjacent land owned by the Treasury and presently being used by the 6 th Regional Directorate of State Hydraulic Works (DSI) for commercial purposes. The necessary correspondence and agreement have been made between the Treasury, MoH and 6 th Regional Directorate of DSI for allocation of the required land for the Project. The Project site (including the abovementioned land currently being used by DSI) is included as a "Health Area" in the latest zoning plan which has been approved by the Adana Metropolitan Municipality (AMM) Board on 13.11.2013 and disclosed for a period of one month that started on 26.11.2013. Based on the AMM Board decision dated 12.02.2014, three objections were made to the plan which were not accepted by the AMM Board. As reported by an officer in the Zoning Planning Department of AMM, the plan has been approved.
PR 6: Biodiversity Conservation and Sustainable Natural Resource Management	PS 6: Biodiversity Conservation and Sustainable Natural Resource Management	No	An ecological walkover survey and literature studies have been conducted by flora and fauna experts. The dominant vegetation in the area is found not to carry natural characteristics but is of an artificial structure that has been created at the site. All of the tree species identified at the site are plantation trees and the rest of the species are cosmopolitan and widespread flora species. Flora species were evaluated according to international guidelines and no rare or endemic flora species were identified. Fauna species were also evaluated according to international standards. None of the fauna species identified at the site were found to be endemic or threatened species. PR6/PS6 are not considered to be directly triggered by the Project as the Project site does not have an ecological high value. Nevertheless, the ESIA report includes a chapter on ecology to describe the baseline conditions and actions needed related to felling of trees.
PR 7: Indigenous Peoples	PS 7: Indigenous Peoples	No	PR7/PS7 are not applicable as no indigenous peoples were found to inhabit the Project area and/or the surroundings.
PR 8: Cultural Heritage	PS 8: Cultural Heritage	No	An archaeological walkover survey was conducted at the Project site and supported by desk research by the archaeology team. No archaeological remains were found on the surface during the walkover survey, and encountering artifacts is reported to be highly unlikely. The nearest known

EBRD PR	IFC PS	Applicability	Notes
			archaeologically important area is the Misis Ancient City which is located approximately 25 km to the Project area. Nevertheless, a Chance Finds Procedure will be implemented by the Project during construction.
PR 9: Financial Intermediaries	-	No	This PR is not applicable as there is no EBRD or IFC financial intermediaries involved during financing.
PR 10: Informing Disclosure and Stakeholder Engagement	-	Yes	The Project should identify and engage with the relevant stakeholders, and disclose appropriate project information throughout the lifetime of the Project. Stakeholders were identified and engagement has started within the scope of ESIA studies.

4.4 Stakeholder Engagement Activities during ESIA Study

Stakeholder engagement activities for the Project have started during the scoping stage and continued during the preparation of the ESIA report. The stakeholder engagement activities considered the social area of the influence of the Project as described below:

- Surrounding communities and facilities as follows (described in more detail in *Chapter 5: Land Use and Zoning*):
 - Shanty houses located adjacent to the south boundary of the Project area
 - Residential buildings of Housing Development Administration of Turkey (TOKI), a small shopping center, a mosque and an elementary school located 500 m to the east of the Project area
 - A small sports facility (Ozden Amateur Sports Club) adjacent to the north boundary of the Project area
 - Chamber of Commerce Anatolian High School (currently providing education) and two other schools (not started education yet) located at the north of the Project area
 - Adana Riding Center located at the west of the Project area
- Surrounding neighborhoods around the Project area:
Kisla, Koprulu, PTT, Karacaoglan, Kazim Karabekir, Serinevler, Beyazevler and Ziyapasa neighborhoods
- Neighborhoods at a wider distance (approximately within 10 km diameter considering the potential for traffic impacts to be felt up to this distance):
62 neighborhoods in total located in 4 districts (Yuregir, Saricam, Seyhan and Cukurova districts)
- All districts of Adana as the Project will serve the whole province

A stand-alone Stakeholder Engagement Plan (SEP) has been developed for the Project, to help structure a systematic communication with the stakeholders during the ESIA study. Relevant stakeholders were identified including governmental authorities and non-governmental organizations (NGOs) at national, regional and district level, and local communities. The list of identified stakeholders is presented in Annex D-1. All these stakeholders were contacted during the ESIA study.

The main communication methods and mechanisms that were used to consult with key stakeholders included:

- Information about the Project and potential impacts to be provided to stakeholders via project document and leaflets during the scoping stage
- Face-to-face meetings with selected governmental authorities
- Face-to-face meetings with selected headmen and facilities around the Project area
- Public consultation meeting
- Local newspapers (for announcements related to public consultation meeting)
- Project website (for providing information about the Project)

The summary of consultation activities are provided below:

- Face-to-face meetings were held with the following governmental authorities:
 - Ministry of Health, Department of Public Private Partnership
 - The Metropolitan Municipality of Adana
 - The Metropolitan Municipality of Adana, Department of Adana Transport Coordination
 - Adana Provincial Directorate of Health
 - 6th Regional Directorate of State Hydraulic Works
- Face-to-face meetings were held with the following headmen and residents supported by questionnaires to collect information on social data including vulnerable people:
 - Headmen of Kislá, Koprulu, PTT, Karacaoglan, Kazim Karabekir, Serinevler, Beyazevler and Ziyapasa neighborhoods
 - TOKI Houses Management team accompanied by three residents (total of 6 people)
 - Residents of shanty houses (10 people)
- Face-to-face meetings were held with the following facilities:
 - Principal of Chamber of Commerce Anatolian High School
 - Manager of Adana Riding Center
 - Board member of Ozden Amateur Sports Club
- Relevant selected NGOs were approached to conduct face-to-face meetings.
- Identified governmental authorities (62 agencies) and NGOs (50 agencies) were sent a Project Information Document together with a cover letter and asked to comment on the Project, its potential impacts and to provide information that may be important for the ESIA study. The letters were sent as certified mail with return receipt requested to ensure that all the letters were delivered.
- A project information pack (including 5 Project Information Documents, 25 Project Information Leaflets and 25 Comment/Grievance Forms) were sent together with a cover letter to headmen of 70 neighborhoods to provide information on the planned Project and related impacts, ongoing environmental and social impact assessment and to provide opportunity to express views and concerns about the project, and to inform how views/concerns can be submitted. The letters were sent as certified mail with return receipt requested to ensure that all the letters were delivered. Prior to sending the information, the headmen were contacted by phone to inform them about the aim of the project information pack and they were requested to distribute the leaflets in their neighborhoods.

- A Public Consultation Meeting was held on 8th November 2013 in Yuregir District. 50 people participated the meeting. The meeting was announced via advertisements in one national and two local newspapers thirteen days in advance on 26th October 2013, and the advertisement was repeated at the same newspapers on 1st November 2013. The meeting was opened by the Provincial Health Director followed by a presentation by a representative of the ESIA team. A representative from ADN PPP A.Ş. was also available during the meeting.
- A Project specific email address (pppadanahastanesi@elcgroup.com.tr) to be used during the ESIA study was created to collect opinions via email.
- A Project specific website (<http://pppadanahastanesi.com/>) was established where the Project Information Document, Project Information Leaflet and Comment/Complaint Form are made available to the public.

Examples of cover letters sent to governmental authorities, NGOs and headmen; the Project Information Document and the Project Information Leaflet; newspaper announcement and photos from the public consultation meeting are presented in Annex D-2.

The discussions made/information obtained during the face-to-face meetings, official response letters that were received from several governmental authorities and one NGO in response to request for comment via sending out the cover letter and project information document, and comments/questions raised by the public during the public consultation meeting are compiled in a stakeholder register and presented in Annex D-3. Information obtained during the face-to-face meetings with the headmen, residents and facilities are included in *Chapter 13: Socio-economy*.

The key issues that were raised during the face-to-face meetings with governmental authorities, headmen and facilities and key issues that were mentioned in the official response letters and during the public consultation meeting are presented below.

Face-to-face meetings with governmental authorities

- Need for clarification of the issue whether a Turkish EIA will be needed for the Project
- Alternative sites considered for the Project location
- Planned light rail system which will have a close stop near the Project
- Need for health campuses so that every party (the MoH and Special Purpose Vehicle) can focus on what they know best which will result in higher quality services

Face-to-face meetings with headmen

- Dust and noise emissions during construction
- Increase in traffic load during construction and operation phases
- Request for further information on FRH
- Necessity of accommodation facilities for patients' relatives
- Positive impacts including job opportunities, easy access to health services and increase in land prices and rents

Face-to-face meetings with facilities

- Dust and noise emissions during construction
- Increase in traffic load during construction and operation phases

Response letters from governmental authorities

- Documentation of the completion of the project bidding process so that the Project is scoped out from the Turkish EIA Regulation
- Waste management and disposal practices
- Waste transportation inside the health campus
- Compliance with Occupational, Health and Safety (OHS) Law and relevant OHS regulations
- Suggestions to have specific units (such as unit related to drug addiction) inside the health campus and specific treatment methods (such as use of sedation methods to small children during dental treatment)
- Inclusion of an oral and dental health center, buildings and services such as accommodation, places of worship, medical supply centers in the health campus

Response letter from Non-Governmental organization

- Need to establish infrastructure for blood supply
- Good location of the Project so that immediate medical response can be provided in the event of disasters
- Employment opportunities

Public

- Access difficulties and increase in traffic load by the Project
- Financing of the project and hospital charges during operation
- Potential hospital closures

The Final Draft ESIA report will be made available in Turkish to the public and disclosed for review and comments, together with the NTS of the Final Draft ESIA, SEP and ESAP that are prepared as separate documents. Comments received during the consultation process will be considered by the Project and the ESIA team, in consultation with the lenders. Appropriate comments will be taken into account to address the issues raised and the ESIA will be finalized accordingly. After completion of the ESIA process, ADN PPP A.Ş. will continue to engage with the stakeholders during construction and operation of the Project and outline plans for this are set out in the SEP.

5.0 LAND USE AND ZONING

5.1 Scope

This chapter describes the land use and discusses the available regional/local zoning plans covering the Project area. No expropriation, resettlement or economic displacement have occurred related with this Project. However, the likelihood of impacts is assessed in this chapter.

The impacts on land use within the Project area are further addressed. The following approach is followed in the assessment:

- Identification of existing land uses within the Project area and its surrounding through site visits, aerial photographs
- Review of existing local zoning and regional plans covering the Project area
- Establishing whether there are impacts with regard to land use and zoning

The following information sources have been used during the assessment:

- 1/100,000 scaled Mersin-Adana Environmental Plan (Approval Date/Number: 16.09.2013/14398)
- 1/5,000 scaled Saricam-Yuregir Zoning Plan approved by the AMM Board on 14.06.2013
- Decision of the AMM Board on amendment of 1/5,000 scaled Zoning Plan (Approval Date/Number: 13.11.2013/277)
- Decision of the AMM Board related to the objections made to the 1/5,000 scaled Zoning Plan (Approval Date: 12.2.2014)
- AMM 1/10,000 scaled City Plan

5.2 Land Use Pattern

5.2.1 Land Use inside the Project Area

The Project area is located at the south of Turkey within the boundaries of Yuregir District of Adana Province. The Project area will cover an area of 328,820 m². The Project area belongs to the Treasury and has been allocated to the MoH (details related to zoning are described in Section 5.2.3). ADN PPP A.Ş. will sign a contract with the MoH for the use of the site. Land use inside the Project area is shown in Figure 5-1.

Some part of the Project area was previously used for fish farming (there were five fish pools which are not in use today). In addition to the fish ponds, there was an artificial pond inside the Project area which was created by extracting water from Seyhan Dam through a channel and also was discharging water back into the channel. As reported, the DSI was responsible from this artificial pond and the water of the pond was recently drained by the DSI.

The majority of the Project area is currently vacant with some buildings/areas on the east part of the area (where FRH will be built) which are currently being used by 6th Regional Directorate of DSI for commercial purposes (such as warehouses, vehicle maintenance area). These buildings and structures used by DSI are described below:

- Two security gates and buildings
- Closed sports facility used by DSI sports club
- Old warehouse with open sides (full of unused items, scrap, etc.)
- Open areas where canalettes are stored
- 5 closed old buildings used for storage of recyclable scrap
- An unused football pitch
- Elevated water storage tank
- 2 above ground vertical fuel tanks
- 2 above ground horizontal cylindrical tanks (usage not known)
- Storage area for fuel drums, oil drums and waste oil

As reported, the responsibility for demolishing of the above buildings will be with the DSI and the site will be handed over to ADN PPP A.Ş. as a completely empty area.

There is a road with approximately 400 m length located inside the Project area which is connecting to E-90 Highway. As reported, the removal of this road will be conducted by the AMM as part of the planned clover-leaf road junction near the Project area. However, as mentioned in *Chapter 2: Project Description*, it is not known at this stage when the construction of the clover-leaf road junction will start.

An ETL (154 kV) is currently passing through the Project area which is being operated by TEIAS. According to the official opinion letter of the 18th Transmission, Facility and Operation Group Directorate of TEIAS dated 13.09.2013 issued to the Adana Provincial Health Directorate, the transmission line can be relocated outside the Project area upon an application to be made by the Adana Provincial Health Directorate. Accordingly, Adana Provincial Health Directorate has prepared and submitted the ETL relocation project for approval to TEIAS. As mentioned in *Chapter 2: Project Description*, it is not clear at this stage when the ETL relocation will take place.



Figure 5-1: Land use inside the Project area (yellow line shows the Project area boundaries)

Some illustrative pictures of the Project area are presented below.

Photo 1. View from the Project area



Photo 2. Former artificial pond area



Photo 3. Closed warehouse of DSI



Photo 4. DSI sports facility



Photo 5. Elevated water tank inside DSI area



Photo 6. Energy transmission line



5.2.2 Surrounding Land Use

The surrounding land use is defined by site visits, use of aerial photographs and Adana Metropolitan Municipality 1/10,000 scaled City Plan and local zoning plans. An overview of the land use in the immediate surroundings of the Project area is presented Figure 5-2.

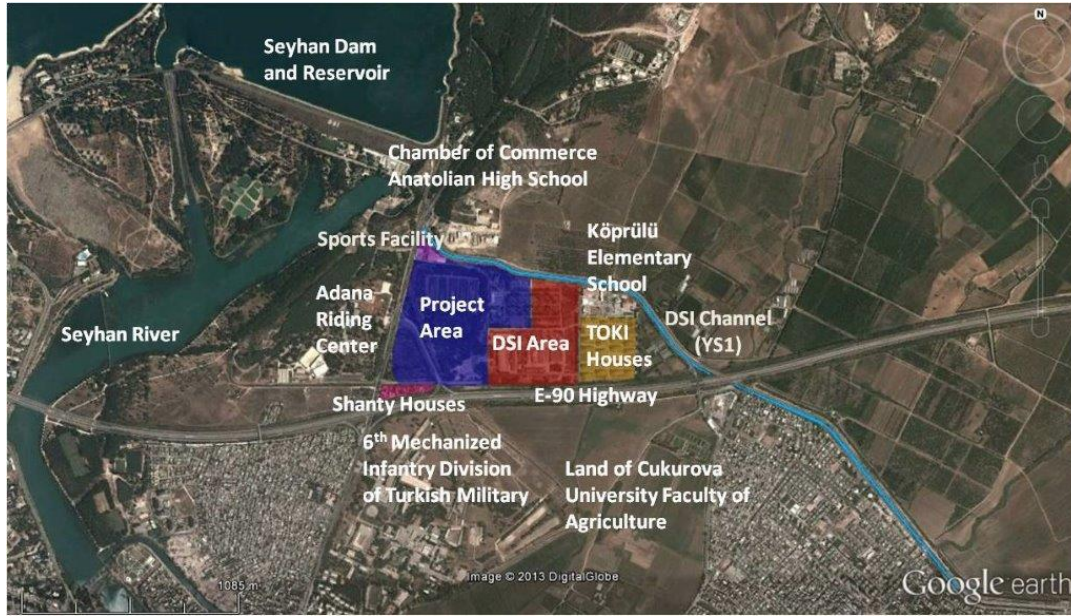


Figure 5-2: Land use in the immediate surroundings of the Project area

The closest settlements to the Project area are the shanty houses located adjacent to the south boundary of the Project area separated by a side road. According to the 1/5,000 scaled Saricam-Yuregir Zoning Plan, the area of these shanty houses are designated as urban transformation area. A face-to face meeting with the residents of shanty houses were conducted and the results of this meeting are given in *Chapter 13: Socio-economy*.

Photo 7. View from shanty houses



Photo 8. View from shanty houses



Behind the shanty houses, E-90 highway is located which is connecting Mersin and Osmaniye Provinces. At the south of the road, 6th Mechanised Infantry Division of Turkish Military is located at a distance of approximately 400 m to the Project area. To the 550-m southeast of the Project area, area belonging to the Cukurova University, Faculty of Agriculture is located.

The adjacent land at the east of the Project area is currently used by DSI. There are residential buildings (TOKİ houses), a small shopping center, a mosque and Köprülü Elementary School located next to the DSI land to the east, at an approximate distance of 500 m to the Project area.

Photo 9. TOKI Houses, elementary school and mosque



At the north of the Project area, there is a manmade DSI channel separated by a side road and then a double-lane road from the Project area (at a distance of 20 m). The channel is fed by the Seyhan River and runs out of the city in the southeast direction. The channel is flowing between double lane roads. Part of the north border of the Project area is adjacent to a small sports facility (Ozden Amateur Sports Club). The facility has a swimming pool, cafeteria and a closed football pitch.

Photo 10. DSI channel



To the north and on the other side of the road, there are ongoing two school constructions (main construction completed). These schools will be Adana Saricam Kabasakal Anatolian High School and Cukurova University Vocational School of Higher Education (as reported by the construction workers). Behind these constructions, Chamber of Commerce Anatolian High School is located approximately at a distance of 250 m to the north boundary of the Project area.

Photo 11. School constructions



Seyhan Dam and reservoir is located at an approximate distance of 550 m to the north border of the Project area.

To the west, there is a road (Dr. Mithat Ozsan Boulevard) located adjacent to the Project area and Adana Riding Center is located at the other side of the road. Seyhan River is flowing at a distance of approximately 600 m to the west of the Project area.

5.2.3 Regional Plans and Zoning

There are several regional and local plans that are related with the Project area. One of them is at a regional scale which is the 1/100,000 scaled Mersin-Adana Environmental Plan approved by the Ministry of Environment and Urban Planning (Approval Date/Number: 16.09.2013, 14398). A section from this plan is extracted to show the land classification at and around the Project area as shown in Figure 5-3. As can be seen in Figure 5-3, the Project area and surroundings are classified as “urban settled area”.

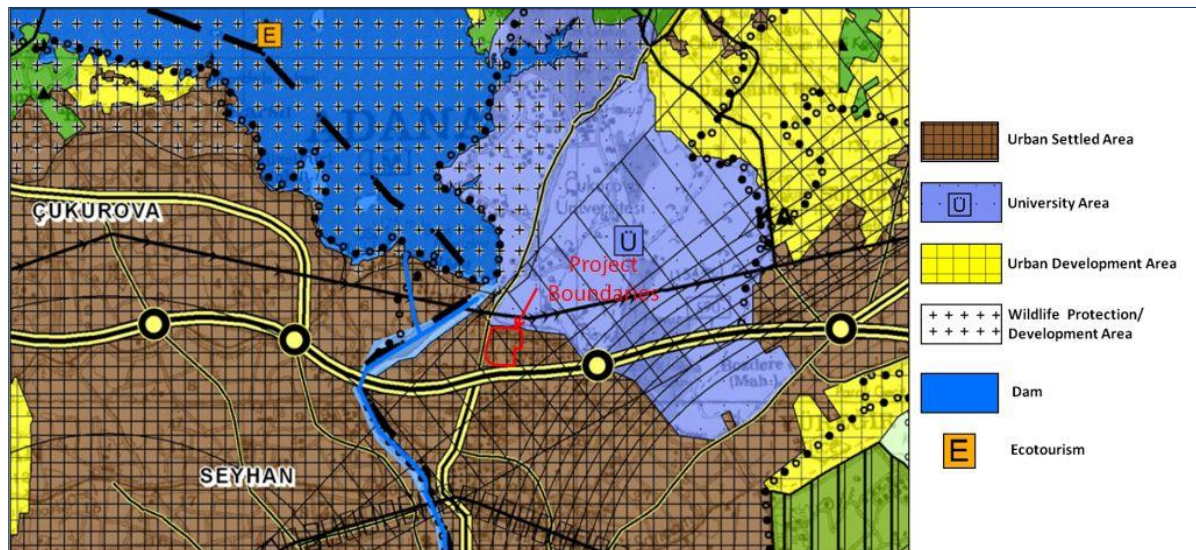


Figure 5-3: Section of 1/100,000 scaled Adana-Mersin Environmental Plan (Project area schematically shown)

With regard to local zoning plans, the Project area is included in the 1/5,000 scaled Saricam-Yuregir Zoning Plan approved by the AMM Board on 14.06.2013. As it is shown in Figure 5-4, the Project area is classified in two different zones as “Health Facility Area” and “Public enterprises area” (area currently being used by DSI). As planning proceeded for the Project, the boundaries of the Project area became clear and it is decided that some part of the area that is adjacent to the already designated Health Facility Area that is owned by the Treasury and presently being used by the 6th Regional Directorate of DSI is allocated for the use of the Project. The necessary correspondence and agreement have been made between the Treasury, MoH and 6th Regional Directorate of DSI for the allocation of the required land for the Project. Accordingly, revision has been made in the 1/5,000 scaled zoning plan to include all the necessary area for the Project which was approved by the AMM Board with an official decision letter dated 13.11.2013. The approved master zoning plan was disclosed for a period of one month that started on 26.11.2013. Based on the AMM Board decision dated 12.02.2014, three objections were made to the zoning plan during the disclosure period which were not accepted by the AMM Board. As reported by an officer in the Zoning Planning Department of AMM, the zoning plan has been approved.

As explained in *Chapter 2: Project Description*, there are planned projects near the Project area which include the removal of shanty houses, construction of clover-leaf road junction and metro expansion. All of these projects have already been included in the 1/5,000 scaled Saricam-Yuregir Zoning Plan. The area where shanty houses are located is indicated as an Urban Transformation Area in the zoning plan as shown in Figure 5-4 (small area with pink color at the south of the Project area). The Project boundaries and the clover-leaf road junction as allocated in the zoning plan is shown in Figure 5-5. The location of the metro line that is passing from the east of the Project area is shown in Figure 5-6.

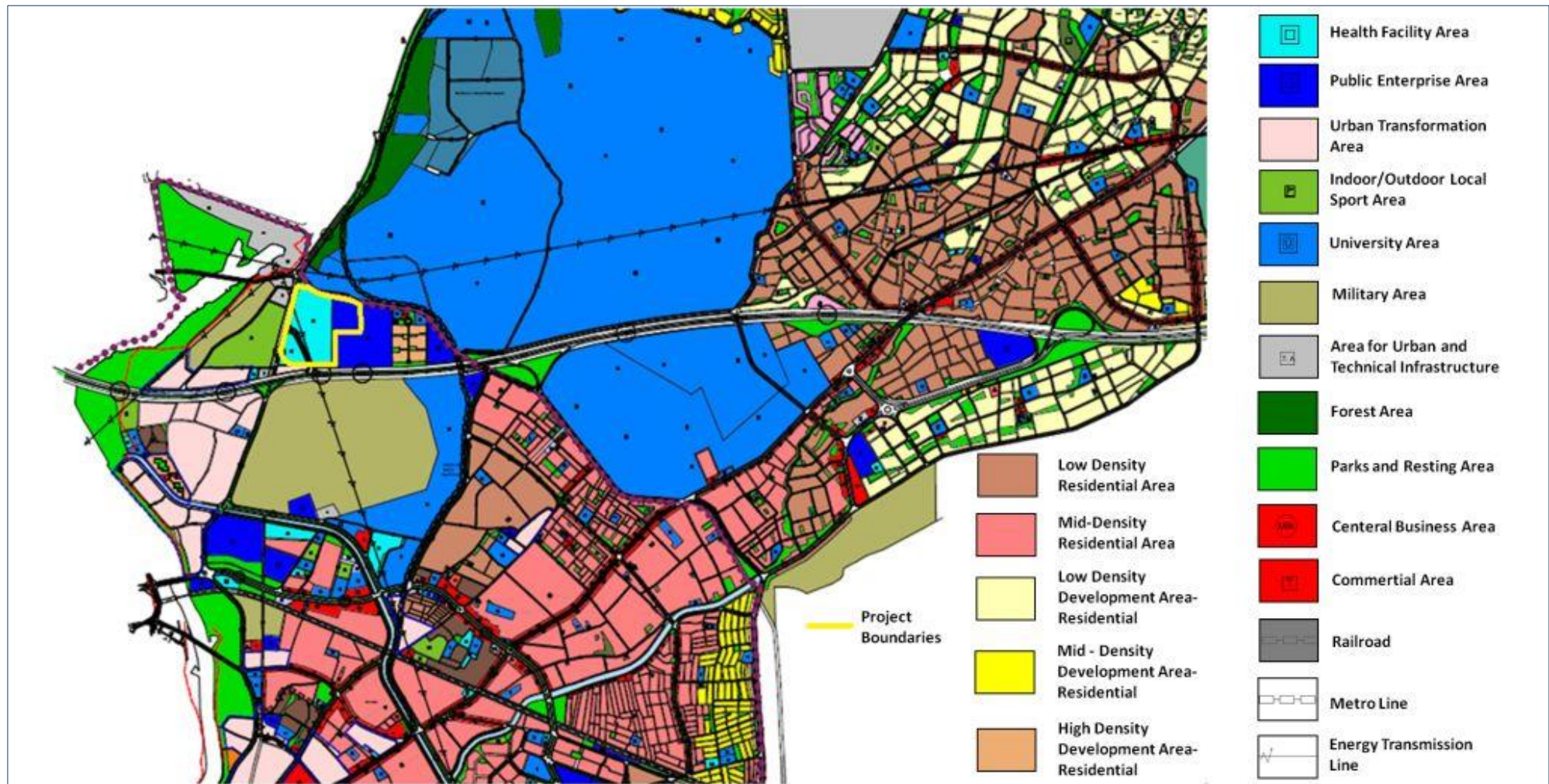


Figure 5-4: Section of 1/5,000 scaled Saricam-Yuregir Zoning Plan (Project boundaries schematically shown)

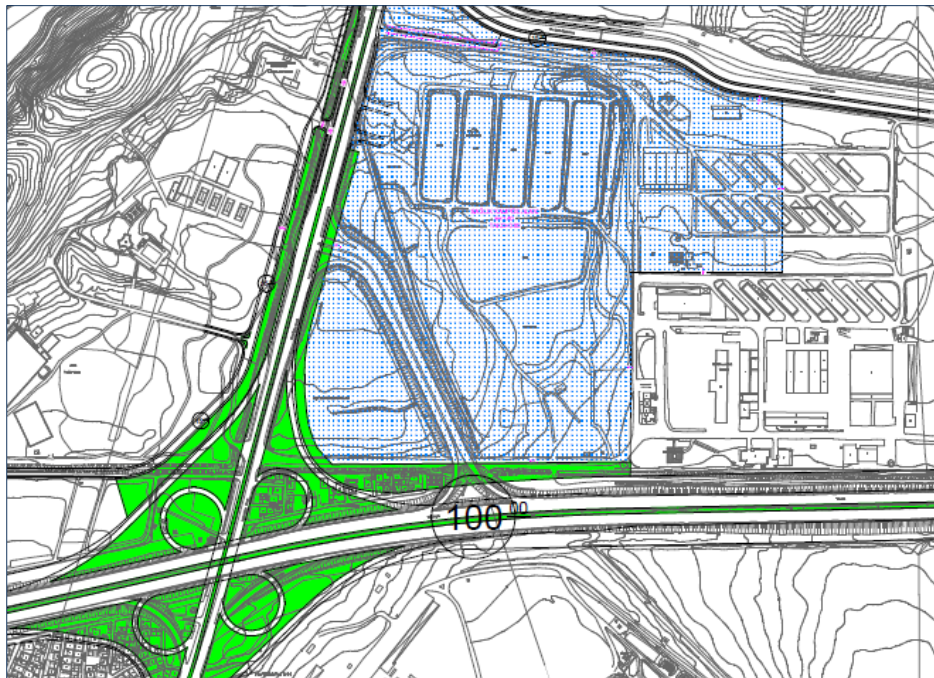


Figure 5-5: Revised version of the zoning plan including the Project area and the planned clover-leaf road junction



Figure 5-6: Planned metro line on 1/5,000 scaled Saricam-Yuregir Zoning Plan (Project boundaries schematically shown)

5.2.4 Assessment

The Project comprises development of an Integrated Health Campus within an area that is owned by the Treasury. No land take, expropriation, resettlement and/or economic displacement have occurred related to the Project. As reported, the construction activities will be undertaken within the defined Project area and no additional land will be used.

As explained in above sections, some part of the Project area will be obtained from the adjacent land owned by the Treasury and presently being used by the 6th Regional Directorate of DSI for commercial purposes, and this part of the area has already been included in the 1/5,000 scaled Saricam-Yuregir Zoning Plan as a “Health Facility Area” and approved by AMM. Moreover, it is important to mention that DSI will be able to continue its operations as there is adequate land area within the remaining DSI area.

As explained in *Chapter 2: Project Description*, the planned clover-leaf road junction and removal of shanty houses near the Project area are under the jurisdiction of public authorities and have been planned based on prior decisions of AMM related to improvement of transportation infrastructure and urban planning as part of the general city planning and therefore are not related with the Project. For this reason, any land take for these projects including the expropriation of the shanty houses are outside the scope of the Project.

6.0 GEOLOGY, SOILS AND CONTAMINATED LAND

6.1 Scope

This chapter presents an evaluation of the predicted impacts of the Project related to geology and soils. The following issues are addressed:

- Seismic activity risks
- Contaminated land risks
- Soil impact risk

A description of the significance criteria to complete the impact assessment is provided followed by a description of the baseline situation. The potential impacts for the issues noted above are discussed and the proposed mitigation measures are presented together with the residual impacts.

The results from the following desktop study and site-specific investigations were used to establish the baseline information:

- The General Directorate of Mineral Research and Exploration (MTA) publications
- Literature survey
- Adana Environmental Status Report (2011)
- The results of a geotechnical site investigation conducted in September 2013. The investigation included the drilling of ten boreholes within the Project site, sample collection and laboratory analysis to assess subsurface soil profile and the soil parameters necessary for geotechnical design. The borehole depths varied between 10.5 m to 15 m below ground level (bgl). The study provided soil profiles across the site as well as the bearing capacity for foundation design and seismic design requirements for the buildings to be constructed at the site.
- The results of a soil quality investigation conducted by ELC at the Project site in November 2013. The study was conducted within the Project site boundaries to assess potential soil contamination from former site activities. The investigation included the drilling of two boreholes to 20 m bgl, installation of groundwater monitoring wells and surface and shallow soil sample collection and analysis. Groundwater was not encountered to a depth of 20 m bgl.

Necessary criteria (e.g. appropriate standards, regulations, etc.) will be taken into account in the design of the facilities to address the seismic risks. This will be conducted considering the defined parameters that need to be used in the design of structures located in 2nd degree earthquake zone where the Project site is located. The geotechnical site investigation identified the geotechnical parameters for seismic and foundation design. The following significance criteria are suggested related to the contamination of soils and presence of contaminated land.

Impact Significance	Description
Negligible	- Temporary use of land (with soil surface) for the storage of excavated materials and construction equipment
Minor	- Temporary small-scale oil spills during construction activities on soils that lead to contamination below generic contamination levels stated in the Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites (Soil Pollution Control Regulations)

Impact Significance	Description
	- In case of disturbance of existing contaminated soils: increase contamination in nearby non-contaminated soils to above the background level but below the generic contamination levels stated in the Soil Pollution Control Regulations
Moderate	- Continuous/long-term oil spills during construction activities on soils and during operation (e.g. accidents) (concentrations of pollutants in the soil defined in the Soil Pollution Control Regulations are exceeded above the generic contamination levels but below the long term cancer and hazard risk) - In case of disturbance of existing contaminated soils: increase contamination in nearby non-contaminated soils to above the background level that are above the generic risk levels stated in the Soil Pollution Control Regulations but below long term cancer and hazard
Major	- Continuous/long-term oil spills during construction activities on soils and during operation (e.g. accidents) (concentrations of pollutants in the soil defined in the Soil Pollution Control Regulations are exceeded to cause long term cancer and hazard risk) - In case of disturbance of contaminated soils, increase contamination in nearby non-contaminated soils to above the background level that will be hazard to human health

6.2 Existing Environment

6.2.1 Geology

Regional Geology

The study area is located in the northern part of the Adana Basin which is one of the major Neogene basins in the Tauridogenic belt (Figure 6-1). The area between the Adana and Misis-Andirin Basins (Mid-Tertiary tectonic-sedimentary processes affecting the northerly, active margin of the South Tethys (Neotethys) in the easternmost Mediterranean region) represent parts of an originally continuous active continental margin and is geographically known as the Cukurova Basin.

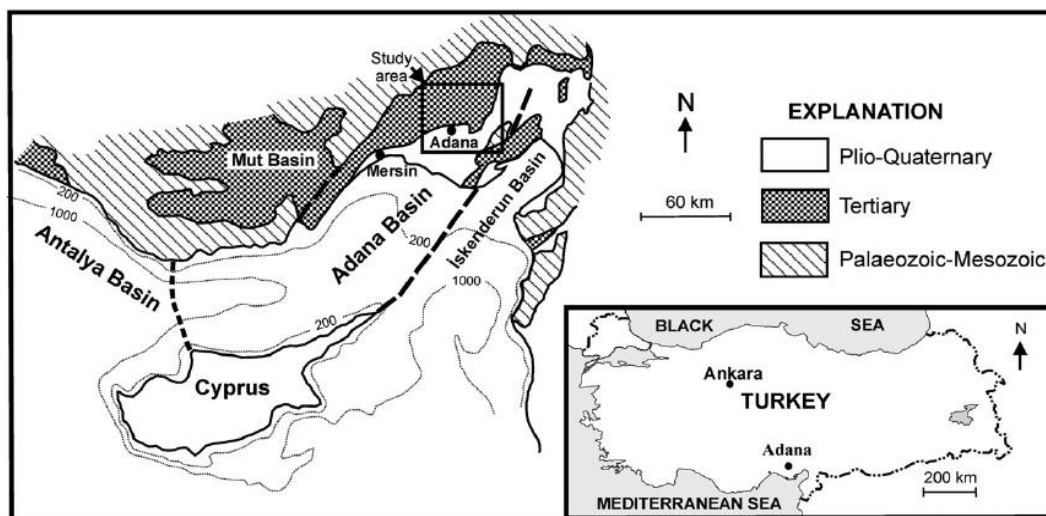


Figure 6-1: Location map of the study area in the Adana basin (Kaplan *et al.* 2012)

The area extends more than 100 km east–west and approximately 70 km north–south. Most of this basin is filled with Quaternary recent (Holocene) deposits (Figure 6-2). According to Kozlu (1987),

the geological units of the Cukurova Basin belong to the Upper Cretaceous, Oligo-Miocene, Miocene, Pliocene and Quaternary periods (Figure 6-3). The rock units of the Upper Cretaceous are found in the south-east of the basin and show a volcano-sedimentary stratigraphy consisting of tuffs, sandstones, marls, agglomerates and huge blocks of lime stones. The Oligo-Miocene series trend northeast–southwest almost parallel to the Mediterranean Sea coast (Figure 6-2) and are characterized by olistostromes. Conglomerates and sandstones from the Miocene outcrop in the southern and northern parts of the basin and are known as the Guvenc Formation (Yetis, 1988). The rock units are generally moderately bedded and rarely cross-bedded. The Handere Formation (Messinian–Pliocene) comprises mainly of mudstone and also conglomerate and sandstone of shallow marine, lagoon and fluvial environments (Gurbuz, 1999; Yetis, 1988; Yetis *et al.*, 1995). The Handere Formation covers large areas in the northern part of the Adana metropolitan area. This is mainly composed of sandstone, siltstone, marl and mudstone and has a thickness of about 700 m (Yetis, 1988). A thick sedimentary sequence ranging in age from Tertiary (Oligocene) to Recent unconformably overlies Palaeozoic and Mesozoic basement rocks in the basin (Figure 6-2 and Figure 6-3; Gurbuz, 1999; Yalcin and Gorur, 1983; Yetis, 1988; Yetis *et al.*, 1995). The Kuzgun (Tortonian) and Handere (Messinian–Pliocene) formations and the Quaternary units widely outcrop in the region. The Kuzgun Formation (Tortonian) consists of shallow marine to non-marine sandstone and mudstone. The Quaternary units in the basin are represented by alluvial terraces, hardpan calcretes and recent alluvium.

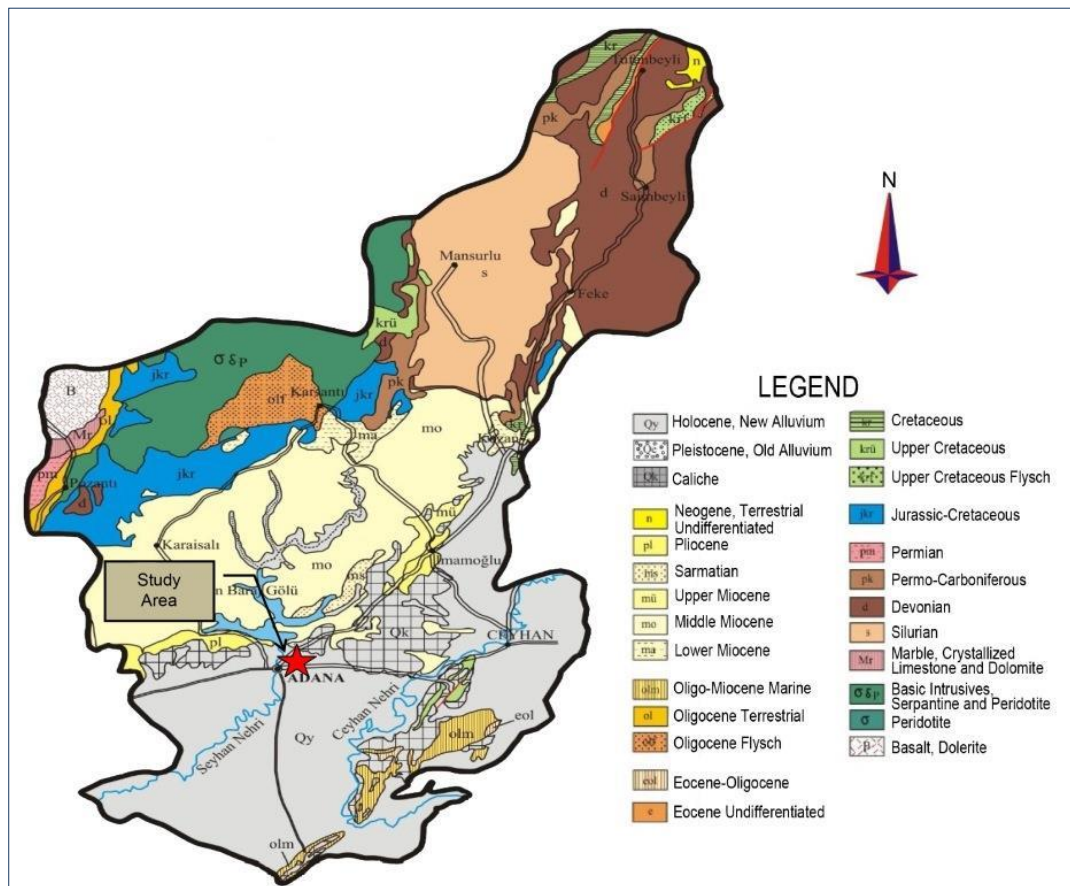


Figure 6-2: General geology map of the study area and its vicinity (Kaplan *et al.* 2012).

The geologic stratigraphy is given in Figure 6-3.

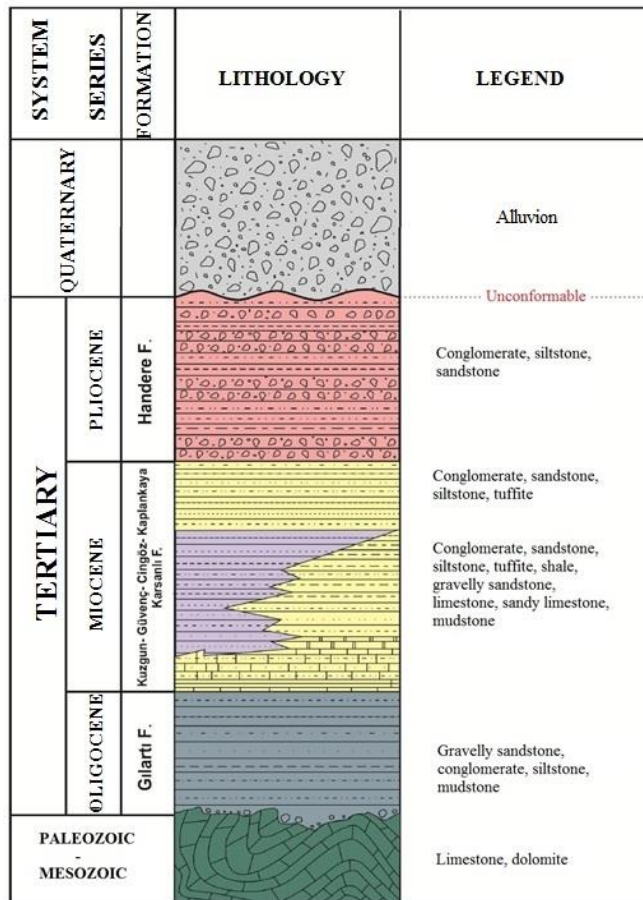


Figure 6-3: Generalized stratigraphic column section of the study area and its vicinity

The Cukurova Basin is a broad, flat, fault-bounded plain traversed by two main rivers, the Ceyhan River in the east and Seyhan River in the west (Figure 6-2). When the Ceyhan River enters the east margin of the basin, the gradient decreases from a rather steep descent in the mountains to the almost flat surface of the basin floor. This sudden change of gradient causes rapid deposition of sediment. The deposition and redistribution of the Quaternary sediments carried into the basin by these rivers has led to the accumulation of thick unconsolidated alluvial plain deposits composed of intercalated gravel, sand, silt and clay layers. The recent alluvium is restricted to the beds of the Ceyhan and Seyhan Rivers. Because of the rapid and dynamic sedimentation processes, the deposits vary from well to poorly graded and are generally loosely compacted. Boreholes drilled by DSI and private companies indicate that the thickness of unconsolidated materials underlying the plain ranges from 100 to 300 m. The alluvial sequence thickens towards the northern part of the basin, reaching up to 320 m at Mercimekkoy and then gradually becoming thinner. The thickness is about 170 m beneath the town of Ceyhan. The depth of the clayey surface varies between 1 and 6 m. In Adana, for example, it is reported to be approximately 1 to 3 m below the clay, the alluvium is generally loose and gravelly or dense and hard with pockets of sand/clayey sand. Along a north-south direction, the alluvial deposits mainly consist of clayey and silty material, although sandy and gravelly layers are found at shallow depths. Towards the east, between Ceyhan and Osmaniye (Figure 6-2), the unconsolidated materials are coarser grained compared to those on the Ceyhan plain. Figure 6-4 shows the geology in the vicinity of the planned development. The Project area geology is noted to be on alluvial material as shown in Figure 6-4.

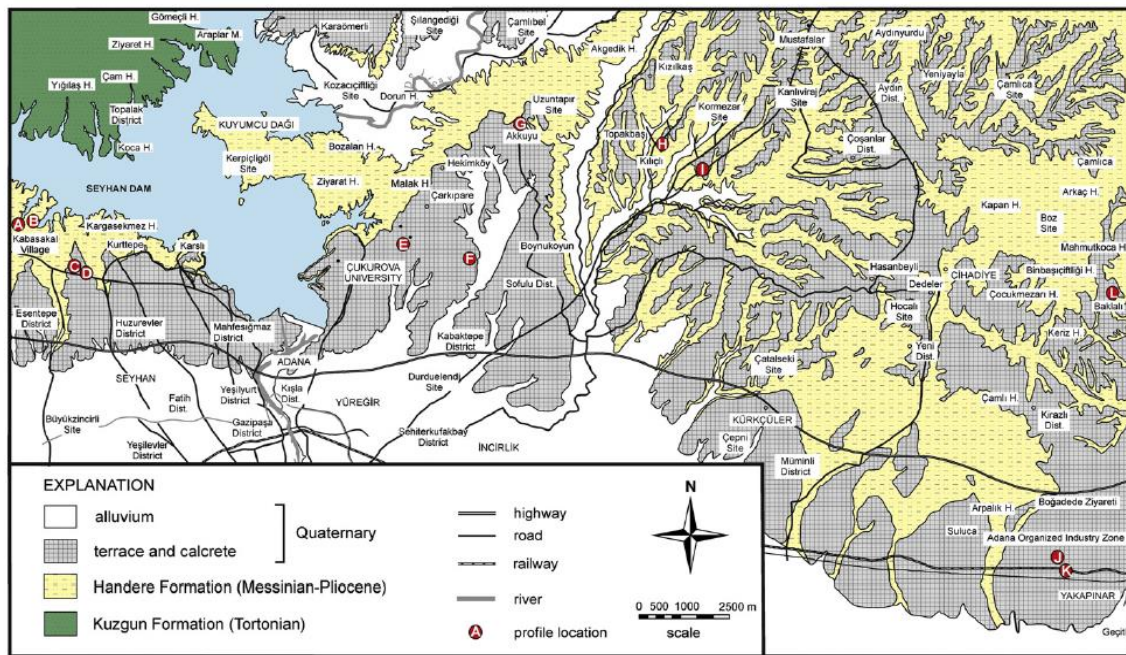


Figure 6-4: Surface geological map near the planned development (Kaplan *et al.* (2012))

Site Geology

A geotechnical investigation was undertaken at the Project site to assess the shallow geology and obtain geotechnical information. Ten shallow boreholes were drilled at the locations shown in Figure 6-5. The depths of the boreholes varied between 10.5 m to 15 m bgl. The lithology obtained from borehole logs are shown in Table 6-1.



Figure 6-5: Borehole locations

The boreholes showed that a fill material is present at the site varying between 0.3 m to 0.7 m thickness. Below the fill material, alluvial units that are composed of gravel-clay layer (consisting of

reddish brown, silty with little sand and gravel and dark brown colored in some places) were noted to extend to depths to 6-9 m bgl. A gravel unit (brown colored, little clayey and sandy and block sandy) was observed in all of the boreholes below the gravelly clay layer.

Table 6-1: Shallow site lithology

Drilling No.	Borehole Depth (m)	Elevation (m)	Depths (m)	Formation- Lithology
SK-1	15.00	42.68	0.00-0.50	Fill Material
			0.50-2.50	GRAVEL, brown, clayey, sandy, partly blocky,
			2.50-6.50	CLAY, reddish-brown, silty, sandy, gravelly,
			6.50-15.00	GRAVEL, brown, coarse-medium granular, partly blocky, clayey, sandy
SK-2	15.00	42.53	0.00-0.50	Fill Material
			0.50-2.50	GRAVEL brown, clayey, sandy, partly blocky
			2.50-6.50	CLAY reddish-brown, silty, sandy, gravelly
			6.50-15.00	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
SK-3	15.00	41.72	0.00-0.50	Fill Material
			0.50-2.50	GRAVEL brown, clayey, sandy, partly blocky,
			2.50-6.50	CLAY reddish-brown, silty, sandy, gravelly,
			6.50-15.00	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
SK-4	15.00	40.90	0.00-0.70	Fill Material
			0.70-6.00	CLAY reddish-brown, silty, sandy, rarely gravelly,
			6.00-15.00	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
SK-5	10.50	41.60	0.00-2.50	Fill Material
			2.50-6.50	CLAY reddish-brown, silty, sandy, partly gravelly
			6.50-10.50	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
SK-6	10.50	41.56	0.00-4.50	Fill Material, m
			4.50-6.50	CLAY reddish-brown, silty, sandy, partly gravelly,
			6.50-10.50	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
SK-7	10.50	39.39	0.00-0.30	Fill Material,
			0.30-1.50	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy,
			1.50-9.00	CLAY reddish-brown, silty, sandy, partly gravelly,
			9.00-10.50	GRAVEL brown, coarse-medium granular, blocky in places, clayey, sandy
SK-8	10.50	38.95	0.00-0.50,	Fill Material
			0.50-3.00	CLAY reddish-brown, silty, sandy, partly gravelly,
			3.00-10.50	GRAVEL brown, coarse-medium granular, blocky in places, clayey, sandy
SK-9	10.50	39.81	0.00-0.30	Fill Material
			0.30-1.50	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
			1.50-9.00	CLAY reddish-brown, silty, sandy, partly gravelly
			9.00-10.50	GRAVEL brown, coarse-medium granular, blocky in places, clayey, sandy
SK-10	15.00	40.68	0.00-0.70	Fill Material
			0.70-3.00	GRAVEL brown, coarse-medium granular, partly blocky, clayey, sandy
			3.00-7.50	CLAY brown, gravelly, silty, sandy
			7.50-15.00	GRAVEL gray, coarse-medium granular, blocky in places, clayey, sandy

Geological sections in the Project area are shown in Figure 6-6.

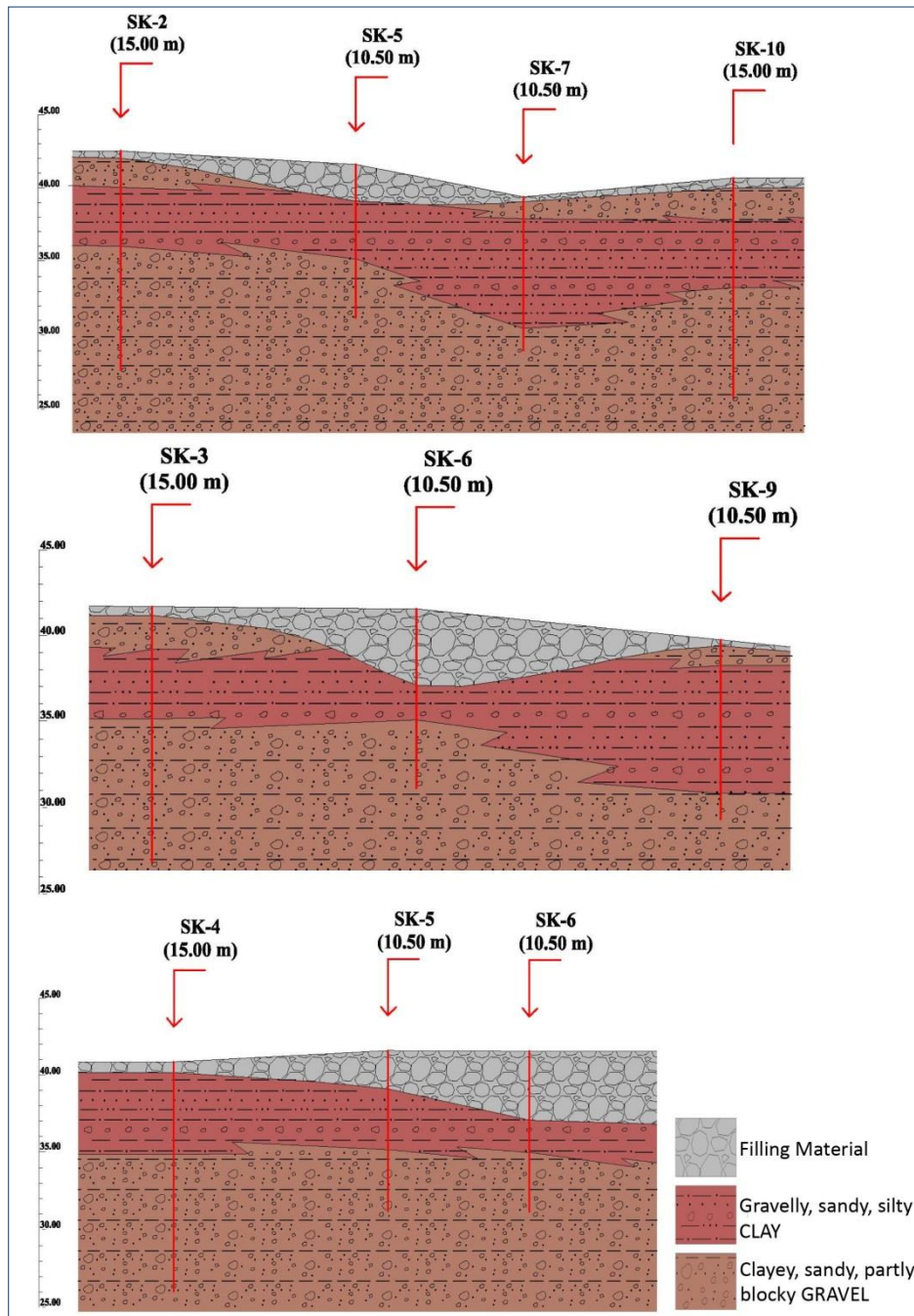


Figure 6-6: Geological sections in the Project area

The following suggestions were made based on the soil sampling collection and laboratory assessment results:

- All foundations will be placed on gravel alluvial material. Excavation up to 10-12 m will be performed so that the fill and clayey soils at the surface will be removed and structure foundations will be placed on solid base blocky gravel material. The structures are expected to have two levels below ground surface.

- The site has very tight blocky alluvial material and does not pose risk for the bearing capacity and settlement under building loads. The assessment indicates that there is no risk of liquefaction in the event of an earthquake.
- The study area is located in Adana province, Yuregir District, 20-N-III Section, 100-101 Plot, 1-1.2 Parcel and has a flat topography. The parcel does not have the transportation, drainage and slope problem. The study area previously has not been exposed to any disaster.
- The building importance factor should be evaluated as 1.5 according to the “Regulation on Buildings to be built in Seismic Zones” published in the Official Gazette dated 06.03.2007 and numbered 26454.

6.2.2 Seismic and Liquefaction Risks

The Adana-Ceyhan area is located in the Eastern Mediterranean region of Turkey and includes complex tectonic features such as a triple junction consisting of the East Anatolian fault, the Dead Sea fault, and Cyprus Arc fault systems (Figure 6-7). The region is dominated by a number of northeast-southwest trending strike-slip faults. The main tectonic structures are the Kozan fault, the Yumurtalik fault, and the Goksun Fault zone, all three lying mainly in the northeast-southwest direction (Kozlu, 1987).

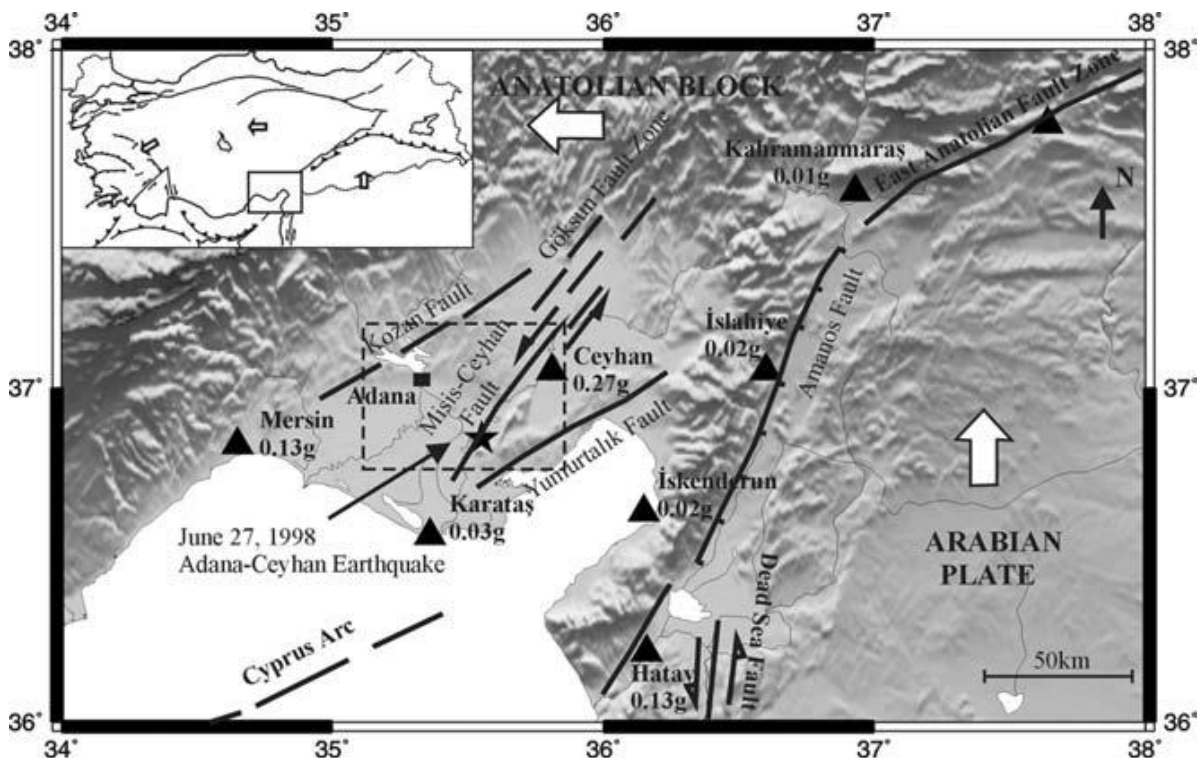


Figure 6-7: Tectonic map nearby the Project area also showing the locations of the stations which recorded the main shock (black triangles) and the values of maximum accelerations during the 1998 earthquake (Kozlu, 1987)

Provisions of “Regulation on Buildings to be built in Seismic Zones” are to be applied in all calculations for newly constructed buildings. The earthquake loads to be taken during the design of the buildings are obtained from the earthquake classification of the zone in which the structures are to be built. According to the Map of Turkey Seismic Zones (dated 18.04.1996) published by the

Ministry of Public Works and Settlement, General Directorate of Disaster Affairs, Earthquake Research Department, Adana, Yuregir is in the 2nd degree seismic zone (Figure 6-8) where 1st degree seismic zone express most tectonically active zones in Turkey. The historical earthquakes recorded in Adana are given in Table 6-2. The earthquake zone classification map of the Adana Province is presented in Figure 6-8.

Table 6-2: Historical earthquakes in Adana region

Date	Location	Magnitude	Details
BC 334	Cilicia	-	40,000 deaths
517	Anavarza	7.0	City Completely Destroyed
757	Misis-Ceyhan	7.0	No Information
803	Misis-Ceyhan	8.0	No Information
1268	Adana	-	60,000 deaths
1855	Ceyhan	6.0	Light damage
1945	Ceyhan	6.0	10 deaths
1998	Adana-Ceyhan	6.3	145 deaths

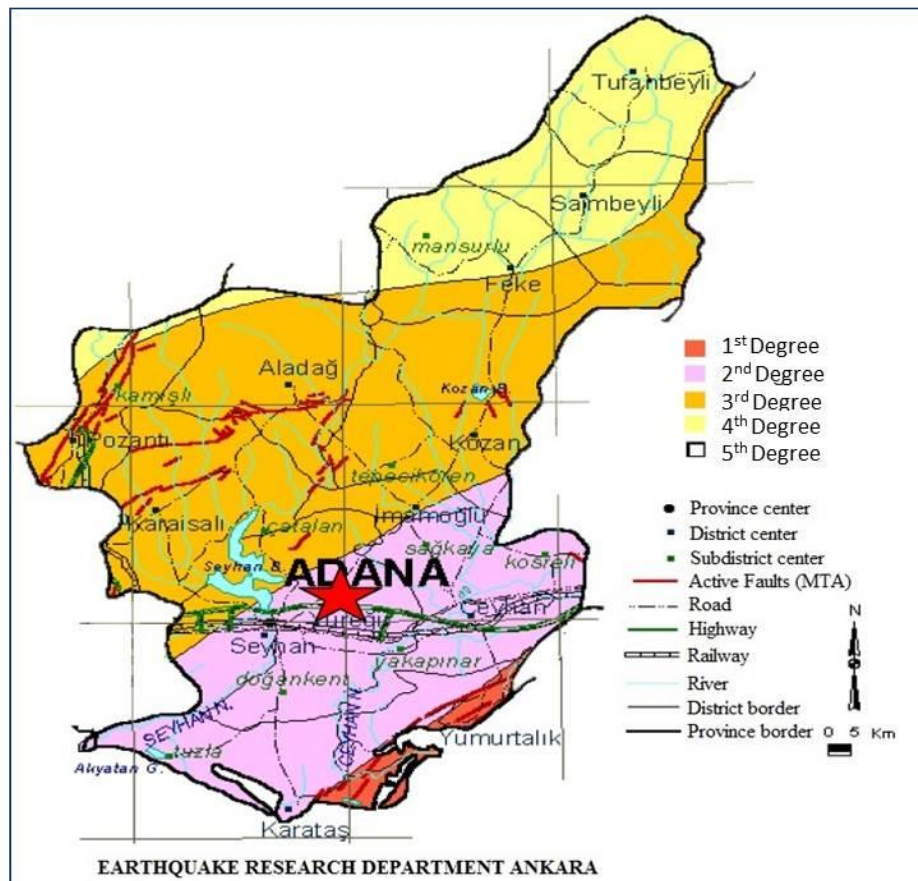


Figure 6-8: Seismic zone classification map of Adana Province

Tudes and Yigitler (2010) used a Geographical Information System (GIS) to assess the geo environmental properties for the City of Adana. Their database included geological, hydrogeological, morphological, engineering and environmental data obtained from the studies carried out in the region by governmental organizations. The earthquake hazard micro-zonation maps were digitalized for Adana province and superimposed by the use of GIS to produce the

thematic map shown in Figure 6-9. The map indicates that the site is located in the very low earthquake hazard zone.

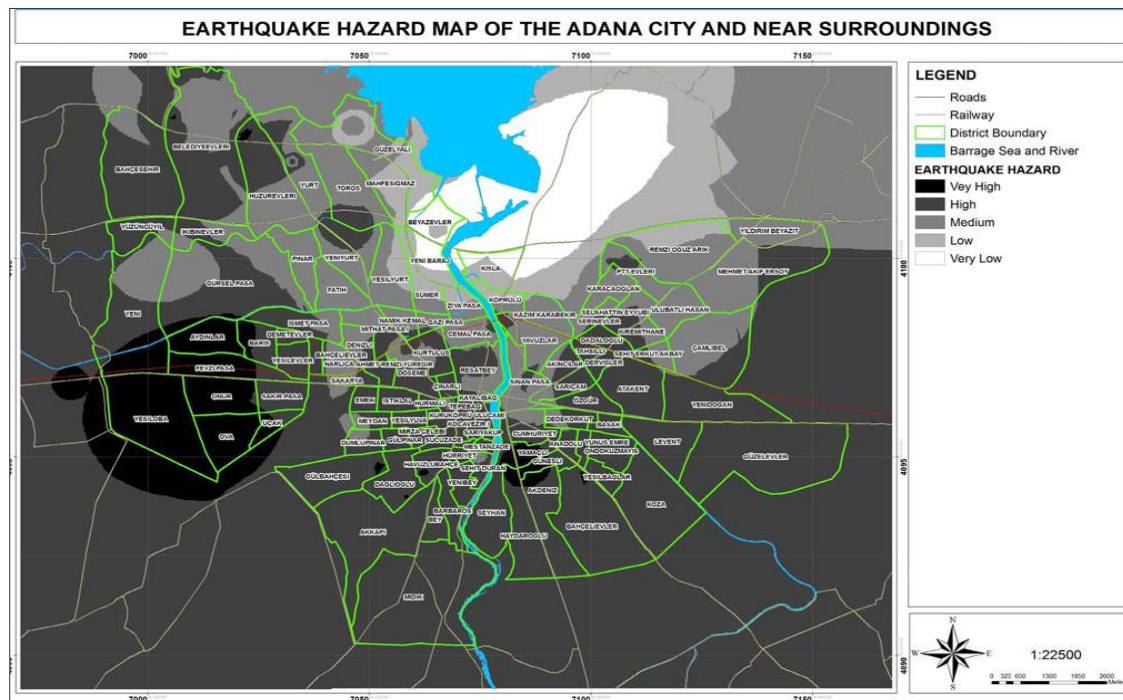


Figure 6-9: Earthquake hazard classification for Adana Province (Tudes and Yigitler (2010))

The geotechnical site investigation indicated that the earthquake design loads will be based on the following conditions (based on “Regulation on Buildings to be built in Seismic Zones”):

- Soil type: B
- Local soil class: Z_2
- Effective ground acceleration coefficient: $A_0 = 0.30$,
- Ground spectrum periods: $T_A = 0.15$, $T_B = 0.40$

6.2.3 Soil Structure of Adana Province

When Adana city center and its vicinity are assessed in accordance with the “Land Ability Classes”, six soil classes are observed to be available. As seen in Figure 6-10, the alluvial soils which are almost flat with very low slopes, to the south, east and west of the city center are made of Class I, II, and III category of lands convenient for agricultural activities. The western part of the city center which has recently experienced a significant level of urban development, comprises rarely Class II, but mostly Class VI and VII category of lands. The land category for the site is Class VI as shown in Figure 6-10.

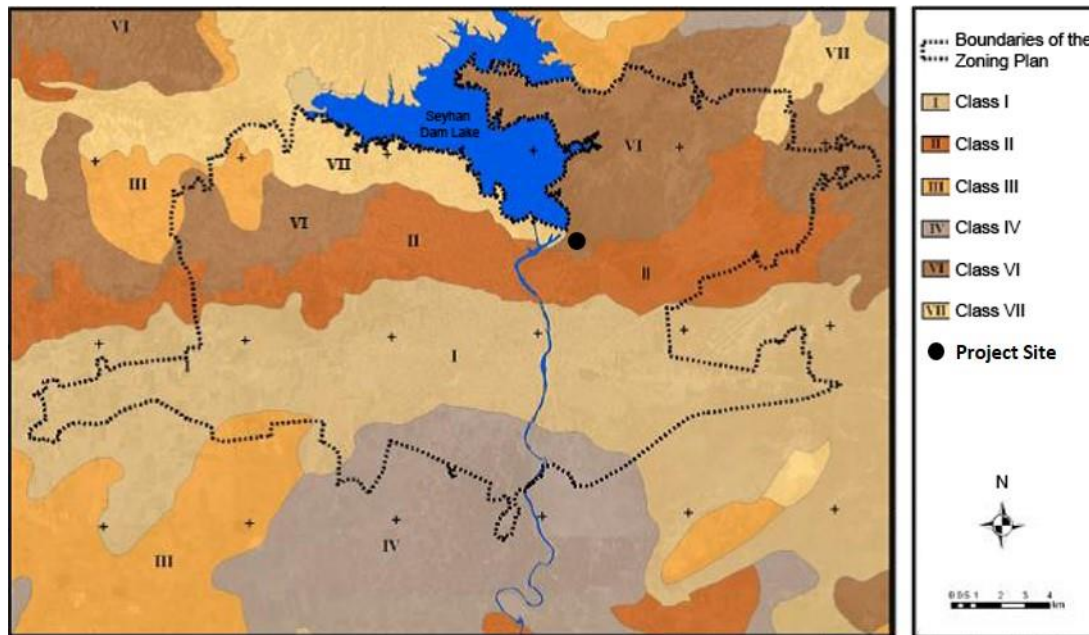


Figure 6-10: Land ability classes for Adana Province center and its vicinity (Say *et al.* (2011))

6.2.4 Site Soils and Contaminated Land

Site walkthrough and the site investigations have shown that the site is predominantly open soil cover with no evidence of reclaimed land presence at the Project site. A fill material is present up to 0.7 m thickness across the site overlaying natural soil units that are of alluvial nature. The preliminary site visits showed the presence of one potential source of contamination within the Project area that might have adversely impacted the soil quality. DSI is operating a vehicle maintenance area where engine oil changes are conducted for the DSI machinery. There are two above ground storage tanks that are being used for mineral oil storage; information on the storage capacity and the establishment date for the above ground tanks could not be obtained from DSI. A number of oil drums were noted to be present within the area without appropriate secondary containment systems. Soil staining was noted in some of the drum storage areas. The photographs from these areas are shown below:



The soil quality across the site as well as the soils near these potential sources of contamination was investigated through a soil and groundwater investigation program undertaken in November 2013. The site investigation was based on a conceptual site model (CSM) that was developed based on the collected site information. The CSM and the reasoning of selection of the soil sampling locations are explained in detail in Annex F. The site assessment consisted of drilling and sampling of shallow soil borings (maximum depth of 1.5 m bgl) and installation of two 20 m groundwater monitoring wells. The sampling locations are shown in Figure 6-11. The soil samples were collected

and analyzed for Total Petroleum Hydrocarbons (TPH), Poly Aromatic Hydrocarbons (PAHs), Volatile halogenated hydrocarbons, BTEX compounds, PCBs, EOX and heavy metals suite (Antimony (Sb), Arsenic (As), Barium (Ba), Lead (Pb), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Molybdenum (Mo), Nickel (Ni), Mercury (Hg), Vanadium (V) and Zinc (Zn)). Groundwater level was not found in the wells that were drilled to 20 m depth bgl and therefore water samples were not collected for analysis. The borehole logs, the laboratory results and the evaluation of the laboratory results are shown in Annex F.

The sample analysis results were compared with the limit values specified in the Regulation on Soil Pollution Control and Point Source Contaminated Sites (Official Gazette date/no: 08.06.2010/27605) and Dutch soil quality standards. The reason for using Dutch standards is that the relevant articles of the Regulation on Soil Pollution Control and Point Source Contaminated Sites have not been enacted yet, and Dutch standards represent the numerical guidelines that were considered in the past by the Turkish Ministry of Environment and Urban Planning. The results from the site survey were evaluated in detail.



Figure 6-11: Sampling locations (SK-1 and SK-2 (20 m groundwater monitoring wells), SK-4 through SK-6 shallow boreholes (maximum depth 1.5 m), YSK-1 through YSK-3 shallow soil samples in the DSI maintenance area)

The soil sample analysis results have been compared in Annex F-4 with the generic contaminant of concern limits for the relevant exposure pathways as well as the intervention limits given in the Dutch guidelines given. The major findings and drawn conclusions can be summarized as follows:

- TPH contamination consisting of aromatic hydrocarbons (C₂₁₋₃₅) and aliphatic hydrocarbons (C₂₁₋₃₅) were measured as 1,900 mg/kg and 4,600 mg/kg in one of the samples collected near the surface stained area (YSK-1) in the vehicle maintenance area. The detected long chained TPH fractions are typically attributed to mineral oil and indicate potential leakage in the oil drum storage tank area. The YSK-1 and all other soil samples showed TPH values below the Turkish generic soil and dermal exposure generic levels in the Regulation on Soil Pollution Control and Point Source Contaminated Sites. Low levels of TPH

(aliphatic hydrocarbons (C>21-35)) were noted in samples SK-1, SK-2, YSK-1, YSK-2 and YSK-3. These values were also below the TPH generic values which indicate that they do not represent risk to human health. It should be pointed out that the Dutch guidelines specify an intervention value of 5,000 mg/kg for the sum of the mineral oil, however the TPH parameters are partitioned with respect to carbon banding in the Turkish Regulations. The total TPH value in YSK-1 is higher than the Dutch intervention value but still below the governing TPH partitioned limits.

- PAHs were recorded in sample SK-2 and SK-6 at 8.01 mg/kg and 0.27 mg/kg, respectively. Benzo(a)pyrene noted in sample SK-2 at 0.07 mg/kg was slightly over the generic values (0.06 mg/kg) in the Regulation on Soil Pollution Control and Point Source Contaminated Sites. All other PAH compounds were below the generic values. The Dutch guidelines specify an intervention value of 40 mg/kg for Total PAHs.
- Levels of Arsenic identified in all of the soil samples exceed the generic values of the soil and ingestion-soil and dermal exposure however they are below the generic values of the inhalation of dust in outdoor air exposure scenarios (Regulation on Soil Pollution Control and Point Source Contaminated Sites). These values are below the Dutch intervention guidelines. Arsenic levels detected in soil samples are similar in range indicating these levels represent natural conditions in the site soils instead of impacts of the potential contamination.
- Nickel values were below the Turkish generic values of the soil and ingestion-soil and dermal exposure and the inhalation of dust in outdoor air exposure scenarios (Regulation on Soil Pollution Control and Point Source Contaminated Sites). However Nickel values at YSK-1, YSK-2, SK-1, SK-4, SK-5 and SK-6 were above the Dutch intervention guidelines. The values detected in soil samples are similar in range indicating that Nickel values may be the natural level in the site soils instead of impacts of the potential contamination.
- Cobalt levels were noted to exceed the generic values of the soil and ingestion-soil and dermal exposure scenario at SK-1, SK-4, SK-5 and SK-6 sampling locations. These values are below the Dutch intervention guidelines. The Cobalt levels detected in soil samples are similar in range indicating that these levels may be naturally present in the site soils instead of impacts of the potential contamination.
- EOX, Volatile halogenated hydrocarbons, BTEX compounds and PCBs were all below detection limits.
- The soil sampling and ground water monitoring well placement investigation has revealed that the activities undertaken in the vehicle maintenance area has adversely impacted in the soils layers. However, the soil samples show that the values detected fall below the generic contaminant of concern limits for the relevant exposure pathways. This means that the soil could be left as is without the need for remediation. Groundwater depth is below 20 m with a consistent presence of low permeability clay layer found underneath the site which may act as potential barrier to prevent migration of contaminants from the near surface layers. The presence of these contaminants will exclude these soils to be excavated as earth material and be placed into an excavated earth disposal area. It should be noted that ground water sampling could not be conducted since there was no water in the ground water wells drilled to a depth of 20 m.

6.3 Impacts

6.3.1 Impacts related to Geology and Seismic Risk

In the event of earthquakes during construction and operation, significant impacts on the environment as well as on the community and workers' health and safety and on patients may arise following accidents, spills, fire, etc. related to the seismic incident. During all construction works within the Project area, the Regulation on Buildings to be Built in Seismic Zones (Official Gazette date/no: 06.03.2007/26454) will be complied with. The Project area lies within a 2nd degree seismic zone and the geotechnical site investigations performed in the area indicated the following parameter values:

- Soil type: B
- Local soil class: Z2
- Effective ground acceleration coefficient: $A_0 = 0.30$,
- Ground spectrum periods: $T_A = 0.15$, $T_B = 0.40$

The Project design will take into account the Turkish regulatory requirements related to seismic design and risk assessment. This will ensure that residual risks are as low as possible.

6.3.2 Impacts on Soils

Impacts during Construction

If any construction was to take place on soils used for productive purposes (e.g. agriculture), this could result in physical damage through compaction. However, the site is predominantly made of fill material overlying alluvial material. No major natural surface soils are present in the Project area. As previously indicated, Figure 6-10 shows that the land ability class at the site and surrounding areas are Class VI which are not suitable for agricultural use. Therefore, the Project will not adversely impact potential agricultural land areas.

Temporary use of land for construction can, if not properly managed and operated, lead to impacts on soil quality by events such as compaction and accidental spills of liquid cement (excluding hazardous material spills). All these events may be expected to have a minor-moderate impact. If not managed appropriately, health and safety impacts due to handling of soils with elevated TPH concentrations are expected to range between minor to moderate depending on the levels of TPH concentrations in soils. Construction activities on soils and storage of construction equipment and materials on soils have the potential to affect soil and groundwater (although below 20 m bgl, there is still potential for impact depending on spill size) through spills of hazardous material such as oils, fuel or other materials (i.e. fuel loading for machinery operating at the site). The vulnerability of the groundwater should be considered as moderate during construction activities since there will be excavation to depths where more permeable soil layers will be present and there are DSI ground water wells in the vicinity of the site. The vulnerability of soil is considered high in case of any spills. If good construction practices are not applied to provide protection against soil and groundwater, potential impacts are expected to range between minor to major significance depending on the duration of the spills that may range from temporary small-scale spills to continuous/long-term spills.

Impacts during Operation

During operation, soils may become contaminated from spills of hazardous materials (i.e. fuel leakage from underground storage tanks), poor management of hazardous wastes generated at the site, leakage from underground pipes used for sanitary wastewater discharges. These spills and leakages may lead to impacts that are considered to range between minor to major depending on the spill size, nature of contaminants and impacted areas.

The following conditions were set in the EHS based design criteria and infrastructure requirements (extracted from Technical Specifications provided by the MoH) as stated in Annex E-5 for the IHC facility:

- The building underground sanitary drainage system will be sized to serve the loads of the proposed facility. A system of sanitary waste and vent piping will be routed throughout the building to vent and collect the discharge from all of the plumbing fixtures and drains.
- Multiple double wall underground fuel oil tanks or above ground tanks with dikes will be provided near the central energy plant to serve the emergency generators and the boilers. Individual remote fill points will be provided. A leak detection and level monitoring control system will be provided in the central energy plant to monitor the piping system and fuel oil tanks.

The Project will therefore be designed with the necessary protection systems against spills from hazardous materials and wastewater generated at the site. Therefore, the risks of soil pollution during operations are deemed to be negligible if these protections are in place and appropriately operated.

6.4 Mitigation Measures

Mitigation measures to avoid and/or mitigate the predicted impacts will include the following:

- All contractors will be required to adopt good construction site practices for the protection of soils and to follow the General IFC EHS Guidelines.
- The Project will be designed, constructed and operated in accordance with the Turkish regulations and standards for protection against seismic activity and therefore, risks will be as low as technically and financially feasible.

Specific measures for protection of soil and groundwater media during the construction and operation phases will include the following:

- Provisions will be taken for the protection of newly exposed soil surfaces from rainfall and wind erosion such as silt fences.
- Procedures will be set up for identifying and dealing with contaminated materials when encountered during construction, including treatment and disposal of contaminated soils. Contaminated soils will be disposed of in an appropriately licensed disposal site.
- The use of cement and wet concrete in or close to any exposed areas will be carefully controlled.
- Hazardous and non-hazardous materials and waste during construction and operation will be handled according to the Integrated Quality, Environment, Health and Safety Management System to be prepared by ADN PPP A.Ş. and where needed, further site-

specific management plans will be developed (i.e. Hazardous Material Management Plan). Details of waste generation and management methods are provided in *Chapter 8: Material Resources and Waste Management*.

- A Soil Sampling Plan will be developed in order to separate the clean and contaminated soils during earthworks at the DSI vehicle maintenance area.
- Fuels, oils and chemicals will be stored on an impervious base protected by bunds to 110% of capacity. Drip trays will be used for fuelling mobile equipment. Any spillages from handling fuel and liquids will be immediately contained on site and the contaminated soil removed from the site for suitable treatment and disposal.
- Spoil and other surplus material arising from the works which is classed as “acceptable fill” shall, wherever practicable, be recovered and used in the construction works. Relevant authorities shall be consulted regarding this on a site by site basis to ensure the re-use of waste materials is acceptable.
- Surplus construction material will be made available to third parties for reuse on local development projects if it cannot be utilized on site.
- Operation of a closed drainage system and implementation of Emergency Preparedness and Response Plan in the event of spills, fire etc. will prevent significant impacts on soils during construction and operation.

6.5 Residual Impacts

With the implementation of mitigation measures mentioned above, the residual impact on soil and groundwater is estimated to be insignificant.

7.0 HYDROLOGY AND HYDROGEOLOGY

7.1 Scope

The potential Project impacts on surface water and groundwater are presented in this chapter. The following concerns were identified:

- Potential impacts on the quality of the surface and groundwater environment during construction and operation
- Potential flooding risks during rainfall events (including Seyhan Dam overflow)

A description of the baseline conditions is provided followed by an impact assessment and identification of potential mitigation measures. The main information sources for the baseline conditions were as follows:

- Adana Provincial Environmental Status Report (2011)
- Watershed Protection Action Plan-Seyhan Watershed, Tubitak Project (2010)
- DSI information on groundwater and surface water in the City of Adana
- Literature survey
- Adana Existing Status Report (2012)-Published by AMM

The significance criteria that were used for assessing impacts on surface water and groundwater environment are presented below.

Impact Significance	Description
Negligible	- Contamination through site run-off from excavated soils/stockpiles, construction materials (such as liquid cement, lime), spills of hazardous materials/wastes during construction and operation that are temporary in nature and that do not degrade the existing surface water runoff quality - Rainfall events do not overflow surface water drainage components to cause flooding of the IHC
Minor	- Contamination of surface water run-off from excavated soils/stockpiles, construction materials (such as liquid cement, lime), spills of hazardous materials/wastes during construction and operation that are temporary in nature and that degrades the surface water runoff quality by 10% of the original water quality - Contamination of groundwater from soils/stockpiles, construction materials (such as liquid cement, lime), spills of hazardous materials/wastes during construction and operation that are temporary in nature; impacts cause background levels increase but remain below the generic risk levels for all sites (levels provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites) - Rainfall events cause overflow of nearby surface water drainage components however does not cause flooding of the IHC site
Moderate	- Contamination of surface water site run-off from excavated soils/stockpiles, construction materials (such as liquid cement, lime), spills of hazardous materials/wastes during construction and operation that are temporary in nature and that degrades the existing water quality by 50% of the original water quality - Contamination of groundwater from soils/stockpiles, construction materials (such as liquid cement, lime), hazardous materials and oil spills during construction and hazardous wastes and materials spills during operations; impacts cause background levels to be below the long-term cancer and hazard

	risk (levels provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites - Rainfall events cause overflow of nearby surface water drainage components causing flooding of the IHC site without damage to facilities
Major	- Contamination of surface water site run-off from excavated soils/stockpiles, construction materials (such as liquid cement, lime), spills of hazardous materials/wastes during construction and operation that are temporary in nature and that degrades the existing water quality by 100% of the original water quality - Contamination of groundwater from soils/stockpiles, construction materials (such as liquid cement, lime), hazardous materials and oil spills during construction and hazardous wastes and materials spills during operations; impacts cause background levels to above the long-term cancer and hazard risk (levels provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites - Rainfall events causes overflow of nearby surface water drainage components causing flooding of the IHC site with damage to facilities - Seyhan Dam failure causing flooding of the IHC site with damage to facilities

7.2 Existing Environment

7.2.1 Surface Water Resources

Watershed Characteristics

The City of Adana is located within the Seyhan Basin borders which has a catchment area of about 20,600 km². The basin has three climatic regions extending from the coast to Central Anatolia. In the coastal region of Cukurova and the foothills in its vicinity, summers are hot and arid while winters are warm and rainy. The region extending from Ulukisla to Pınarbasi and further on displays the features of Central Anatolia; there are hot and arid summers and cold and rainy/snowy winters. The area between the arid northern region and the coastal line, encompassing the ridges of Taurus Mountains lying in the northeastern direction differs from both northern and southern parts with more precipitation and colder climate. The average yearly rainfall is 624 mm resulting in an annual average flow rate of 211.07 m³/sec. The annual average yield of the basin is 10.18 lt/sec/km² and the ratio of flow to precipitation is 0.51. The basin surface waters are collected by the Seyhan River via Goksu, Zamanti, Kurkun, Eglence, Cakit, Ucurge Rivers and their tributaries (Table 7-1). The longest water course is Seyhan River with a length of 560 kilometers while the shortest water course is the 60 km long Ucurge. Figure 7-1 shows the location of the basin, surface water drainage rivers and topographical elevations.

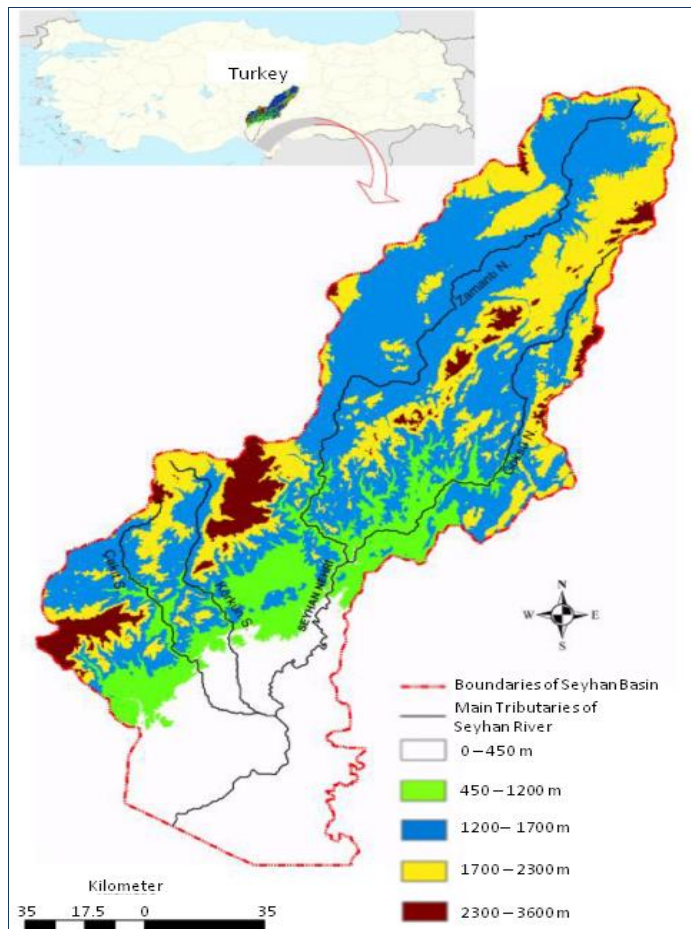


Figure 7-1: Seyhan basin characteristics (Source: Watershed Protection Action Plan (2011))

Table 7-1: Seyhan River and some of its tributaries within the provincial borders of Adana

Rivers	Length (km)	Flow rate (m ³ /sec)	Discharge to	Tributary	Potential hm ³ /year	Features
Seyhan	560	190	Mediterranean	Seyhan	6,200	Suitable for aquaculture and fishing
Cakit	162	12.8	Seyhan Dam	Seyhan	-	Suitable for aquatic sports
Eglence	87	8.8	Seyhan Dam	Seyhan	-	Suitable for aquaculture
Korkun	157	13.4	Seyhan Dam	Seyhan	-	Suitable for aquaculture
Ucurge	60	0.7	Seyhan Dam	Seyhan	-	Suitable for aquaculture

Source: Adana Provincial Environmental Status Report (2011)

The Seyhan River runs through the City of Adana and divides it into two parts, namely the Seyhan and Yuregir areas. The Seyhan River and the Seyhan Dam Reservoir positioned on the river and the irrigation channels running through the city are significant elements that have been influential on the urban development and social life. After running for 60 km, the river joins Tarsus Stream (at 20 km to the south of Tarsus) and discharges into the Mediterranean at Cape Deli at Adana-Icel Border, to the west most end of Cukurova.

The annual average flow of the Seyhan Basin is $6.66 \times 10^9 \text{ m}^3$ ($10.18 \text{ lt/sec km}^2$), constituting 3.62% of Turkey's surface water potential. The utilizable part of this flow is estimated to be $3.33 \times 10^9 \text{ m}^3/\text{year}$, based on the average utilizable surface water ratio assumed as 50%. Based on the data from the Survey Planning Department and Geotechnical Services and Groundwater Department under the General Directorate of DSI, the groundwater reservoir of the Seyhan Basin is $223.50 \times 10^6 \text{ m}^3/\text{year}$ and the groundwater potential is estimated to be $298 \times 10^6 \text{ m}^3/\text{year}$, based on the assumption that operation reservoir is between 70-80 (75)% of the groundwater potential.

Dams and Reservoirs

There are a number of dams and reservoirs built along the rivers of the Seyhan Watershed basin. The most important ones are the Catalan and Seyhan dams built on the Seyhan River which provide irrigation, generate energy and also prevent floods.

Seyhan Dam and Reservoir:

The Seyhan Dam was commissioned in 1956 with the purpose of irrigation, energy generation and flood control on the Seyhan River. The dam was built to prevent the City of Adana and an 85.000 hectare land from flooding of the Seyhan River. The dam is located in an area comprising of limestone hills by the feet of the Taurus Mountains, adjacent to the provincial center of Adana, in the valley formed by Seyhan River and its main tributaries. It also functions as a recreational area due to the proximity to the city center as well as easiness of transportation. Stocks of aquatic products in the dam lake are subject to both commercial and sports fishing activities. There are active Fishery Cooperatives established by the villages in the vicinity. During the previous years, water levels were greatly reduced due to excessive amounts of water drawing from the reservoir for irrigation needs. However with the commissioning of Catalan Dam, the water regime in the reservoir has become steadier. The dam is fed by the Seyhan River, Delicay, Cakit, Ucurge and Korkun Rivers and irrigates a land of 96,581 hectare in the Lower Seyhan Plain. The irrigated land gets larger as new irrigation projects are brought into life. Total storage volume impounded by the dam is 832 km^3 .

The Seyhan Dam is an earth filled dam with a clay core zone with a height of 77 m from the foundation. The reservoir created by the dam has an area of 6,782 hectare at the normal water elevation of 53.2 m. The earth embankment dam has a volume of $7,500,000 \text{ m}^3$. A total of 174,000 hectares of land could be irrigated with the water of the dam. It has three units (including one back-up unit) of 18,000 kW energy. Hydroelectric power plant generates annually 350 GW electricity with a capacity of 54 MW. Information on the dam safety risk and related monitoring conducted for the integrity of the Seyhan Dam was requested from the 6th Regional Directorate of DSI, Ministry of Forest and Water Works. The official response provided by the Regional Directorate (Annex G-1) does not provide monitoring details however the authorities states that there has been no adverse condition identified from the monitoring conducted on the Seyhan Dam to date.

Catalan Dam and Reservoir:

The Catalan Dam is located to the north of the Seyhan Dam. The dam was built between the years 1982 and 1997 with the purpose of energy generation and flood control. Up to $425,000 \text{ m}^3/\text{day}$ of the potable and utility water need of the City of Adana is supplied by Catalan dam. The drinking water for all residential areas within the City except for the neighborhoods of Resatbey, Cemalpasa,

Kurtulus, Doseme and Cinarli is supplied from Catalan Dam's reservoir. It is an earth embankment dam with a volume of 14,500,000 m³ and a height of 70 m above the river bed. The reservoir has a volume of 2,126.33 hm³ and an area of 81.86 km² at normal water elevation. The dam generates annually 596 GW energy with a capacity of 169 MW.

Irrigation Channels

Irrigation channels were built by DSI with the purpose of irrigating agricultural lands in the vicinity of Adana. Four irrigation channels (YS1, YSO, TSO and TS1) which run through the City of Adana also constitute large water surfaces within the City which provide recreational opportunities. These irrigation channels are fed by the reservoir of the Seyhan Dam and Seyhan River (Figure 7-2). Located to the west of the city center, the TS1 channel begins directly from the reservoir and runs for 11 km within the residential areas. It has a base-width of 6 m. The TSO channel which originates from the Seyhan River with an initial flow rate of 54 m³/sec is also located in the western part of the city. It runs through the residential areas for 10.5 km. Its total length is 40 km and base-width at the start is 20 m. Located to the east of Seyhan River, YS1 channel is also fed by the Seyhan River and runs out of the city in the southeast direction intersecting with the Tarsus-Adana-Gaziantep (TAG) motorway. YS1 which is located near the IHC site has a total length of 27 km, 8 km of which run through residential areas and its initial base-width is 4.5 meters. Also located to the east of Seyhan River, YSO starts from the river and, again, runs to the exteriors of the city in the southeast direction. The initial flow rate of YSO channel is 90 m³/sec, its total length is 18.5 kilometers, 9.5 km of which runs through residential areas and its base-width at the start is 25 meters.

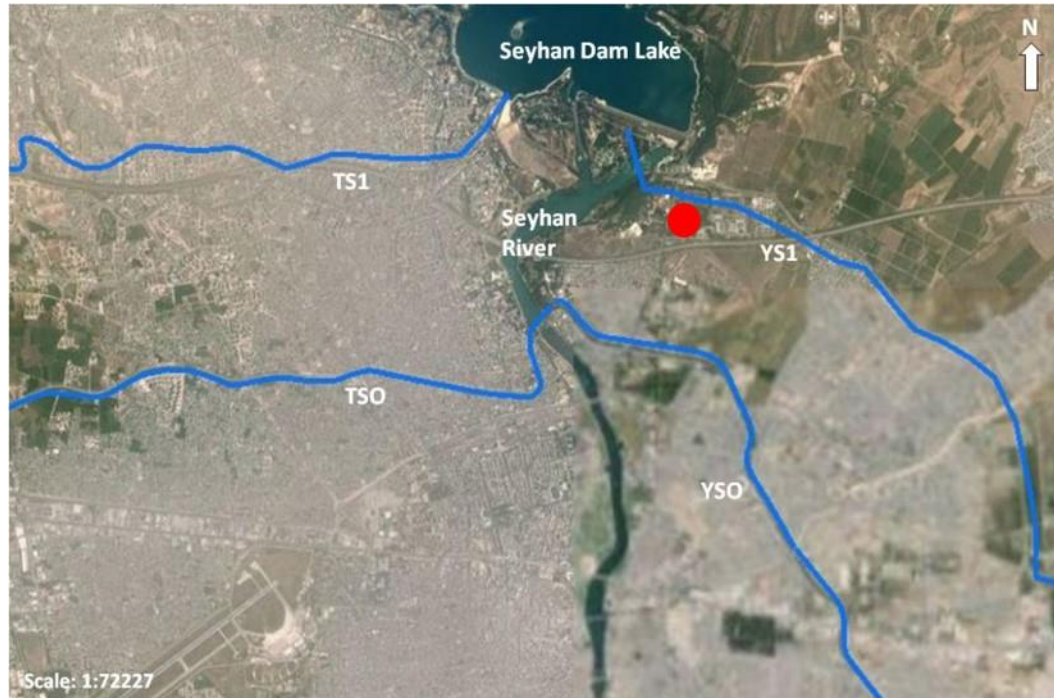


Figure 7-2: DSI irrigation channels in the City of Adana (Project site is indicated by red circle) (Source: GIS of the Ministry of Forestry and Water Works)

Surface Water Quality

Table-I of the Turkish Regulation on Water Pollution Control (RWPC) and Table 5 of Annex 5 of the Surface Water Quality Management Regulation (SWMR) classify surface water quality in four classes as: 1) Class I: High quality water, 2) Class II: Less polluted water, 3) Class III: Polluted water and 4) Class IV: Highly polluted water Both tables have common parameters and the numerical classification limits are the same, however, the tables are not identical in the scope of the parameters being tested. As an example the Chemical Oxygen Demand (COD) is present in both regulations and the limits for the four classes are the same. COD is listed as an oxygenation parameter in SWMR and as an organic parameter in RWPC. A number of surveys have been conducted and reported in the literature using the RWPC water quality classification including the watershed protection plans drawn as Watershed Protection Action Plans for a number of watersheds across Turkey.

The Lower Seyhan basin is more populated and industrialized compared to the upper basin and a great deal of agricultural activities is performed in the Cukurova plains. The Seyhan Dam reservoir and the stream flows feeding the reservoir are categorized as high quality in terms of organic matter, as less polluted in terms of ammonium nitrogen. However after running through the city of Adana, the waters of Seyhan River are categorized as polluted in terms of organic matter and as highly polluted in terms of ammonium nitrogen.

A Watershed Protection Action Plan for the Seyhan Watershed was conducted as a Tubitak Project in 2010. Water quality classes for the 18 DSI stations installed at the Seyhan River, and tributaries and dams feeding the Seyhan River were identified using the RWPC Table-I based on the significant parameters demonstrating organic carbon and nitrogen pollution. The maps of the rivers and concentration levels are given in Annex G-2. The closest surface water tribute to the site is the YS1 channel by the Seyhan River as shown in Figure 7.2 the YS1 surface water quality will be reflective of the Seyhan River quality downstream of the Seyhan Dam. There is no specific surface water quality for YS1 and right after the exit of the Seyhan Dam, however the Tubitak Study (2010) indicates that the Seyhan River is adversely impacted as it flows through the City of Adana:

- After running through Adana, the water quality of Seyhan River falls to Class III in terms of COD (Figure G1 of Annex G-2) and other organic parameters, (Figure G3 of Annex G-2). and Class IV for physical and inorganic parameters. The water quality of Seyhan River after running through the City of Adana and Cakit Stream at the exit of Pozanti was assessed as Class IV including $\text{NH}_4\text{-N}$ (ammonium nitrogen).
- The water quality of the rivers and the dams was determined as Class I in terms of COD upstream of Seyhan Dam. Only the water quality of Saricam Stream was determined as Class III in terms of COD.
- The water quality of the streams that feed the dams of Zamanti, Goksu, Seyhan and Catalan from the north and of downstream Seyhan River until Adana, was assessed as Class II or III based on the $\text{NH}_4\text{-N}$ (ammonium nitrogen) parameter demonstrating the level of nitrogen pollution.
- In terms of physical and inorganic chemical parameters, water quality of the Seyhan basin is Class III or IV (Figure G2 of Annex G-2). In the parts of Zamanti River before entering Gumusoren Dam, in Cakit Stream, in the estuary where Saricam Stream joins Seyhan River,

the water quality was classified as Class IV, in other parts of the basin it was assessed as Class III.

- In terms of inorganic pollution, the water quality was determined as Class III in upstream Zamanti River and as Class I in other rivers (Figure G4 of Annex G-2).

7.2.2 Flooding Risks

The City of Adana experienced two major flood disasters in 1936 and 1980. In the light of the past experiences and statistical data, the following neighborhoods of the central district of Adana were identified as flood risk areas (Adana Provincial Environmental Status Report (2011)):

- Neighborhoods located along Saricam Stream: Mutlu, Dervisli, Kiremithane, Sinanpasa, Cumhuriyet, Yamacli. When there is excessive precipitation, these neighborhoods are exposed to the risk of being in the flood plain of Saricam Stream which joins Seyhan River to the north of Taskopru location. But with the reclamation of the riverbed of Saricam Stream for a section of 5.5 kilometers between DSI's irrigation channel and the 10th Tanker Military Base Command, that risk was greatly reduced.
- A section of Sehit Duran Neighborhood
- A section of Hurriyet Neighborhood
- A section of Akkapi Neighborhood
- A Section of Bey and Yenibey Neighborhoods.

These areas are shown in Figure 7-3.

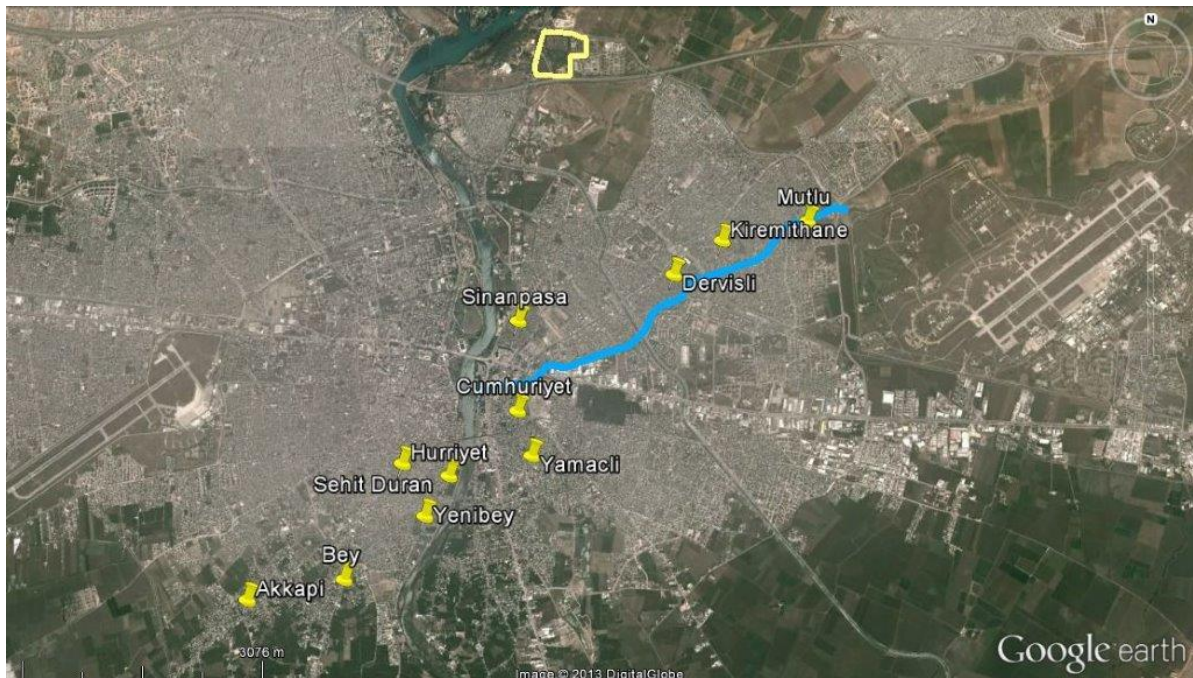


Figure 7-3: Flood prone areas (blue line is Saricam Stream, Project area is indicated by yellow lines)

The Seyhan River was prone to flooding prior to the construction of the Seyhan and Catalan Dams built upstream of the City of Adana urban setting. It is being reported that the flooding events are being controlled by the presence of these dams and there is adequate control of increasing river flow rates during high rainfall events (Adana Provincial Environmental Status Report (2011)). It is

also reported that the rainwater runoff generated in the City of Adana is fed into the sanitary wastewater collection lines at certain locations. This has caused issues in the past when the conveyance capacity of the sanitary sewer line which is designed for handling wastewater is not able to adequately handle rainwater runoff and sanitary wastewater streams at the same time during high rainfall events.

7.2.3 Groundwater Resources

The City of Adana and its vicinity are comprised of two regions in terms of topography: mountainous area and the plains. The district centers of Seyhan and Yuregir are located in the plains which occupy a large area that is low sloped. The plains downgradient of the Seyhan Dam reservoir comprises of very thick alluvium layers of loose clay, sand, pebbles and conglomerate. The alluvium starts from the north of E-5 highway and extends all the way to the Mediterranean. Water supplying formations in the plain are generally of alluvial characteristics and it is always possible to get water in response to any needs from these aquifers. The aquifers are fed with rainfall, irrigation waters and mostly with the permeation of the waters of Seyhan River. It is estimated that annually $500 \times 10^6 \text{ m}^3$ of groundwater can be drawn and no significant level change is anticipated at the groundwater table. There are a number of well water supplying aquifers drilled on the left and right banks of the Seyhan River around the provincial center of Adana. Generally, the best groundwater sources are located within a zone of 15 kilometers starting from the exit of Seyhan Dam Regulator and running along the course of Seyhan River until the Mediterranean. As of 2002, the drinking water need of the whole Yuregir District and a large part of Seyhan District have been supplied directly from Catalan Dam following treatment. As of 2006, with the commissioning of Catalan drinking water project, 106 of 142 wells drilled by AMM were inactivated and 36 wells are still in operation. Annually 29.5 hm^3 of water is being drawn from these wells.

Cobanoglu *et al.* (2012) developed groundwater level and quality maps based on static water level measurements and water sample analysis conducted at 91 existing water well locations. The results were used to identify the water table map underneath the City of Adana as well as to classify the groundwater level quality.

The groundwater level map exhibits that water levels get closer to the surface from north to south and from east to west (Figure 7-4). The groundwater levels are observed to vary between 2 to 40 meters within the survey area.

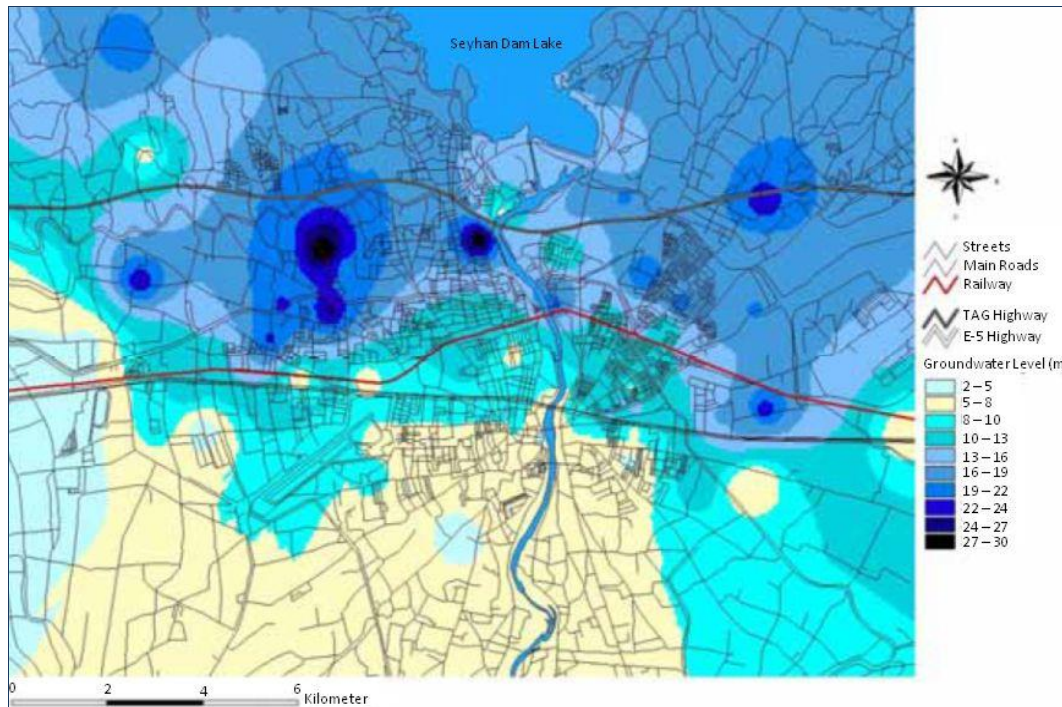


Figure 7-4: Contour map of groundwater levels within the survey area of Cobanoglu *et al.* (2012)

The pH value of groundwater varies between 6.8 and 8.1 (Figure 7-5), electrical conductivity (EC) is 370 to 1,773 $\mu\text{mho}/\text{cm}$ (Figure 7-6), and hardness in French degree is 17.0 to 67.2 (Figure 7-7). In the survey area, for the majority of the waters examined sulphate values vary between 0.18 and 3.81 mEq/L (Figure 7-8).

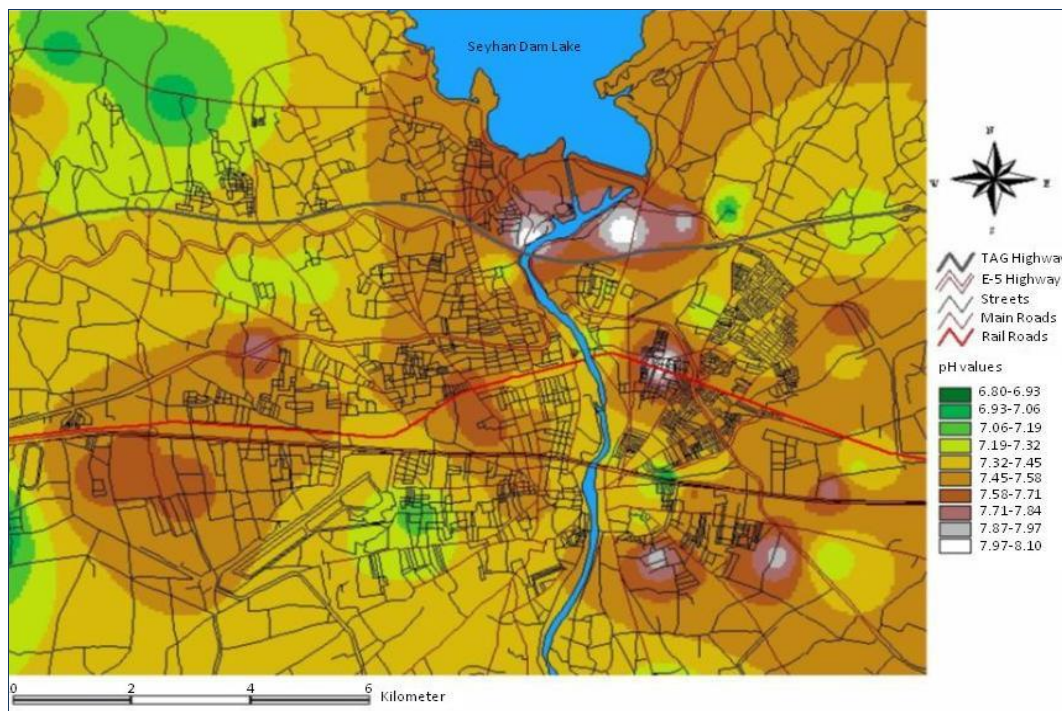


Figure 7-5: Contour map of groundwater pH values within the survey area of Cobanoglu *et al.* (2012)

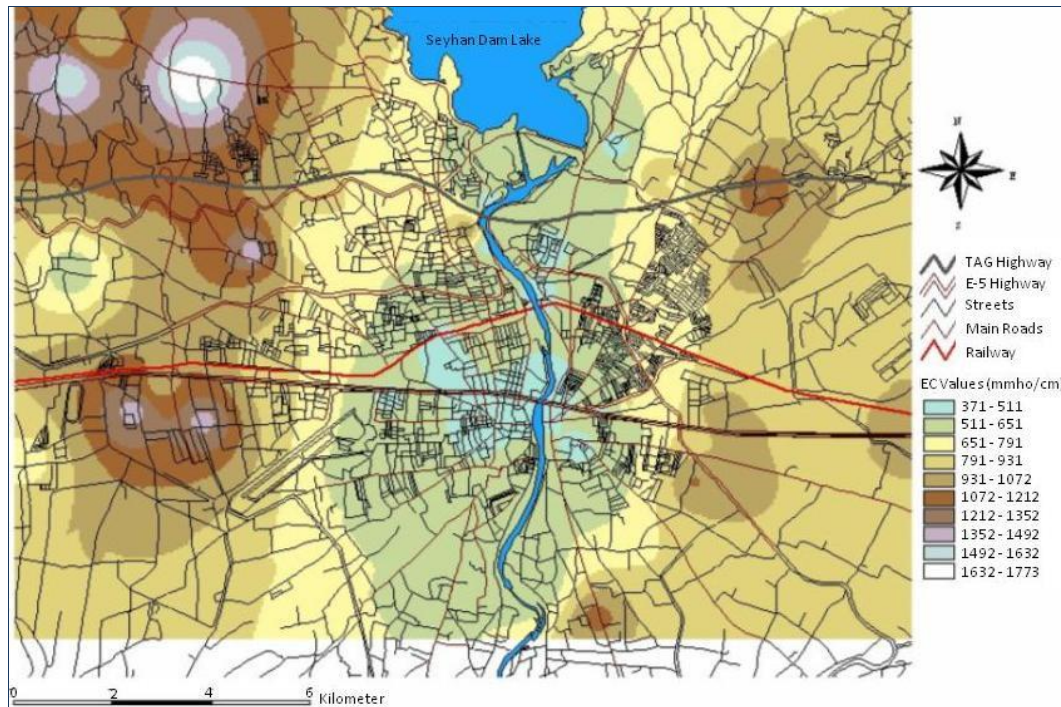


Figure 7-6: Contour map of groundwater EC values within the survey area of Cobanoglu *et al.* (2012)

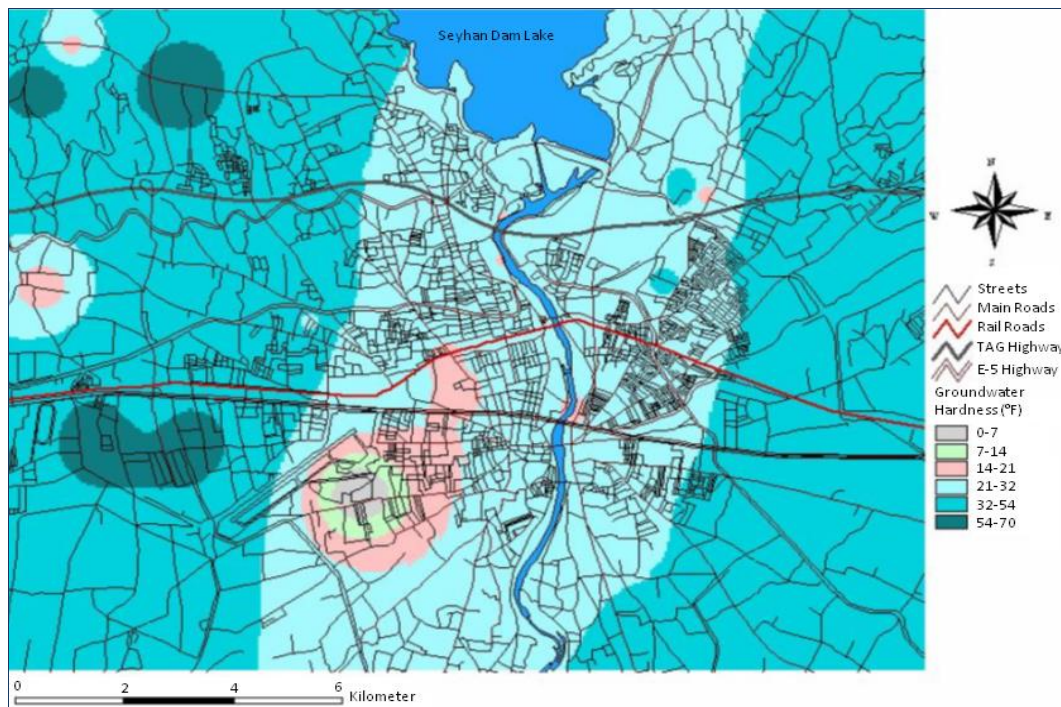


Figure 7-7: Contour map of groundwater hardness values within the survey area of Cobanoglu *et al.* (2012)

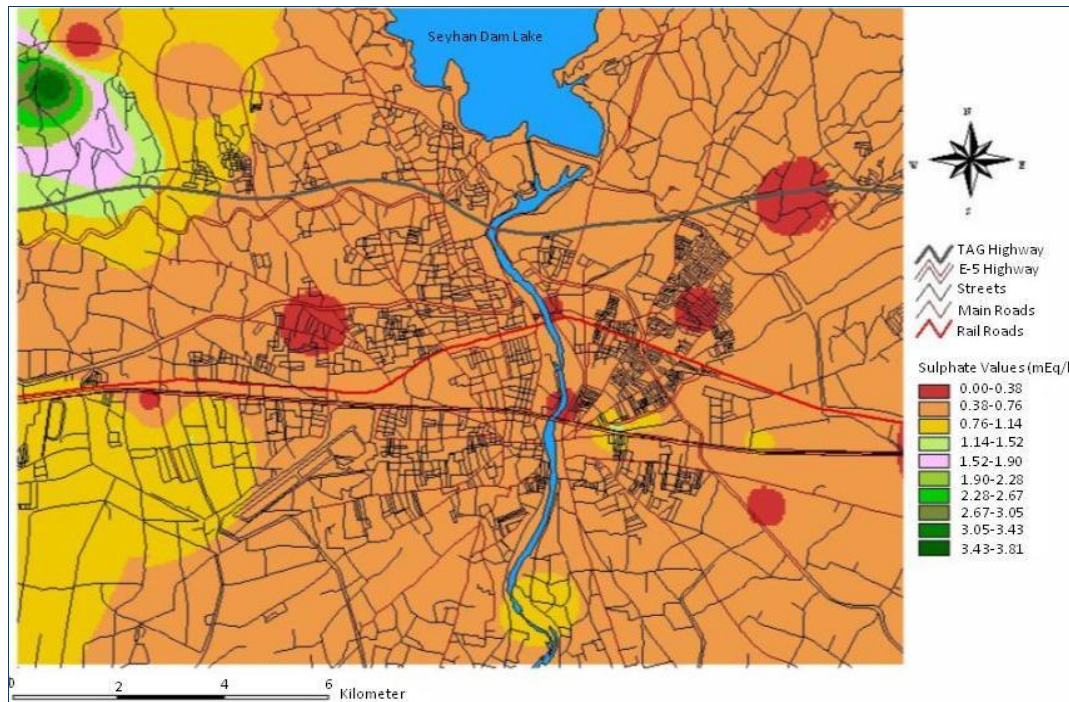


Figure 7-8: Contour map of groundwater sulphate (mEq/Lt) values within the survey area of Cobanoglu *et al.* (2012)

Schoeller (1961) categorized waters in terms of being drinkable with respect to the parameters such as EC, hardness (French degree), Na (mg/Lt), Cl (mg/Lt) and SO_4 (mg/Lt) values. In general, the water sample analysis can be categorized as “medium-good” and “very good” based on the Schoeller scale. According to TSE Standard 266 (TS266), the waters are assessed for being drinkable in line with various parameters. In terms of the assessment of chemical properties, all waters were found compatible with the standards for pH, EC, Cl and Mg values. Majority was found compatible with TS266 in terms of being drinkable. They were also found to be of adequate quality to be utilized for irrigation.

The groundwater wells in the vicinity of the Project site are shown in Figure 7-9. Information on the well construction as well as groundwater quality was requested from DSI. However the information was not obtained at the writing of the Draft ESIA report. Two groundwater monitoring wells (20 m deep) were drilled within the site boundaries as part of the soil quality investigation conducted by ELC at the Project site in November 2013. Groundwater was not found at that depth. The study was conducted within the Project site boundaries to assess potential soil contamination from former site activities as described in *Chapter 6: Geology, Soils and Contaminated Land*.

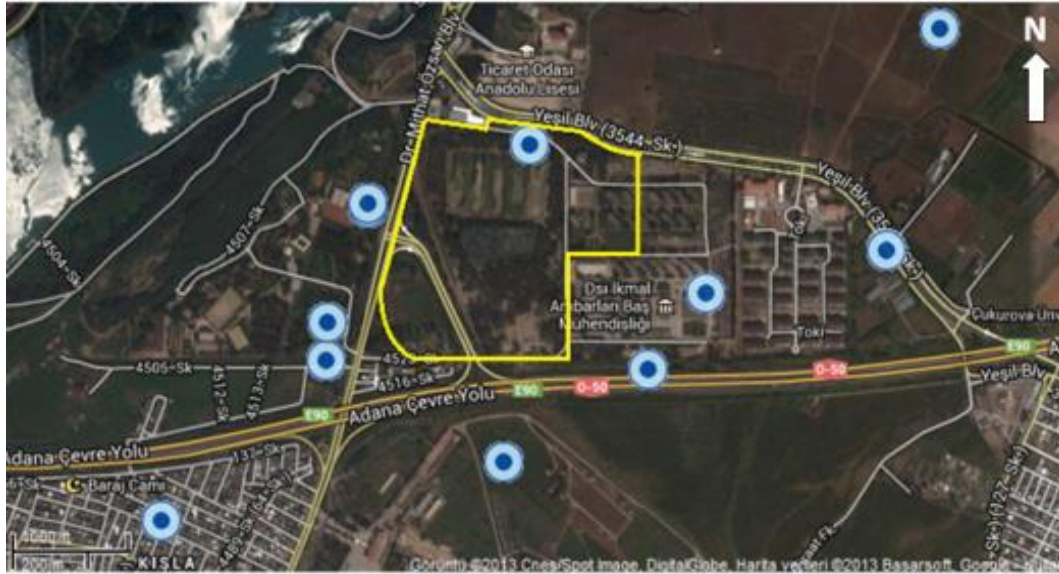


Figure 7-9: Groundwater wells in the vicinity of the Project site (Source: GIS of the Ministry of Forestry and Water Works)

7.3 Impacts

A number of construction activities may adversely impact surface and groundwater resources. These activities include soil and concrete movement due to excavations and the presence of stockpiles of exposed soil (including contaminated soils identified during the soil quality investigation) and concrete which may lead to suspended sediment in runoff waters from the work sites. Exposed soils that are dampened to reduce dust emissions may also produce surface runoff leaving the site boundaries. If not mitigated, impacts may be expected to range between minor to major significance depending on the amount and quality of surface runoff leaving the site. The excavated soils and concrete could contain contamination and if not properly managed could infiltrate to the groundwater and cause contamination. It should be noted that the distance to nearby surface water bodies is close to the site boundaries. The closest distance is the irrigation channel YS1 which is approximately 20 m north from the site boundaries and separated by a side road and then a double-lane road which decreases the chances of surface water or spills from entering directly to the channel.

Impacts may occur as a result of accidental spills from the use of hazardous materials (fuel oils and lubricants) as well as construction materials (liquid cement, lime) during construction which may migrate off and also infiltrate to the groundwater resulting in the degradation of groundwater quality. Spills may also occur from the refueling of equipment during construction. Associated impacts are considered to be of minor to major significance depending on the amount of spill and the timely response to the incident.

If the hazardous materials (i.e. fuels stored in underground storage tanks) are not handled appropriately, potential spills and leakages may result in impacts ranging from minor to major significance and may become permanent during operation. Accidental discharges and spills of hazardous materials and wastes have the potential to contaminate groundwater and related impacts are considered to be of minor to major significance depending on the amount of spill and timely response to the incident.

Inappropriate storm water drainage conditions for the Adana IHC facilities may result in flooding of the site area. Flooding may result in impacts ranging from minor to major significance in terms of health and safety conditions. The flooding assessment from nearby surface water bodies is deemed to be low based on the information discussed in Section 7.2.2. Moreover, specific mitigation measures as given in Section 7.4 below were requested by MoH to be part of the design which will cause the potential impacts of storm water flood occurrence, sanitary water leakage from pipes and hazardous material spills from underground storage tanks to be considered as negligible.

In addition, DSI has stated that the integrity of the Seyhan Dam is being monitored since it became operational and adverse conditions were not detected to date. Dam failure risk is deemed to be low based on the DSI declaration.

7.4 Mitigation Measures

Some specific mitigation measures were already requested by the MoH to be part of the EHS design. The following conditions were set in the EHS based design criteria and infrastructure requirements (extracted from Technical Specifications provided by the MoH) as stated in Annex E-5 for the IHC facility:

- The building underground sanitary drainage system will be sized to serve the loads of the proposed facility. A system of sanitary waste and vent piping will be routed throughout the building to vent and collect the discharge from all of the plumbing fixtures and drains.
- The storm water piping from the roofs will be collected within the building and routed outside the building for connection to the site storm sewer system. Storm water from the upper levels will be discharged to the site storm sewer system by gravity flow. The storm water from the loading dock and from the parking structures (parking garages) will be routed through an oil interceptor. If the outlets are below the site storm main, interior storm sump pump systems with duplex pumps will be provided. The duplex storm water pumps will be provided with emergency power from the building. The building automation system will monitor the storm water sump pump system with a high water alarm. The storm water collected by the foundation drainage system will be collected in multiple separate sumps within the building and pumped to the exterior of the building for extension by the site utility contractor to the site storm sewer system.
- Multiple double wall underground fuel oil tanks or above ground tanks with dikes will be provided near the central energy plant to serve the emergency generators and the boilers. Individual remote fill points will be provided. A leak detection and level monitoring control system will be provided in the central energy plant to monitor the piping system and fuel oil tanks.

Specific additional mitigation measures to avoid and/or mitigate the potential impacts to surface water and groundwater will need to include the following:

- The mitigation measures discussed in *Chapter 8: Material Resources and Waste Management* will be implemented. The mitigation measures are specific to the management of wastes including storage, transport and disposal of waste materials generated during construction and operation.
- Good construction site practices (i.e. measures as described below such as using designated areas for storing materials, regular inspections at construction sites, training of

construction workers, placement of sediment traps and/or oil/water, etc.) will be adopted to minimize risks of water pollution.

- Stockpiles of soil will be stored as needed at designated areas.
- Construction activities will be regularly inspected on site.
- Construction workers and relevant staff will be trained related to the implementation of good construction site practices and on spill response and prevention measures.
- No fuelling of vehicles or equipment will take place within excavated areas; no hazardous materials will be stored in excavated areas and all handling of hazardous materials will be under special supervision. Fuelling shall only be carried out in designated areas away from surface drainage pathways exiting the site. Suitably sized impervious bunds or other containment will be installed where hazardous materials are handled (such as fuel stores and loading areas, concrete mixing, hazardous material stores) to prevent hazardous materials entering the site drainage.
- All staff and subcontractors will be required to report any incidents and these will be subject to investigation, and remedial and preventive actions will be taken as needed.
- Spill response kits including absorbent materials suitable for the materials will be present on site. These will be kept at designated areas with specific instructions for their use. Site staff will be trained on the use of spill kits.
- Response to the spill will be made as fast as possible. Contaminated materials will be collected and sent to appropriate disposal facilities.
- Regular periodic integrity testing for hazardous material storage equipment (i.e. underground storage tanks and lines) will need to be conducted and appropriate leak detection systems will be in place.
- A Hazardous Material Management Plan should be developed to ensure proper handling of hazardous materials during construction and operation of the IHC.
- An Emergency Preparedness and Response Plan should be developed to ensure mitigation of spills from hazardous materials during construction and operation of the IHC.

7.5 Residual Impacts

Assuming that mitigation measures mentioned above and those mentioned in relevant chapters (i.e. *Chapter 6: Geology, Soils and Contaminated Land* and *Chapter 8: Material Resources and Waste Management*) are implemented and good site practices are adopted, the residual impacts on the surface water and groundwater is estimated to be negligible. Based on the DSI declaration for Seyhan Dam's condition, residual impact related to dam failure is not foreseen.

8.0 MATERIAL RESOURCES AND WASTE MANAGEMENT

8.1 Scope

The potential impacts from the use of material resources and generated wastes during construction and operation of the Project are discussed in this chapter. A description of the material resources that will be required for the construction and operation of the Project is provided. The waste management baseline conditions have been identified and the types of wastes that will be generated by the Project during construction and operation phases have been identified. The assessment indicates that energy efficiency will be an important consideration in terms of the use of material resources during the operation phase. Furthermore, the following potential concerns related to waste management were identified.

- Potential impacts to the environment related to inadequate solid and liquid waste management (excluding medical waste) during construction and operation phases
- Potential health and safety impacts to the patients, workers and employees at the IHC related to inadequate medical waste management during operation
- Potential EHS impacts to the community related to inadequate waste disposal practices specifically from medical waste.

8.2 Material Resources

It is anticipated that approximately 10,000 m³ of aggregate, 250,000 m³ of concrete, 3,000 tons of asphalt and 25,000 tons of iron will be needed for the Project. These materials will be procured by the construction contractor and at this stage their sources are not known. The construction material required for the Project will be transported to the site via roads from suppliers. Given the size of the construction sector in Adana, it is expected that all materials cannot be supplied from the existing marketplace. No borrow areas or quarries will be operated by the contractor. There should therefore be no adverse impacts from the extraction of raw materials or production of finished materials that will be attributable directly to the Project.

Besides the delivery of materials, various types of vehicles and machinery will be used during construction phase. These are identified in *Chapter 2: Project Description* and will all be sourced locally as far as possible from existing suppliers.

During the detailed design and procurement stage, the contractor will be responsible for identifying sources for all materials and equipment and will be required to consider environmental impacts in selecting materials to be used for the Project. This will include using less harmful materials where possible, considering the carbon footprint of alternative materials and considering the impacts of extraction, processing and transport. In particular, the contractor will be required to:

- source materials from as close as possible to the Project site so as to minimize the impact of transport;
- use recycled materials and materials certified as being from “green” or lower carbon sources where practicable;
- source aggregates and materials from quarries, borrow pits, crushing plants and asphalt plants operating with valid environmental and other permits and licenses and where the

sites are managed in full compliance with all applicable environmental standards and specifications.

There will be drinking and potable water usage by construction workers and during construction activities. A 150 lt/day/capita was selected for water usage resulting in a daily water requirement of construction workers (Ministry of Environment and Urban Planning (MEUP) based consumption data) resulting in 270 m³/day (assuming the maximum number of workers (1,800) at the site). In addition to this, water will be used for dust suppression activities, spraying concrete, adding water to backfill material, equipment cleaning and site clean-up. The construction activity water requirement can be taken as 60-70% of the construction worker requirement based on case studies (Wrap UK, 2011). This would mean an extra 175 m³/day for construction activities. The total daily water requirement for the construction activities would be 445 m³/day.

During operation, there will be water uses related to general domestic and sanitary use (including laundry), food preparation processes, sterilizers and autoclaves, X-ray equipment (water used in the processing of prints) and water used for gardens. A daily water consumption value per capita per bed was identified to vary between 1.13 m³/day (Altin *et al.*, 1999) and 1.60 m³/day (data for large hospitals in the United States (U.S. Energy Information Administration, 2007). Water consumption of the IHC is predicted to vary between 1,750 and 2,480 m³/day.

The water supply to the Saricam-Yuregir districts is provided from the Catalan Dam which is treated prior to distribution. The water supply in 2012 for the region was 48,178,603 m³/year (or 132,000 m³/day) according to the Adana Water and Sewage Administration (ASKI) Activity Report (2012). Based on this information, the water supply increase during the construction and operation of the IHC Project can be considered negligible on the water supply requirements for the region.

The electricity, heating and cooling needs of the facility will be from the trigeneration system and boiler that will be installed inside the IHC during operation. The trigeneration system and boiler will use natural gas. Data for large hospitals in the U.S. (U.S. Energy Information Administration, 2007) indicates that the yearly electricity consumption is 250 kWh/m². This would indicate that the yearly electricity consumption of the IHC would be 73,000,000 kWh. The natural gas will be used for heating and for producing warm water.

The energy and natural gas requirements will therefore be high for the IHC operation. Efficiency opportunities and associated tasks to achieve energy savings will need to be considered in the design and operation of the IHC Project. The IHC Project will need to identify opportunities in the following themes:

- Design of sustainable hospitals (green buildings-green hospital design)
- Best practices and training
- Codes and standards
- Selection of HVAC design and technology
- Electrical system design
- Lighting
- Medical equipment and process loads
- Economic and operational issues

Number of the above mentioned themes are requested by the MoH to be part of the health campus design as indicated in the bid documentation.

8.3 Waste Management

The waste generation including the medical wastes in the existing healthcare service, on-going disposal practices and review of the waste disposal facilities in the Province of Adana are presented in this section. Information on baseline conditions and wastes that will be generated during the construction and operation of the Adana IHC have been identified using the following sources:

- Adana Province Environmental Status Report (2011)
- Adana Water and Sewage Administration Activity Report (2012)
- Literature Survey (including medical waste studies conducted for the Province of Adana)
- Interviews conducted with ITC Invest Trading & Consulting AG that is developing and operating the Adana Sofulu Integrated Solid Waste Disposal Facility
- Official letter received from the AMM, Department of Environmental Protection and Control dated 20.11.2013 (received as part of the stakeholder engagement activities during the ESIA study)
- Official letter from the MoH, Turkish Public Hospitals Institution, Adana Province Public Hospital Union General Secretary dated 28.11.2013 (received as part of the stakeholder engagement activities during the ESIA study)

Waste storage, transport and disposal practices during the construction and operation phases of the Project are required to be in full compliance with the regulatory framework. The Turkish regulations that govern the wastes that will be generated during construction and operation of the Project are as follows:

- Regulation on General Principles of Waste Management (Official Gazette (OG) Date/ Number: 05.07.2008/26927)
- Medical Waste Control Regulation (OG Date/Number: 22.07.2005/25883)
- Solid Waste Control Regulation (OG Date/Number: 14.03.1991/20814)
- Hazardous Waste Control Regulation (OG Date/Number: 14.03.2005/25755)
- Packaging Waste Control Regulation (OG Date/Number: 24.07.2007/26562)
- Waste Oil Control Regulation (OG Date/Number: 30.07.2008/26952)
- Regulation on Control of Waste Batteries and Accumulators (OG Date/Number: 31.08.2004/25569)
- Regulation on Control of Excavated Soil, Construction and Demolition Wastes (OG Date/ Number: 18.03.2004/25406)
- Regulation on Control of Waste Vegetable Oils (OG Date/Number: 19.04.2005/25791)
- Water Pollution Control Regulation (OG Date/Number: 31.12.2004/25687)
- Urban Wastewater Treatment Regulation (OG Date/Number 08.01.2006/26047)
- Regulation on Environmental Permits and Licenses (OG Date/Number: 29.04.2009/27214)
- Communiqué on Road Transportation of Wastes (OG Date/Number: 18.01.2013/28532)
- Regulation on Control of Waste Electrical and Electronic Equipment (OG Date/Number: 22.05.2012/28300)
- Communiqué on Non-hazardous and Inert Waste Recycling (OG Date/Number: 12.05.2010/27579)

In addition to the Turkish regulations, waste management practices for the Project will also need to abide with the following IFC and EBRD Guidelines:

- IFC General EHS Guidelines
- IFC EHS Guidelines for Health Care Facilities

- EBRD Sub-sectoral Environmental and Social Guidelines: Health Services and Clinical Waste Disposal

The Turkish regulatory framework requirements and the conditions set in the IFC and EBRD guidance documents provide inherent mitigation measures against the impacts resulting from waste generation. These conditions were reviewed and discussed in Section 8.7.

8.3.1 Overview of Waste Generation in Adana Province

Wastes that are generated in the Adana Province include solid waste, excavation waste, hazardous waste, medical waste and special wastes as well as domestic wastewater. The types of wastes together with the volume and rates (to the extent information is available) and disposal locations are discussed in the section below.

Domestic Waste: According to the Adana Province Environmental Status Report (2011), a total of 1,500 tons of domestic waste is brought daily to the Adana Integrated Solid Waste Disposal Facility (details are provided in Section 8.3.2.) for landfilling.

Excavation Wastes: Management of the construction and excavation wastes generated within the defined municipal area is within the responsibility of AMM. Presently, these wastes are being used as fill material in excavation waste disposal areas, road construction sites and recreation areas as determined by AMM, Administration of Public Works and Urban Planning. The amount of these excavation wastes was 18,230 m³ in 2011.

Hazardous Wastes: These wastes are either sent to recycling or disposal facilities that have necessary licenses in accordance with the relevant regulations.

Medical Wastes: Medical wastes are collected and transported by the municipal districts of Seyhan, Yuregir, Ceyhan, Saricam and Cukurova using non-compactor trucks that are in compliance with the Medical Waste Control Regulation. Medical wastes are disposed of in the Medical Waste Sterilization Unit of the Adana Integrated Solid Waste Disposal Facility. According to the information given in Adana Province Environmental Status Report (2011), the amount of medical wastes generated in hospitals in the Seyhan, Yuregir and other districts is 7,245 kg per day.

Waste Oils: Waste oils are either sent to recycling or disposal facilities that have necessary licenses in accordance with the relevant regulations. AMM has signed a protocol with PETDER (Petroleum Industry Association – authorized by the MEUP for the collection and transport of waste oils) for the management of waste oils generated at AMM premises.

Waste Batteries and Accumulators: Used batteries are collected in specified locations and then disposed of in compliance with the agreement between AMM and TAP (Portable Battery Manufacturers and Importers Association – authorized by the MEUP). As part of the used battery collection works carried out by AMM, a total of 11,729 kg was collected in 2012. These batteries are transported by TAP to the Adana Integrated Solid Waste Disposal Facility which has a temporary storage unit for waste batteries. Waste accumulators are collected by retailers which sell these products and by car care services as a deposit in return for a new accumulator. Additionally, there are four licensed temporary storage areas for storing used up accumulators.

Domestic Wastewater: The domestic wastewater generated in the Seyhan and Yuregir parts of the Adana Province are being treated in the West (Seyhan) wastewater treatment plant (WWTP) with a fully biological treatment plant (startup date of 2003) and East (Yuregir) WWTP with a full biological treatment plant (startup date of 2007), respectively. Wastewater that is treated in the East WWTP include the domestic wastewater generated and collected from the Yuregir and Saricam Districts which have a population of 422,529 and 120,325, respectively based on the 2011 population census.

Surface Water: The wastewater collection lines in the Adana Province have been designed as separate surface water run-off and domestic wastewater collection lines. However, the Adana Province Environmental Status Report (2011) indicates that the surface water run-off is discharged into the domestic wastewater collection lines at certain locations. The 2012 activity report published by AMM indicates that there are plans to segregate the surface water run-off and domestic wastewater collection lines.

8.3.2 Waste Disposal and Treatment

There are three main waste treatment facilities for the management of the waste stream generated in the Adana Province and its vicinity. These facilities are as follows:

- Adana Integrated Solid Waste Disposal Facility (AISWDF) located in Sofulu
- Licensed recycling and hazardous waste treatment facilities in and outside the Adana Province
- Domestic wastewater treatment plants operated by ASKI

Adana Integrated Solid Waste Disposal Facility

A large part of the wastes to be generated during construction and operation phases will be managed in AISWDF facility which is owned by AMM. The facility is being operated by a third party ITC Invest Trading & Consulting AG since 2011. The facility has the following units:

- **Domestic Waste Sorting Unit:** Domestic waste is collected by the municipality trucks and delivered to the facility for further waste fraction separation. Domestic waste is separated to organic, inert and packaging fractions. The packaging materials in the raw (mixed) domestic waste are sent to the licensed recycling facilities.
- **Anaerobic Fermentation Composting Unit:** Organic part of the domestic waste is composted for further use of compost material.
- **Medical Waste Sterilization Unit:** Medical waste which is collected from hospitals, healthcare units and facilities by AMM is sterilized in the sterilization unit at above 100°C to inactivate the pathogenic life in the waste stream. The sterilized medical waste can be managed as domestic waste. It has a reported treatment capacity of 8-10 tons per day. The sterilization unit meets the Turkish national standards given in the Turkish Medical Waste Control Regulation (OG Date/Number: 22.07.2005/25883). When the European Union legislation for the healthcare wastes was reviewed, it was observed that there was no single Directive, Decision or Regulation referring to the management and disposal of the healthcare wastes specifically. Instead of a single legislative action that directs the handling of wastes from healthcare related facilities (producers), there are a number of Directives, Decisions and Regulations that describe the measures to be taken for various types of wastes (municipal, hazardous, dangerous, toxic etc.). Therefore, there are no EU

regulations specific to the Medical Waste Control Regulations as in Turkey hence there are no specific EU permitting Guidelines to the sterilization of Medical Wastes.

- **Class II Landfill Facility:** Domestic waste and the industrial waste which can be managed as domestic waste are landfilled in the Class II Landfill Facility. Inert part of the raw domestic waste is also landfilled after sorting the step.
- **Energy Production Unit:** Energy is generated from methane gas recovery unit of the landfill. As of May 2012, 6 MW of energy is being produced.
- **Waste Battery Temporary Storage Unit**

The satellite view of the AISWDF is shown in Figure 8-1.



Figure 8-1: AISWDF facility (Source: Adana Provincial Environment Report, 2011)

The photographs of the units in the AISWDF are given below (Source: Adana Provincial Environment Report, 2011).

Photo 1. Waste sorting unit



Photo 2. Waste sorting unit



Photo 3. Composting unit



Photo 4. Energy production unit



Photo 5. Medical waste sterilization unit



Photo 6. Medical waste sterilization unit



Licensed Third Party Waste Management Facilities

The licensed third party waste management facilities in Adana Province have been reviewed from the MEUP website and are listed in Table 8-1. Wastes during the construction and operation of the Project will be managed at the appropriate facility not only according to their class and type but also according to the status (validity) of the facility permit.

Table 8-1: Licensed waste management (recycling / disposal) facilities located in Adana Province

No	Name of Waste Facility	Location	Distance to IHC (~km)	Permit Type	Permit Validity Date
1	Akbulut Geri Dönüşüm Sis. Plas. Kauçuk İnş. Taah. Lojistik Hiz. İthalat İhracat San. Tic. Ltd. Şti. (Akbulut Recycle System Plastic Rubber Construction Commitment Logistics Services Import Export Industry Trade Ltd. Co.)	Seyhan	13	Plastic packaging waste recovery	07.02.2016
2	Erler Boya Tiner Madeni Yağ İmalat Geri Dönüşüm Hırdavat Nak. Kimya San. Tic. Paz. Ltd. Şti (Erler Paint Thinner Mineral Oil Manufacturing Recycle Scrap Transport Chemistry Industry Trade Marketing Ltd. Co.)	Yuregir	24	Hazardous waste recycling	06.09.2016
3	Plasteks Plastik. Tekstil. Ambalaj San ve Tic. A.Ş. (Plasteks Plastic Textile Package Industry and Trade Inc. Co.)	Yuregir	26	Plastic packaging waste recovery	05.04.2017
4	Coruk Hurdacılık ve Tekstil Ticaret Ambalaj Atığı Toplama ve Ayrıştırma Tesisi- Mahmut Coruk(Coruk Garbage Collection and Textile Trade Package Waste Collection and Separation Plant-MahmutCoruk)	Yuregir	26	Packaging waste recycling	04.05.2017
5	Şahinler Otomotiv Nakliye Hurdacılık İnşaat Tarım Turizm Ticaret ve Sanayi Ltd. Şti (Şahinler Automotive Transportation Garbage Collection Construction Agriculture Tourism Trade and Industry Ltd. Co.)	Seyhan	13	End of life vehicles temporary storage	09.05.2017
6	Ersoplast Plastik Sanayi Ticaret Ltd Şti. (Ersoplast Plastic Industry Trade Ltd. Co.)	Yuregir	6	Non-hazardous waste recovery, Packaging waste recovery	14.05.2017
7	4 K Plastik Ambalaj Tur. Taş. Petrol Ürün. Day. Tük. Mal. Tek. Gıda ve Tar.Ür. İnş. İth. İhr. Ltd. Şti. (4 K Plastic Package Tourism Transportation Petroleum Products Durable Consumable Goods Technology Food and Agricultural Production Construction Import Export Ltd. Co.)	Saıçam	21	Plastic packaging waste recovery	11.06.2017
8	Mehmet Otomotiv Ömrünü Tamamlamış Araç Geçici Depolama ve Oto Çıkma Parçaları-Bahri Aldatmaz (Mehmet Automotive End of Life Vehicle Temporary Storage Area and Used Car Parts-Bahri Aldatmaz)	Seyhan	10	End of life vehicles temporary storage	13.07.2017
9	Ögem Plastik Kağıt Ambalaj San. ve Tic. Ltd. Şti. (Ögem Plastic Paper Package Industry and Trade Ltd. Co.)	Seyhan	13	Plastic package waste recovery	02.08.2017
10	Kılıçlar Hurdacılık San. ve Tic. A.Ş. (Kılıçlar Garbage Collection Industry and Trade Inc. Co.)	Seyhan	13	Scrap metal processing, End of life vehicles processing	13.08.2017
11	Adana Çimento Sanayi A.Ş. (Adana CementIndustry Inc. Co.)	Ceyhan	41	Non-hazardous waste recovery, Hazardous waste co-combustion	24.08.2017
12	Toros Tarım Sanayi ve Ticaret A.Ş. Ceyhan Fabrika (Toros Agricultural Industry and Trade Inc. Co. Ceyhan Factory)	Ceyhan	45	Waste acceptance facility	27.08.2017
13	Anka Geri Dönüşüm-Atık Toplama ve Petrol Sanayi ve Ticaret Ltd. Şti./Organize Sanayi Bölgesi Şubesi (Anka Recycle-Waste Collection and Petroleum Industry and Trade Ltd. Co./ Organized Industrial Zone Branch Office)	Yuregir	24	Packaging waste recycling	11.09.2017

No	Name of Waste Facility	Location	Distance to IHC (~km)	Permit Type	Permit Validity Date
14	İsmail Oto Çıkma Yedek Parça-İsmail Üçkardeş (İsmail Automotive Used Car Parts-İsmail Üçkardeş)	Seyhan	11	End of life vehicles temporary storage	17.09.2017
15	Özgür Atermit San. Tic. A.Ş. (Adana) (Özgür Eternit Industry and Trade Inc. Co. (Adana))	Seyhan	13	Packaging waste recovery	03.12.2017
16	Gül-Ak Geri Dönüşüm İnşaat Taahhüt Nakliyat Ticaret ve Sanayi Limited Şirketi (Gül-Ak Recycle Construction Commitment Transportation Industry and Trade Ltd. Co.)	Seyhan	8	Packaging waste recycling	13.12.2017
17	Rengin Otomotiv Yedek Parça Taşımacılık Tekstil Elektronik Eşya İletişim Madencilik İnşaat Sanayi ve Ticaret Limited Şirketi (Rengin Automotive Spare Parts Transportation Textile Electronic Good Communications Mining Construction Industry and Trade Ltd. Co.)	Seyhan	13	End of life vehicles temporary storage	31.12.2017
18	Dönkasan Dönüşen Kağıt Hammaddeleri Sanayi ve Ticaret Anonim Şirketi Adana Şubesi (Dönkasan Transform Paper Raw Materials Industry and Trade Inc. Co.- Adana Branch Office)	Seyhan	20	Packaging waste recycling	15.02.2018
19	Deniz Plastik Gıda San. Tic. Ltd. Şti. (Deniz Plastic Food Industry and Trade Ltd. Co.)	Seyhan	8	Plastic package recovery	05.04.2018
20	Zülfükar Otomotiv 1. Şube - Zülfükar Güneş (Zülfikar Automotive 1 st Branch Office - Zülfükar Güneş)	Seyhan	9	End of life vehicles temporary storage	10.04.2018
21	Çetin-Dağ Kimyasal Ürünler San. Tic. ve Paz. Ltd. Şti. (Çetin-Dağ Chemical Products Industry Trade and Marketing Ltd. Co.)	Seyhan	14	Non-hazardous waste recovery	30.04.2018
22	Mahmut ERDOĞDU	Seyhan	11	Hazardous waste recycling	21.05.2018
23	Meltem Kimya ve Tekstil Sanayi İth. İhr. ve Tic. Ltd. Şti. (Meltem Chemistry and Textile Industry Import Export and Trade Ltd. Co.)	Seyhan	16	Non-Hazardous waste recycling, Hazardous waste recycling	09.07.2018
24	Akasan Adana Kağıt Sanayi ve Ticaret Anonim Şirketi (Akasan Adana Paper Industry and Trade Inc. Co.)	Sarıcam	25	Packaging waste recovery	06.08.2018
25	ITC Invest Trading&Consulting Ag-Türkiye Ankara Şub - Adana Şubesi (ITC Invest Trading & Consulting Ag-Turkey Ankara Branch Office - Adana Branch Office)	Yüreğir	61	Medical waste sterilization, Packaging waste recycling, Class II Landfilling,	11.09.2018
26	Helmed Sağlık Ürünleri Gıda İth. İhr. Ür. Paz. San. ve Tic. Ltd. Şti. (Helmed Medical Products Food Import Export Product Marketing Industry And Trade Ltd. Co.)	Seyhan	13	Packaging waste recovery	21.10.2018
27	Yılmaz Ambalaj Atıkları Geri Dön. San.ve Tic. Ltd. Şti. (Yıldız Package Waste Recycle Industry and Trade Ltd. Co.)	Seyhan	13	Packaging waste recycling, Packaging waste recovery	21.10.2018

Source: MEUP Website

8.3.3 Domestic Wastewater Treatment Plant

The domestic wastewater generated in the Seyhan and Yuregir parts of the Adana Province are being treated in the West (Seyhan) WWTP and East (Yuregir) WWTP, respectively. Both WWTPs are licensed by the MEUP. The West WWTP discharges directly into an irrigation water drainage channel (TD8) whereas the East WWTP discharges directly into the Seyhan River. The domestic wastewater from the Adana IHC will be treated in the East WWTP located in Yuregir. The East WWTP has the following components:

- Coarse and fine screens
- Aerated grit chamber
- Primary sedimentation tanks
- Sludge thickener lagoons
- Aeration tanks
- Secondary sedimentation tanks

Energy is being produced from anaerobic sludge digester which produces up to 40% of the facility electricity requirements. Sludge is generated at a rate of 50-60 tons per day which is being dried by spreading on land followed by disposal at the Sofulu landfill.

The existing and planned treatment capacities for the East WWTP are given in Table 8-2.

Table 8-2: Design and operating parameters for East Adana WWTP

Project Target Date	First Stage	2015	2025
Total Equivalent Population	531,940 E.N50	709,255 E.N50	924,000 E.N50
Daily Flow Rate	128,208 m ³ /day	170,940 m ³ /day	203,972 m ³ /day
Entrance BOD ₅ Value		207,5 mg/lit	249 mg/lit
Total BOD ₅ Value		35,463 kg/day	50,798 kg/day

Source: ASKI Activity Report, 2012

According to the ASKI Activity Report dated 2012, East WWTP has been designed considering effluent quality as Biochemical oxygen demand (BOD₅) ≤ 35 mg/L; Chemical Oxygen Demand (COD) ≤ 90 mg/L; suspended solids ≤ 25 mg/L; and the effluent quality data for year 2012 is provided in Table 8-3.

Table 8-3: East WWTP influent and effluent results for year 2012

Year: 2012	Wastewater Quantity	Effluent Quality (Average)		
Capacity	Influent	BOD ₅	COD	TSS
Unit	m ³ /month	mg/L	mg/L	mg/L
Design Value/ Regulation Limit	3,846,150	<=35	<=90	<=25
January	2,528,322	12.00	43.00	11.00
February	2,592,353	13.00	38.00	12.00
March	3,035,370	12.00	44.00	11.00
April	2,858,555	14.00	35.00	8.00
May	2,873,877	24.00	42.00	11.00
June	2,768,716	25.00	30.00	9.00
July	2,609,951	16.00	31.00	9.00
August	2,435,289	17.00	34.00	13.00
September	2,567,687	16.00	44.00	12.00
October	2,387,336	16.00	37.00	9.00
November	2,229,706	17.00	46.00	14.00
December	2,237,108	24.00	55.00	7.00
Total	31,124,270			
Average (daily)	85,272	18.18	42.55	11.91
WPCR*		35	90	45
EU** Directive and Turkish*** Regulation		25	125	35
IFC EHS Guideline		30	125	50

Source: Adana Water and Sewage Administration Activity Report, 2012

* Water Pollution Control Regulation (31.12.2004/ 25687)

**EU Urban Wastewater Treatment Directive (91/271/EEC)

***Urban Wastewater Treatment Regulation (08.01.2006 /26047)

It has been reported that there are odor problems in the East WWTP according to the Adana Environmental Status Report (2011). It has also been reported in the literature that due to the collection of surface water within the wastewater collection lines, the East WWTP may not be appropriately operational during high intensity rainfall periods.

During operation, there will be water uses related to general domestic and sanitary use (including laundry), food preparation processes, sterilizers and autoclaves, X-ray equipment (water used in the processing of prints) and water used for gardens (if they are irrigated). A daily water consumption value per capita per bed was identified to vary between 1.13 m³/day (Altin et al., 1999) and 1.60 m³/day (data for large hospitals in the U.S. (U.S. Energy Information Administration, 2007)). Water consumption of the IHC is predicted to vary between 1,750 and 2,480 m³/day. All the water consumed is assumed to be converted into wastewater and will be discharged into municipality sewer lines. The treatment capacity of the East WWTP is 128,000 m³/day. The existing wastewater flow coming in to the East WWTP is 85,272 m³/day and the IHC wastewater load will represent less than 3% maximum increase in the existing flow rate indicating that this will still be within the treatment capacity of the WWTP.

8.4 Waste Generation and Management during the Construction Phase

The types of wastes that will be generated during construction phase include domestic waste, excavation waste, packaging waste, hazardous waste, special waste and medical waste. The list of these wastes, proposed management practices and relevant risks related to the load on existing management facilities are given in Table 8-4.

Table 8-4: Waste characteristics and disposal methods during construction activities

Waste Class	Waste Type	Waste Code	Characteristics	Governing Regulation	Proposed Management	Disposal Method	Risks
Domestic Waste	Solid Wastes	20 03 01	Non-hazardous- Household waste from the camp sites	Solid Waste Control Regulation (OG Date/Number: 14.03.1991/20814)	Impermeable and sealed waste containers	Sofulu (AISWDF) Class II Landfill Facility	Low Risk. Facility already in use and has adequate capacity to receive waste
	Domestic Wastewater	20 03 01	Generated by workers at the campsites and during construction activities (estimated as 445 m ³ /day)	Water Pollution Control Regulation (OG Date/Number: 31.12.2004/25687)	Direct discharge into the nearby municipal wastewater collection line	East Adana WWTP	Low Risk. Number of workers represent a small increase in the wastewater being generated in the region and for treatment at the WWTP
Excavation Waste	Excavated material-non contaminated	17 05 04	Non contaminated natural soil material due to levelling and excavation for foundations (estimated to be 600,000 m ³)	Regulation on Control of Excavated Soil, Construction and Demolition Wastes (OG Date/Number: 18.03.2004/25406)	Temporary piling on ground within construction site with care against dust generation and surface runoff	Excavation disposal area that is licensed and approved by Municipality.	High Risk. Excavated volume is large and there may not be a suitable area to dispose of the material
Packaging waste	Recyclable metal and glass waste	15 01 04 (metal) 15 01 07 (glass)	Non hazardous - Generated from packaging of products brought to the site that will include certain plastic materials, textile waste Nonhazardous-Metal wastes shall be disposed separately for reuse and recycling.	Packaging Waste Control Regulation (24.07.2007/26562) Communiqué on Non-hazardous and Inert Waste Recycling (OG Date/Number:12.05 .2010/27579)	Impermeable and sealed waste containers	Sofulu (AISWDF) domestic waste separation facility or any licensed facility listed in Table 8-1 for packaging waste recycling	Low Risk. Facilities already in use and has adequate capacity to receive waste
Special Wastes	Waste oils	13 01 ... 13 02 ... Code to be defined based on type of waste oil	Hazardous materials- Generated from upkeep and use of construction equipment	Waste Oil Control Regulation (OG Date/Number: 30.07.2008/26952)	Waste oils will be segregated and stored based on the waste oil category.	Licensed waste oil recycling facilities listed in Table 8-1 or outside the Province of Adana.	Low Risk. Waste oil collection, transport and disposal/ recycling are common practice that are well regulated by MEUP

Waste Class	Waste Type	Waste Code	Characteristics	Governing Regulation	Proposed Management	Disposal Method	Risks
	Waste Batteries Waste Accumulators	20 01 33* 16 06 01*	Generated from construction equipment used at the site	Regulation on Control of Waste Batteries and Accumulators (OG Date/Number: 31.08.2004/25569)	Stored in special containers and areas as in line with the regulations. Waste batteries to be forwarded to TAP and waste accumulators to dealers	Sofulu (AISWDF) Temporary waste batteries collection unit.	Low Risk since this is an established practice and the waste batteries and accumulators will not represent a large increase in the existing waste stream.
Hazardous wastes	Pharmaceutical waste, liquid fuel, chemical substances, antifreeze, vehicle/engine filters, oiled textile, old filters, polluted soil, etc.		Hazardous wastes can mainly be generated during maintenance of vehicles.	Hazardous Waste Control Regulation (OG Date/Number: 14.03.2005/25755)	Hazardous wastes will be segregated and stored based on the waste code. Wastes shall be temporarily stored on a designated area and labeled with special signs. These areas will be covered and sealed areas that will be separated from other types of wastes generated on the site. The hazardous wastes will be stored for a maximum of 6 months on the site. The areas will have an impermeable surface and will be designed to contain any spillages or leakage of hazardous wastes.	Licensed waste recycling and disposal facilities including the ones listed in Table 8-1 in the Adana region as well as those outside of the Province (i.e. Izaydaş).	Low Risk. Hazardous waste collection, transport and disposal are common practice that are well regulated by MEUP.
	Excavated material-contaminated	17 05 03*	Contaminated natural soil material due to levelling and excavation for foundations- specifically from area where DSI vehicle maintenance activities were taking place (estimated to be around 1% of the total excavated material which makes 6,000 m ³)	Regulation on General Principles of Waste Management (OG Date/Number: 05.07.2008/26927)	Temporary piling on ground within construction site with care against dust generation and surface runoff and surface soil contamination. Needs to directly truck the material off-site without temporary storage.	Sofulu (AISWMF) Class II Landfill Facility if levels of contamination in the leached solution pass the leachate test given in Hazardous Waste Control Regulation (HWCR). Izaydas Izmit Facility Class I if levels of contamination in the leached solution fail the leachate test given in HWCR.	Low Risk. Either one of these solutions is feasible and comply with the regulatory framework.
Medical Waste	Infectious waste, pathological waste, sharps waste	18 01 ...* 18 02 ...*	Generated from infirmary during construction	Medical Waste Control Regulation (OG Date/Number: 22.07.2005/25883)	Stored in special containers and areas in line with the regulations. Medical waste to be collected by dedicated AMM trucks.	Sofulu (AISWDF) Medical Waste Sterilization Unit:	Low Risk since the medical waste sterilization unit is in place and the medical waste generation amounts represent a negligible increase in the existing waste stream.

8.5 Waste Generation and Management during the Operation Phase

The waste categories that will be generated during the operation phase include medical wastes, hazardous and non-hazardous wastes, domestic wastes and wastewater. Specific waste categories, expected amounts of waste to be generated, relevant waste codes and potential disposal locations have been assessed in this section. Of specific importance for the operation phase, focus has been given to the healthcare waste (including medical waste, some types of hazardous wastes and other types of waste such as radioactive waste).

One of the critical aspects is the estimation of medical waste amount to be generated during the operation of the IHC and the suitability of the existing Sofulu waste management facilities to handle these wastes. As mentioned previously, the Sofulu facility has a Medical Waste Sterilization Unit where presently the medical waste which is collected from hospitals, healthcare units and facilities by AMM is sterilized. It has a reported treatment capacity of 8-10 tons per day. In order to identify the amount of healthcare waste to be generated during the operation of the IHC, literature survey was conducted to determine waste generation ratios per bed.

As Adana Province is a regional hub, the province serves both the patients from the residents of the province and patients coming from the surrounding districts and provinces. Daily amount of medical waste per bed calculated according to the information collected from medical institutions was covered in the research by Ege and Budak (2012) and presented in Table 8-5 and Table 8-6 for Adana Province and for several other provinces in Turkey, respectively. It was indicated in the research that there are many factors that have an impact on daily medical waste amount per bed including the economical structure of the provinces, technical infrastructure of medical institutions, bed occupancy rates, hospital's field of activity and bed capacities of the private branch hospitals leading to different amount of wastes among various provinces.

Table 8-5: Medical waste generation in Adana hospitals (kg/day/bed) (Ege and Budak, 2012)

Hospital Type	2006	2007	2008
University Hospital	0.91	1.02	1.32
Training and Research Hospital	0.52	0.43	0.61
Chest Hospital	0.14	0.16	No data
Psychiatric Hospital	0.01	0.01	0.009
Maternity and Childcare Hospital	0.54	0.98	1.18
State Hospital	0.41	0.63	0.54
City Average	0.51	0.67	0.85

Table 8-6: Medical waste generation in Turkey (kg/day/bed) (Ege and Budak, 2012)

Medical waste amount	kg/bed-day
Turkey average (Demir <i>et al.</i> , 2002)	0.66
Istanbul (Birpınar, 2008)	0.63
Edirne (Uysal and Tinmaz, 2004)	0.28
Kırklareli (Uysal and Tinmaz, 2004)	0.49
Tekirdağ (Uysal and Tinmaz, 2004)	0.82
Konya (Evirgen, 2007)	1.08
Bursa (Varınca <i>et al.</i> , 2009)	1.15

An assessment was also carried out by Adana Numune Training and Research Hospital (Ege and Budak, 2012) to determine the ratio of medical wastes to general hospital waste. The assessment study was carried out in the main building of the mentioned hospital with a bed capacity of 510. Daily domestic waste, medical waste, glass waste, packaging waste and paper waste generated in the hospital were separated and weighed. Data acquired from this study is provided in Table 8-7.

Table 8-7: Ratio of medical wastes to general hospital waste in the Adana Numune Training and Research Hospital (Ege and Budak, 2012)

Waste type	Average amount of waste (kg)	Waste amount per bed (kg/bed/day)	%
Medical waste	500	0.98	28
Domestic waste	1,200	2.35	68
Glass waste	38	0.07	2
Paper waste	35	0.07	2
Total amount of waste	1,773	3.47	100

In accordance with the IFC EHS Guidelines for Health Care Facilities, the healthcare wastes are categorized into infectious wastes (including pathological waste), sharps, pharmaceutical waste, genotoxic/cytotoxic waste, chemical waste, radioactive waste, waste with high content of heavy metals, pressurized containers and general healthcare waste. Each of these classifications has a separate waste code and suitable disposal method in accordance with the Turkish regulations. Based on the above mentioned information and the information on the distribution percentages of different types of medical waste obtained from World Health Organization (1999), medical waste and domestic waste generation during IHC operation have been estimated as provided in Table 8-8.

Table 8-8: IHC Project waste generation rates

Waste type	Waste amount per bed (kg/bed/day)	%	Waste Amount (kg/day)
Medical waste	0.85*	100	1,317.5
- infectious		37.5	494
- pathologic		37.5	494
- pharmaceutical		5	66
- sharps		5	66
- Genotoxic/ cytotoxic waste		2	26
- chemical waste		10	132
- high levels of metal content		2	26
- pressurized containers		1	13
Domestic Waste	2.35**	100	3,642.5
- Non-recyclable		95	3460
- Metal (recyclable)		2.5	91
- Plastics (recyclable)		2.5	91

*the average value for the year 2008 as provided in Table 8-5 is used considering that it represents the average in the Province.

**the value in Table 8-7 is used.

Table 8-9 (developed based on the information provided in IFC EHS Guidelines for Health Care Waste) provides guidelines for the wastes anticipated to be generated during the IHC operation based on the classification made together with waste codes, best practice disposal methods as defined in the mentioned IFC guideline and the likely disposal method that will be used for the Project.

Table 8-9: Wastes anticipated to be generated during the operation of the IHC and the management options

Type of waste	Waste Code	Type of waste Summary of treatment and disposal options / notes	Anticipated Amount	Waste Transporter	Waste Management Facility
Infectious waste: Includes waste suspected to contain pathogens (e.g. bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. Infectious waste belongs to medical waste classification according to the Turkish Environmental Legislation.	18 01 03* 18 02 02*	Waste Segregation Strategy: Yellow or red colored bag / container, marked “infectious” with international infectious symbol. Strong, leak proof plastic bag, or container capable of being autoclaved. Treatment: Chemical disinfection; Wet thermal treatment; Microwave irradiation; Safe burial on hospital premises; Sanitary landfill; Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator) - Highly infectious waste, such as cultures from lab work, should be sterilized using wet thermal treatment, such as autoclaving.	494 kg/day	Adana Metropolitan Municipality	Medical Waste Sterilization Plant: 1. Adana Integrated Solid Waste Management Facility, Medical waste Sterilization Unit
Pathologic waste: Includes pathological and anatomical material (e.g. tissues, organs, body parts, human fetuses, animal carcasses, blood, and other body fluids), clothes, dressings, equipment/ instruments, and other items that may have come into contact with infectious materials. Pathological waste belongs to medical waste classification according to the Turkish Environmental Legislation.	18 01 02*	- Anatomical waste should be treated using Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator).	494 kg/day	Licensed Waste Transportation Company	Hazardous and Medical Waste Incineration Facility: 1. IZAYDAS Hazardous Waste Incineration Plant (body parts cannot be accepted to the plant)
Sharps: Includes needles, scalpels, blades, knives, infusion sets, saws, broken glass, and nails etc. Sharps waste belongs to medical waste classification according to the Turkish Environmental Legislation.	18 01 01* 18 02 01*	Waste Segregation Strategy: Yellow or red color code, marked “Sharps”. Rigid, impermeable, puncture-proof container (e.g. steel or hard plastic) with cover. Sharps containers should be placed in a sealed, yellow bag labeled “infectious waste”. Treatment: Chemical disinfection; Wet thermal treatment; Microwave irradiation; Encapsulation; Safe burial on hospital premises; Incineration (Rotary kiln; pyrolytic incinerator; single-chamber incinerator; drum or brick incinerator) - Following incineration, residues should be landfilled. - Sharps disinfected with chlorinated solutions should not be incinerated due to risk of generating POPs. - Needles and syringes should undergo mechanical mutilation (e.g. milling or crushing) prior to wet thermal treatment	66 kg/day	Adana Metropolitan Municipality	Medical Waste Sterilization Plant: 1. Adana Integrated Solid Waste Management Facility, Medical waste Sterilization Unit

Type of waste	Waste Code	Type of waste Summary of treatment and disposal options / notes	Anticipated Amount	Waste Transporter	Waste Management Facility
Pharmaceutical waste: Includes expired, unused, spoiled, and contaminated pharmaceutical products, drugs, vaccines, and sera that are no longer needed, including containers and other potentially contaminated materials (e.g. drug bottles vials, tubing etc...). Pharmaceutical waste belongs to hazardous waste classification according to the Turkish Environmental Legislation	18 01 08*	Waste Segregation Strategy: Brown bag / container. Leak-proof plastic bag or container. Treatment: Sanitary landfill; Encapsulation; Discharge to sewer; Return expired drugs to supplier; Incineration (Rotary kiln; pyrolytic incinerator); Safe burial on hospital premises as a last resort. - <u>Small quantities:</u> Landfill disposal acceptable, however cytotoxic and narcotic drugs should not be landfilled. Discharge to sewer only for mild, liquid pharmaceuticals, not antibiotics or cytotoxic drugs, and into a large water flow. Incineration acceptable in pyrolytic or rotary kiln incinerators, provided pharmaceuticals do not exceed one percent of total waste to avoid hazardous air emissions. Intravenous fluids (e.g. salts, amino acids) should be landfilled or discharged to sewer. Ampoules should be crushed and disposed of with sharps. - <u>Large quantities:</u> Incineration at temperatures exceeding 1200 °C. Encapsulation in metal drums. Landfilling not recommended unless encapsulated in metal drums and groundwater contamination risk is minimal	66 kg/day	Licensed Waste Transportation Company	Hazardous waste incineration facility: 1. IZAYDAS Hazardous Waste Incineration Plant
Genotoxic / cytotoxic waste: Genotoxic waste may have mutagenic, teratogenic, or carcinogenic properties, and typically arises from the feces, urine, and vomit of patients receiving cytostatic drugs, and from treatment with chemicals and radioactive materials. Cytotoxic drugs are commonly used in oncology and radiology departments as part of cancer treatments. Genotoxic / cytotoxic waste belong to hazardous waste according to the Turkish Environmental Legislation	18 01 08*	Waste Segregation Strategy: See above for “infectious waste”. Cytotoxic waste should be labeled “Cytotoxic waste”. Treatment: Return expired drugs to supplier; Chemical degradation; Encapsulation; Inertization; Incineration (Rotary kiln, pyrolytic incinerator); - Cytotoxic waste should not be landfilled or discharged to sewer systems. - Incineration is preferred disposal option. Waste should be returned to supplier where incineration is not an option. Incineration should be undertaken at specific temperatures and time specifications for particular drugs. Most municipal or single chamber incinerators are not adequate for cytotoxic waste disposal. Open burning of waste is not acceptable. - Chemical degradation may be used for certain cytotoxic drugs - Encapsulation and inertization should be a last resort waste disposal option	26 kg/day	Licensed Waste Transportation Company	Hazardous waste incineration facility: 1. IZAYDAS Hazardous Waste Incineration Plant

Type of waste	Waste Code	Type of waste Summary of treatment and disposal options / notes	Anticipated Amount	Waste Transporter	Waste Management Facility
Chemical waste: Waste may be hazardous depending on the toxic, corrosive, flammable, reactive, and genotoxic properties. Chemical waste may be in solid, liquid, or gaseous form and is generated through use of chemicals during diagnostic/ experimental work, cleaning, housekeeping, and disinfection. Chemicals typically include formaldehyde, photographic chemicals, halogenated and non-halogenated solvents, organic chemicals for cleaning/disinfecting, and various inorganic chemicals (e.g. acids and alkalis). Chemical waste belongs to hazardous waste according to the Turkish Environmental Legislation	18 01 06*	Waste Segregation Strategy: Brown bag / container. Leak-proof plastic bag or container resistant to chemical corrosion effects. Treatment: Return unused chemicals to supplier; Encapsulation; Safe burial on hospital premises; Incineration (Pyrolytic incinerator); - Facilities should have permits for disposal of general chemical waste (e.g. sugars, amino acids, salts) to sewer systems. - <u>Small hazardous quantities</u>: Pyrolytic incineration, encapsulation, or landfilling. - <u>Large hazardous quantities</u>: Transported to appropriate facilities for disposal, or returned to the original supplier using shipping arrangements that abide by the Basel Convention. Large quantities of chemical waste should not be encapsulated or landfilled.	132 kg/day	Licensed Waste Transportation Company	Hazardous waste incineration facility: 1. IZAYDAS Hazardous Waste Incineration Plant
Radioactive waste: Includes solid, liquid, and gaseous materials that have been contaminated with radionuclides. Radioactive waste originates from activities such as organ imaging, tumor localization, radiotherapy, and research/ clinical laboratory procedures, among others, and may include glassware, syringes, solutions, and excreta from treated patients.		Waste Segregation Strategy: Lead box, labeled with the radioactive symbol. Treatment: Radioactive waste should be managed according to national requirements and current guidelines from the International Atomic Energy Agency (IAEA (2003), Management of Waste from the Use of Radioactive Materials in Medicine, Industry and Research. IAEA Draft Safety Guide DS 160, 7 February 2003).		Inform TAEK (Turkish Atomic Energy Authority)	Inform TAEK (Turkish Atomic Energy Authority)
Waste with high content of heavy metals: Batteries, broken thermometers, blood pressure gauges, (e.g. mercury and cadmium content). The waste may belong to special waste or hazardous waste classification due		Waste Segregation Strategy: Waste containing heavy metals should be separated from general healthcare waste. Treatment: Safe storage site designed for final disposal of hazardous waste. - Waste should not be burned, incinerated, or landfilled. Transport to specialized facilities for metal recovery.	26 kg/day	Licensed Waste Transportation Company	Hazardous waste recycling/disposal facility Authorized Battery Recycler: TAP for batteries

Type of waste	Waste Code	Type of waste Summary of treatment and disposal options / notes	Anticipated Amount	Waste Transporter	Waste Management Facility
to the waste types.					
Pressurized containers: Includes containers / cartridges / cylinders for nitrous oxide, ethylene oxide, oxygen, nitrogen, carbon dioxide, compressed air and other gases. Pressurized containers belong to hazardous waste classification.		Waste Segregation Strategy: Pressurized containers should be separated from general healthcare waste. Treatment: Recycling and reuse; Crushing followed by landfill - Incineration is not an option due to explosion risks - Halogenated agents in liquid form should be disposed of as chemical waste, as above.	13 kg/day	Licensed Waste Transportation Company	Hazardous waste incineration facility: 1. IZAYDAS Hazardous Waste Incineration Plant
General health care waste (including food waste and paper, plastics, cardboard): Food waste belongs to domestic waste and the others belong to packaging waste classification.	20 03 01 15 01 04 (metal) 15 01 07 (glass)	Waste Segregation Strategy: Black bag / container. Halogenated plastics such as PVC should be separated from general healthcare facility waste to avoid disposal through incineration and associated hazardous air emissions from exhaust gases (e.g. hydrochloric acids and dioxins). Treatment: Disposal as part of domestic waste. Food waste should be segregated and composted. Component wastes (e.g. paper, cardboard, recyclable plastics [PET, PE, PP], glass) should be segregated and sent for recycling.	3,460 kg/day (domestic waste) 91 kg/day (metal) 91 kg/day (glass)	Adana Metropolitan Municipality Licensed Recycling Facility Vehicle	Domestic Waste Disposal Facility: 1. Adana Integrated Solid Waste Management Facility(Food waste) Packaging waste Recycling Facility

IFC Guidelines indicated that often the wastewater quality from healthcare facilities has a quality similar to urban wastewater. However, contaminated wastewater may result from discharges from medical wards and operating theaters (e.g. body fluids and excreta, anatomical waste), laboratories (e.g. microbiological cultures, stocks of infectious agents), pharmaceutical and chemical stores; cleaning activities (e.g. waste storage rooms), and x-ray development facilities. Wastewater may also result from treatment disposal technologies and techniques, including autoclaving, microwave irradiation, chemical disinfection, and incineration (e.g. treatment of flue gas using wet scrubbers which may contain suspended solids, mercury, other heavy metals, chlorides, and sulfates).

There will be no separate WWTP within the IHC, however as reported by ADN PPP A.Ş., wastewater from departments within the IHC will be collected via different piping systems and discharged directly into the sewer system, except for the wastewater that is contaminated with radioactive substances (i.e. from nuclear medicine department) which will be collected separately and/or subject to neutralization prior to being discharged into the sewer system. It is important to note that several conditions are set for liquid wastes contaminated with radioactive substances in the Regulation on Wastes Generated upon Usage of Radioactive Substances (OG date/no: 02.09.2004/25571) related to discharging this type of wastewater into the sewer system. These conditions as given below will need to be met during the operation phase:

- Liquid wastes that remain within the limit values set forth in the regulation can be discharged by diluting into the sewer system from a sink having a standard radioactive substance mark and this sink shall not be used for work other than radioactive studies.
- Liquid wastes containing radioactive substances above the limits set forth in the regulation are kept in waste holding systems whose projects are approved by the TAEK. After being kept in holding systems, the liquid wastes can be discharged into the sewer system if they remain within the limit values set forth in the regulation.
- All radioisotopes in liquids (that are to be released into the sewer system) should be soluble and dispersible. If the liquid waste contains solid particles or precipitates that are not soluble, the liquid waste should be filtrated prior to discharging into the sewer system.
- Acidic solutions containing radioisotopes should be neutralized prior to discharging into the sewer system.
- If the liquid waste having radioactivity contains hazardous substances or other chemical substances, permits should be obtained by the license owner (described as the institutions that obtained a license from the TAEK for keeping and using radioactive substances as per the Radiation Safety Regulation – it is expected that the responsibility will lie with MoH) from authorities as per the Environmental Law and relevant legislation before discharging into the sewer system.

As per the mentioned regulation, if the liquid wastes contain radioactivity higher than the limit values covered in above requirements, these wastes are not allowed to be discharged into the environment and application is required to be made to the TAEK by the license owner related to procedures to be applied for such wastes.

8.6 Potential Impacts

Noncompliance with storage, transport and final disposal according to the Turkish regulatory framework was deemed to constitute a major impact. The existing Turkish regulatory framework

has been modelled to be parallel to the EU Waste Legislative framework. The previous discussions indicate that the Turkish regulatory framework is in place for assigning specific waste codes to each of the waste stream to be generated in the construction and operation phases. Furthermore, the waste disposal infrastructure for domestic, medical, hazardous and wastewater streams are available and operational in the Province of Adana as well as outside the Province boundaries. The impacts of the generated wastes can be considered negligible if the IHC Project complies with the applicable regulations during construction and operation including disposal of the waste stream in licensed facilities given in Table 8-1. The medical waste that will be generated in total is expected to be 1.3 ton/day. The relevant authorities have been contacted by the ADN PPP A.Ş. to secure confirmation regarding the disposal of the wastewater and medical waste for the operation phase. The authorities had not yet responded at the time of the ESIA report preparation.

Construction Phase

Solid wastes likely to be generated during construction will include excavation waste, contaminated soils, sanitary and domestic wastes from site offices and kitchens and clean-up materials from accidental spills. If not handled and disposed of in an appropriate manner, the generation of these wastes can give rise to major impacts. All wastes during construction can be managed in line with the waste management plan (WMP) given in Annex H; and the regulatory framework which will render the impact of solid wastes negligible with the exception of the excavated soil.

Excavated soil has the potential to cause local nuisance due to dust generation during construction phase which will require disposal in a licensed excavated soil and construction debris disposal facility. The volume of excavated material from the site will be large and a potential disposal area for the excavated soil has been identified with the appropriate storage capacity. Figure 8-2 shows the area -within the Cukurova University grounds- that was used as a borrow material for the Seyhan Dam construction which was never refilled. Initial contacts between ADN PPP A.Ş. and the University Officials indicate a high likelihood for use of the area as disposal and land reclamation project.



Figure 8-2: Potential disposal area for excavated soil

Excavated soil which is contaminated at the site has a major potential for pollution of land, surface water and groundwater if not segregated from the clean excavated soil, transported and disposed of properly. The impacts can be minimized only if there is a site survey conducted to identify the extent of the contaminated soil and proper segregation is performed at the site. Contaminated soils can be disposed in suitable licensed facilities following testing for hazardous contents. The impacts can be considered negligible if these actions are taken.

Any oil and/or chemical spills during maintenance activities at the workshops during construction may create health and safety impacts as well as environmental impacts. Related impacts may vary from minor to major significance depending on the amount of spills, the environment where the spill has occurred and the response time to the incident. Clean-up materials such as spill kits should be managed as hazardous waste and disposed of appropriately.

Domestic solid waste, especially the organic part from foods, attracts vermin and other disease carriers. Also if not managed properly, the solid wastes generate irritant odor in and around the Project area. The domestic waste will need to be appropriately collected, stored and disposed off site in accordance with the regulatory framework.

If not managed properly, special waste such as waste mineral oils, waste vegetable oils, battery and accumulators, waste electronic and electronic equipment, can also give rise to adverse impacts to human and environmental health. These wastes must be managed appropriately during construction in line with the regulations and disposed in licensed facilities.

Domestic wastewater generated during construction phase, if not managed properly, can have significant adverse effects on the environment. The wastewater discharge will need to be connected to a nearby wastewater collection line to be treated by the East WWTP. The daily wastewater discharge is expected to be 445 m³ which will be within the treatment capacity of the East WWTP.

Operation Phase

Healthcare wastes (particularly medical wastes) may cause extremely adverse impacts in human and environmental health if managed improperly. Table 8-8 shows that there will be a substantial amount of medical waste which will be generated during operation. The amount of healthcare waste that will be expected to be generated is 1,315 kg/day with the breakdown in categories given in Table 8-9. The Sofulu facility has a Medical Waste Sterilization Unit where presently the medical waste which is collected from hospitals, healthcare units and facilities by AMM is sterilized. It has a reported treatment capacity of 8-10 tons per day which is not fully utilized presently. The IHC will not create medical waste treatment overload on the sterilization unit at Sofulu facility. Table 8-9 also shows that there are adequate numbers of facilities that are licensed and can be used for disposal of healthcare waste stream that will be generated by the IHC. Therefore, the healthcare wastes can be disposed of properly without any adverse impact.

Domestic wastewater generated in healthcare facilities will contain a variety of pathogens, organic pollutants, nitrogen, phosphorous and suspended solids due to its sewage content. If not managed properly, discharge of untreated domestic wastewater can have major impact on the water supplies and the local population. Proper management during operation phase is an essential step to protect public and environmental health. Water consumption of the IHC is predicted to vary

between 1,750 and 2,480 m³/day. All the water consumed is assumed to be converted into wastewater and will be discharged into municipality sewer lines. The treatment capacity of the East WWTP is 128,000 m³/day. The existing wastewater flow coming into the East WWTP is 85,272 m³/day and the IHC wastewater load will represent less than 3% maximum increase in the existing flow rate indicating that this will still be within the treatment capacity of the WWTP. Therefore, the risk of inadequate treatment from the existing East WWTP is negligible.

It should be noted that contaminated wastewater may result from discharges from medical wards and operating theaters, pharmaceutical and chemical stores; cleaning activities (e.g. waste storage rooms), and x-ray development facilities. Wastewater may also result from treatment disposal technologies and techniques, including autoclaving, microwave irradiation, chemical disinfection, and incineration (e.g. treatment of flue gas using wet scrubbers which may contain suspended solids, mercury, other heavy metals, chlorides and sulfates). These waste streams will need to be collected separately, otherwise there will be a major impact if the domestic wastewater stream is contaminated with this wastewater and the legal wastewater limits are not met for discharging into the municipal wastewater collection lines.

If not managed properly, special waste such as waste mineral oils, waste vegetable oils, battery and accumulators, waste electronic and electronic equipment, can also give rise to adverse impacts to human and environmental health. These wastes must be managed appropriately during operation in line with the regulations and disposed in licensed facilities.

The domestic waste that will be generated in the hospital is expected to be 3.5 tons/day which is a negligible increase in the 1,500 tons/day being collected and disposed of by AMM in the Adana Province.

Hazardous waste has the potential for pollution of land, surface water and groundwater as other waste classes; however, the consequences of inadequate management of hazardous waste are more serious than pollution by other waste classes. Direct contact with toxic components or uptake of those components such as heavy metals through the food chain may cause significant impacts to human and environmental health. The hazardous wastes that have been identified need to be disposed at the appropriate licensed facilities that are given in Table 8-1. There will be negligible risk in disposing of the hazardous wastes generated during the operational phase of the IHC.

The previous discussions indicate that the Turkish regulatory framework is in place for assigning specific waste codes to each of the waste stream to be generated in the construction and operation phases. Furthermore, the waste disposal infrastructure for domestic, medical, hazardous and wastewater streams are available and operational in the Province of Adana as well as outside the Province boundaries. The impacts related to regulatory non-compliance and improper disposal with Turkish, EU Regulatory framework and IFC EHS guidelines can be considered negligible for disposal and treatment aspects. However, the management of these wastes needs to be performed adequately to ensure that the stages of temporary storage and management within the facilities do not cause adverse impacts which may range between minor to major impacts if these wastes are not managed properly. These are discussed in the following section.

8.7 Mitigation Measures

The following mitigation measures will be implemented related to waste management:

- Necessary permits related with disposal of excavated soil during construction phase will be obtained from the local environmental authorities. Relevant authorities have been contacted for the permitting process and responses were being awaited at the time of the ESIA report preparation. An appropriate disposal facility has been identified for the disposal of excavated soil..
- The excavation waste will be disposed in line with Regulation on Control of the Excavated Soil, Construction and Demolition Wastes. Contaminated soils will be disposed in line with the Regulation on Soil Pollution Control and Point Source Contaminated Sites.
- A Soil Sampling Plan will be developed in order to separate the clean and contaminated soils during earthworks at the DSI vehicle maintenance area. The sampling plan will be conducted following the approval of the Final Draft ESIA Report by the FIs.
- The waste management practices given in the IFC EHS guidelines for Health Care Facilities will be implemented.
- The IHC will establish, operate and maintain a Healthcare Waste Management System adequate for the scale and type of activities and identified hazards.
- All waste will be collected, segregated, labeled and stored on site according to the Waste Management Plan (WMP) as provided in Annex H that has been developed for the Project. The WMP addresses waste minimization, segregation, labeling, storage, transportation and recycling/disposal to meet the national and international standards.
- Domestic wastewater discharge will be done to the municipality infrastructure and the necessary permits and protocols will be maintained for connection to the municipal sewer system.
- Procedures and mechanisms will need to be in place for the separate collection of urine, feces, blood, and vomit from patients treated with geno-toxic drugs to avoid their entry into the wastewater stream. Necessary measures will be taken for liquid wastes contaminated with radioactive substances as per the Regulation on Wastes Generated upon Usage of Radioactive Substances (OG date/no: 02.09.2004/25571) related to discharging this type of wastewater into the sewer system.
- All wastes must be segregated according to their category and will be disposed of at relevant licensed facilities in accordance with regulatory requirements. Record keeping about waste generation, storage and transportation to third party waste management facilities will be maintained according to the details given in WMP. Periodic inspections will be conducted in the waste recycling/disposal facilities to ensure proper disposal practices are implemented.
- TAEK should be informed due to the radioactive waste generation and the radioactive waste management options should be identified prior to implement any practice with TAEK.

The following requirements have been suggested in the letter received from MoH, Turkish Public Hospitals Institution, Adana Province Public Hospital Union General Secretary (letter dated 28.11.2013 received as part of the ESIA stakeholder engagement process) which will need to be incorporated into the mitigation measures:

- A waste transportation system is established in a way that potential accidents are avoided during transportation of wastes from their source to the temporary storage area.
- The route for waste transportation is to selected as where patients/patients' relatives are not intensely present.
- Wastes are to be transported with special elevators or tube systems connecting source of waste generation and the temporary storage area directly, without the need for man power.
- The temporary waste storage area should be separated into special sections for the storage of each type of waste.
- Cooling system for the temporary waste storage area should be taken into consideration due to the hot climate of the Cukurova Region.
- Systems that do not need manpower, are installed for transferring the single use water soluble medical consumables (such as urine bags) into the sewer system.
- Chemicals used in the laboratories and the effluents from laboratory equipment are not to be discharged to sewer system and transferred to barrels via special collection systems that do not need manpower.

8.8 Residual Impacts

The residual impact as a result of waste generation is estimated to be negligible when the WMP and the mitigation measures that are described above are fully implemented throughout the lifetime of the project.

9.0 AIR QUALITY

9.1 Scope

Emissions during construction and operation of the Project will contribute to regional air pollutant levels and thereby may impact health of nearby communities, workers and other sensitive receptors. This chapter presents the assessment of the impacts of Project-related emissions on air quality and sets out the mitigation measures to avoid or minimize the risks together with the residual impacts that are foreseen to remain.

The most significant direct or indirect sources of air pollutants from the hospital operations will include emissions from exhaust air from heating, ventilation and air conditioning systems; trigeneration system, mainly containing NO_x; exhaust air (released from sources such as medical waste storage areas, medical technology areas and isolation wards) that may be potentially contaminated with biological agents, pathogens or toxic materials, and emissions from increased road traffic.

In addition to impacts on air quality during the operation of the Project, the assessment also considers short term effects from construction activities. Adverse effects can be caused by emissions from construction machinery and vehicles and also from activities generating particulate matter (such as earthworks and storage of dusty materials). In addition to affecting health, dust can lead to unsightly and potentially harmful deposits on property and vegetation if not managed properly.

The following sources of information have been used during the assessment:

- Background Air Quality Measurement Report by Ekotest
- Air Quality Modeling Report by Ennotes Ltd.
- Data provided by the General Directorate of Meteorology
- General Directorate of Meteorology website (<http://www.mgm.gov.tr>)
- Adana Province Environmental Status Report, 2011
- Information and data collected during field studies

The significance criteria that are used related to impacts on air quality are presented below.

Impact Significance	Description
Negligible	- No perceptible change in baseline conditions
Minor	- Temporary dust and gas emissions within the Project area during construction and operation activities - Temporary emissions due to construction equipment and vehicle movements resulting in change in baseline air quality by 20% - Emissions during operation resulting in change in baseline air quality by 20%
Moderate	- Temporary dust and gas emissions extending the project area during construction and operation activities - Temporary emissions due to construction equipment and vehicle movements resulting in change in baseline air quality by 40% but still below regulatory and IFC air emission limits - Emissions during operation resulting in change in baseline air quality by 40% but still below regulatory and IFC air emission limits
Major	- Temporary emissions due to construction equipment and vehicle movements, and during operation resulting in change in baseline air quality by 70% or above regulatory and IFC air emission limits - Emissions during operation resulting in change in baseline air quality by 70% or above regulatory and IFC air emission limits

9.2 Legal Context

This section provides an overview of Turkish and international ambient air quality standards. In Turkey, ambient air quality is regulated under the Regulation on Assessment and Management of Air Quality - RAMAQ (Official Gazette Date/Number: 06.06.2008/26898) and Industrial Air Pollution Control Regulation – IAPCR (Official Gazette Date/Number: 03.07.2009/27277), which both set up a tiered system to reduce air quality limits (general air quality limits and limits applicable to industries) over time and both provide mostly identical ambient air quality limits for pollutants.

Annexes of these regulations specify air quality targets as summarized in Table 9-1 below. As Turkey is a candidate for accession to the EU, standards set out in the EU Council Directive 2008/50/EC on ambient air quality, which are generally equivalent to IFC and WHO targets, are also considered to be relevant and included in Table 9-1.

Table 9-1: EU Council Directive 2008/50/EC, Turkish ambient air quality standards (as per RAMAQ Annexes 1 and 1A and IAPCR Annex 2) and IFC standards

Parameter	Concentration in $\mu\text{g}/\text{m}^3$								
	Hourly average			Short-term value, STV (Daily average)			Long-term value, LTV (Annual average)		
	EU standards	Turkish standards	IFC	EU standards	Turkish standards	IFC	EU standards	Turkish standards	IFC
Nitrogen dioxide (NO_2)	200	2014 ^{a,b} =300 2024 ^a =200	200	-	-	-	40	2014 ^{a,b} = 60 2024 ^a = 40	40
Sulfur dioxide (SO_2)	350	2014 ^{a,b} =500 2019 ^a =350	-	125	2014 ^{a,b} =250 2019 ^a =125	20	-	-	-
Carbon monoxide (CO)	-	-	-	10,000 (8-hr)	2014 ^a = 10,000 2014 (8-hr) ^{a,b} =16,000 2017 (8-hr) ^a =10,000	-	-	-	-
Particulate matter with diameter of 10 μm or less (PM_{10})	-	-	-	50	2014 ^{a,b} = 100 2019 ^a = 50	50	40	2014 ^{a,b} = 60 2019 ^a = 40	20
Fine particles <2.5 μm ($\text{PM}_{2.5}$)	-	-	-	25	-	25	25 (2015) 20 (2020)	-	10

^aas provided in RAMAQ Annex 1.

^blimit value will decrease equally each year to reach the next limit value

9.2.1 Air Quality Index

Air quality index is a scale defined by the Ministry of Environment and Urban Planning (MEUP) to identify air quality. The index classifies ambient air quality into 6 categories from 1 (very good) to 6 (very bad) and every category is visualized by colors. The index is based on the concentrations of five pollutants.

These pollutants and their air quality index levels are shown in Table 9-2.

Table 9-2: Air quality index of main pollutants

Air Quality Index	SO ₂	NO ₂	CO	O ₃	PM ₁₀
	Hourly Average	Daily Average	Daily Average	Hourly Average	Daily Average
	[µg/m ³]	[µg/m ³]	[mg/m ³]	[µg/m ³]	[µg/m ³]
1-(Very Good)	0 - 50	0 - 45	0 – 1.9	0 - 35	0 - 25
2 (Good)	51 - 199	46 - 89	2.0 – 7.9	36 - 89	26 - 69
3 (Moderate)	200 - 399	90 - 179	8.0 – 10.9	90 - 179	70 - 109
4 (Medium)	400 - 899	180 - 299	11 – 13.9	180 - 239	110 - 139
5 (Bad)	900 – 1,499	300- 699	14.0 - 39.9	240 - 359	140 - 599
6 (Very Bad)	>1,500	> 700	> 40.0	> 360	> 600

9.3 Climate and Meteorological Conditions

Adana is influenced by two types of climate. These are Mediterranean climate that is observed at shores and plains (winters are mild and wet, summers are hot and dry) and continental climate that is observed at uplands (winters are cold and snowy, summers are hot and dry). Yuregir District has the characteristics of Mediterranean Climate as it is located in the plain. As the high mountains in the north of the province block the northern winds, summers are extremely hot in Adana. No precipitation occurs for 2-3 months in summer season and no snowfall occurs in the city within the year, except for the very rarely seen slush that does not cover the ground.

Meteorological data on temperature, precipitation, relative humidity, pressure and wind flow, as given in the official website of the General Directorate of Meteorology or recorded at the Adana regional meteorological station in Yuregir District (Elevation from sea level: 23 m, Latitude: 37.0041 N, Longitude: 35.3443 E) are described in the following sections.

9.3.1 Temperature and Sunshine

Monthly average values of temperature parameters based on data collected for a period of 52 years (1960-2012) are provided in Table 9-3.

Table 9-3: Average temperature and sunshine data for a period of 52 years (1960-2012)

Temperature parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean temp.(°C)	9.6	10.5	13.5	17.5	21.8	25.7	28.1	28.5	26.0	21.5	15.5	11.1
Mean high temp.(°C)	15.0	16.1	19.6	23.7	28.2	31.7	33.7	34.5	33.1	29.1	22.4	16.7
Mean low temp. (°C)	5.5	6.1	8.6	12.2	16.0	20.1	23.4	23.6	20.5	16.2	10.8	7.1
Max. recorded temp.(°C)	26.5	25.0	32.0	37.5	40.6	41.3	44.0	43.8	43.2	39.4	33.3	30.8
Min. recorded temp. (°C)	-8.1	-6.4	-3.6	-1.3	5.6	12.6	16.8	14.8	10.9	4.8	-1.0	-3.5
Mean daily sunshine (hrs)	4.4	5.1	5.5	7.0	9.1	10.4	10.5	10.3	9.0	7.2	5.5	4.3

The annual mean temperature, annual mean maximum temperature and annual mean minimum temperature observed in Adana are 19.1°C, 23.8°C and 14.2°C, respectively. The minimum and maximum temperatures occurred in the province are -8.1°C and 44°C. The meteorological data of the province for the last ten years indicate that there are no significant changes in average temperatures.

9.3.2 Precipitation

Based on the meteorological data obtained from the Adana regional meteorological station between 1975 and 2012, the total average annual precipitation in the region is 670.4 mm with average monthly precipitations ranging from 5.6 mm in August to 127.5 mm in December (Table 9-4).

Table 9-4: Precipitation data for Adana

Precipitation parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average data for a period of 52 years (1960-2012)												
Mean number of days with precipitation	10.1	10.4	10.0	9.4	6.6	2.9	1.0	0.7	2.6	5.6	7.2	10.8
Mean total monthly precipitation (kg/m ²)	108.7	88.1	66.9	57.1	46.2	19.4	7.7	5.0	13.8	41.9	79.5	133.9
Average data for a period of 37 years (1975-2012)												
Total average precipitation (mm)	113.4	86.6	61.8	56.6	46.8	18.9	9.4	5.6	13.7	47.5	82.6	127.5
Maximum precipitation (mm)	125.5	69.3	65.0	100.4	78.8	106.2	51.0	48.4	50.5	90.3	112.4	115.2

Precipitation usually occurs as a result of the encountering of orographic precipitation with mobile air masses and the mean rainfall in the region is 625 mm with an annual average of 74 rainy days. Approximately, the half of the annual rainfall amount (51%) in the region is observed in winter season, while precipitation barely occurs (5%) or does not occur in summers despite of the damp air.

9.3.3 Humidity and Pressure

Based on the meteorological data obtained from the Adana regional meteorological station for a period of 37 years (1975-2012), the average monthly humidity in the region ranges from 61.7% in October to 70.7% in July and August (Table 9-5).

Table 9-5: Relative humidity and pressure data for a period of 37 years (1975-2012)

Humidity and pressure parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average humidity (%)	66.7	65.3	66.3	67.6	67.2	67.7	70.7	70.7	65.5	61.7	64.4	68.3
Minimum humidity (%)	7	5	3	2	2	5	11	10	2	3	3	4
Mean pressure (kPa)	101.6	101.4	101.2	101	100.9	100.6	100.3	100.4	100.8	101.2	101.5	101.6
Max. pressure (kPa)	103.2	103.0	102.6	102.4	101.9	101.4	101.2	101.1	101.8	102.3	102.7	103.2
Min. pressure (kPa)	99.2	99.2	98.9	99.5	99.6	99.5	99.5	99.6	100.0	100.0	99.7	98.9

9.3.4 Wind Characteristics

The prevailing wind direction in Adana is from north-northeast (NNE) in winter; south (S) in March and September; and southwest (SW) in June, July and August. The average wind speed is 2.2 m/s. Maximum wind speed is recorded as 126.4 km/h.

The prevailing wind direction shifts to opposite direction in cold months (November, December and February) due to the fact that thermal low pressure in terrestrial area turns into dynamic high pressure and thermal high pressure in offshore area turns into thermal low pressure in winter. The observed annual average wind speed is 1.4 m/s (Table 9-6).

Table 9-6: Monthly average wind speed between the years 1975-2012

Wind speed (m/s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual average
Ave. wind speed	1.4	1.4	1.4	1.4	1.4	1.6	1.7	1.5	1.3	1.1	1.1	1.3	1.4
Max. wind speed and direction	30.9 NNW	35.1 NNE	34.9 NNE	30.9 E	24.9 E	23.1 NNE	20.0 WSW	21.1 NNW	22.7 WNW	24.8 SSW	25.8 SW	27.0 W	30.9

9.4 Air Quality Baseline Conditions

9.4.1 Background

The land use around the Project area is described in *Chapter 5: Land Use and Zoning*. There are no industrial facilities within the close proximity of the Project area. The major industries and thus potential sources of emissions in the region (together with air distances to the Project area) are Woodwork Small Industrial Zone (6 km), Adana Sub-Industrial Center (7.5 km) and another industrial area containing agricultural machinery manufacturing facilities (9 km), a large cement plant (11 km) and Hacı Sabancı Organized Industrial Zone (21 km) along the Adana-Ceyhan Road (D400) in southeast; and Seyhan Small Industrial Zone (9 km) in southwest. Additionally, the civil airport of Adana (Adana Sakirpasa Airport) is located approximately 6.5 km southwest and the Incirlik Air Force Base is located approximately 6 km southeast of the Project area as potential fuel emission sources.

According to the assessments conducted by the relevant authority at the end of 2012, the main cause of the air pollution in the province is determined as the industrial emissions where the other reasons are unplanned urbanization (increase in population), heating emissions and traffic emissions, respectively. The nearest air quality monitoring station is "Adana-Meteorology" (established by the MEUP) located approximately at 2.5 km southwest of the Project area. Average concentrations measured at the station for August 2012 - August 2013 period are 61 $\mu\text{g}/\text{m}^3$ for PM_{10} , 4 $\mu\text{g}/\text{m}^3$ for SO_2 , 25 $\mu\text{g}/\text{m}^3$ for NO , 27 $\mu\text{g}/\text{m}^3$ for NO_2 , 57 $\mu\text{g}/\text{m}^3$ for NO_x and 69 $\mu\text{g}/\text{m}^3$ for O_3 . Average concentrations of air pollutants in the province in 2012 are given in Table 9-7.

Table 9-7: Average concentrations of air pollutants in the province in 2012 ^{1,2,3}

Months	SO ₂	PM ₁₀	CO	NO	NO ₂	NO _x	O ₃
January	20	50	410	17	18	36	35
February	22	45	357	6	6	16	48
March	9	42	404	5	10	17	51
April	7	60	507	6	24	32	52
May	7	62	511	4	22	28	51
June	9	79	501	7	15	25	53
July	6	53	576	5	22	28	44
August	2	50	604	40	28	69	47
September	5	62	584	22	22	45	35
October	7	58	450	21	32	54	118
November	17	43	489	36	32	68	28
December	23	44	594	168	68	235	72
Annual Average	11	54	499	28	25	54	53

1 Unit: $\mu\text{g}/\text{m}^3$

2 Source: <http://www.havaizleme.gov.tr>

3 SO₂, PM₁₀ data are invalidated raw data.

9.4.2 Baseline Measurements Methodology

IAPCR Annex 2 covers the general rules of ambient air quality measurement methods. According to Annex 2, if the mass flow rate of a pollutant exceeds the limit values which are given in Table 2.1 of this annex, air pollution contribution values (APCV) must be calculated for the impact area and air quality measurement studies must be carried out for given pollutant according to APCV.

In this study, mass flow rates of potential pollutants were calculated by using emission factors with the results given in Section 9.5.2. Based on these results, only particulate matter emissions exceed the limits values given in IAPCR Annex II Table 2.1. Therefore, the air quality baseline measurements have focused on the following pollutants of concern identified as principle components of emissions during construction activities:

- PM deposition
- Particulate matter of 10 microns or below (PM₁₀)

In air quality measurements, continuous monitoring with Met One Instruments BAM 1020 was applied for PM₁₀ measurement and quadrivial (A,B,C,D) dust sampling system was used for PM deposition measurement using the methods given in Table 9-8.

Table 9-8: Air pollutant measurement methods

Emissions	Method	Method No
PM deposition	Gravimetric	BS 1747
PM ₁₀	Beta Ray Absorption Method	TS ISO 10473-2003

In accordance with IAPCR Annex 2, two sampling points were identified for each parameter within the investigation location exhibiting the highest APCV. Locations of the measurement systems are indicated in Figure 9-1 below. Continuous measurements of PM deposition have been conducted at two locations over a period of 30 days (from 25th October to 25th November 2013) via two

measurement systems for each location, whereas one measurement system was used for PM₁₀ measurements for 15 days in turn for each of the two locations with 24-hour cycles.



Figure 9-1: Air pollutant investigation locations (all measurement systems)

Upon obtaining the sampling results, the following values were calculated for each parameter, as per the aforementioned regulation:

- Long-Term Value (LTV): Arithmetical mean of the sampling results
- Short-Term Value (STV): Maximum daily average value or the value remaining below 95% of all measurements when sorted in numerical order
- Total Pollution Value (TPV): Sum of Air Pollution Contribution Value (APCV) and LTV, which is considered for proposed projects/new facilities.

Further details on air pollutant measurements are provided in the Background Air Quality Measurement Report prepared by Ekotest (2013) which is provided in Annex I-1.

9.4.3 Results of PM Deposition Sampling

The results of PM deposition sampling and comparison of the calculated STV values with Turkish regulatory limits (as per IAPCR Annex 2, Table 2.2) are presented in Table 9-9. Hourly data are provided in Annex I-1.

Table 9-9: PM deposition sampling results

Measurement Location	PM Deposition (mg/m ² .day)						Short Term Limit Value ¹	
	Start date	End date	Daily average concentration					
			A	B	C	D		Average (Short term value)
1	25.10.2013	25.11.2013	173	23	51	84	83	390
2			81	24	62	46	53	
3			32	7	8	3	12	
4			13	39	34	38	31	

¹As per IAPCR Annex 2, Table 2.2

9.4.4 Results of PM₁₀ Sampling

Results of PM₁₀ sampling and comparison of the calculated LTV and STV values with Turkish regulatory limits (as per RAMAQ Annex I limit values) are presented in Table 9-10. Hourly data are provided in Annex I-1.

Table 9-10: PM₁₀ sampling results

Investigation Location	PM ₁₀ (µg/m ³)				Limit value ¹			
	Start date	End date	Period	Value	2014	2015	2016	2017
1	25.10.2013	09.11.2013	STV	143	60	56	52	48
			LTV	73	100	90	80	70
2	09.11.2013	25.11.2013	STV	86	60	56	52	48
			LTV	53	100	90	80	70

¹As per RAMAQ Annex I Limit Values

9.4.5 Assessment of Baseline Air Pollutant Levels

It is observed that the detected baseline STVs for PM deposition remain below the Turkish ambient air quality limits for industrial facilities.

LTV PM₁₀ emissions at location 1 complies with the limit values up to 2016, whereas they comply at location 2 until the year 2017. STV for PM₁₀ exceeds the regulatory limit at the two measurement locations. Elevated PM₁₀ levels may possibly be attributed to the earth road adjacent to the measurement location 1 in addition to the busy motorway approximately 150 m south of the measuring device.

On the other hand, air quality indexes of the daily PM₁₀ values are at Level 3 (Moderate) for measurement location 1 and at Level 2 (Good) for measurement location 2. These levels show that average air quality of the Project location is between good and moderate levels.

9.5 Air Quality Modeling

Air quality modelling study was conducted by Ennotes Environmental Engineering Consultancy Contracting Co. (Ennotes) and results are provided in the Air Quality Assessment and Modeling Report by Ennotes (2013) which is provided in Annex I-2.

9.5.1 Methodology

Air quality modelling study was conducted using “Lakes Environmental AERMOD View” dispersion model software (under License No: AER0005591).

This model is one of the most state-of-the-art computer models which can estimate hourly, daily and annual ground level concentration (GLC) values, based on real time data varying over time. The model comprises the calculations of different dispersion models for different sources (point, volume, area) ranging from isolated stacks to fugitive pollutants and also takes into consideration aerodynamic waves, turbulence and similar phenomena that may affect the pollutants released from the sources in any industrial site.

Hourly, daily and annual average GLC values of the pollutants in the ambient air can be estimated by running the model after transferring to the program the above ordered information.

Long term meteorological data needed for modeling studies is obtained from the regional meteorological stations. In this study, Adana Meteorological Station of the Turkish State Meteorological Service is considered as suitable and the meteorological data recorded in this station was used in the modeling study. Since upper air observation values of the region are measured by this station, these records were obtained as well. A satellite map showing the Project area and meteorology station is shown in Figure 9-2.



Figure 9-2: Satellite map showing the Project area and Adana meteorological station

Meteorological data year was chosen by comparing long term wind direction frequency distribution to the wind direction frequency distribution of the last 10 years. Year 2009 was determined as the most appropriate year. Long term and year 2009 wind direction distribution diagrams are shown in Figure 9-3.

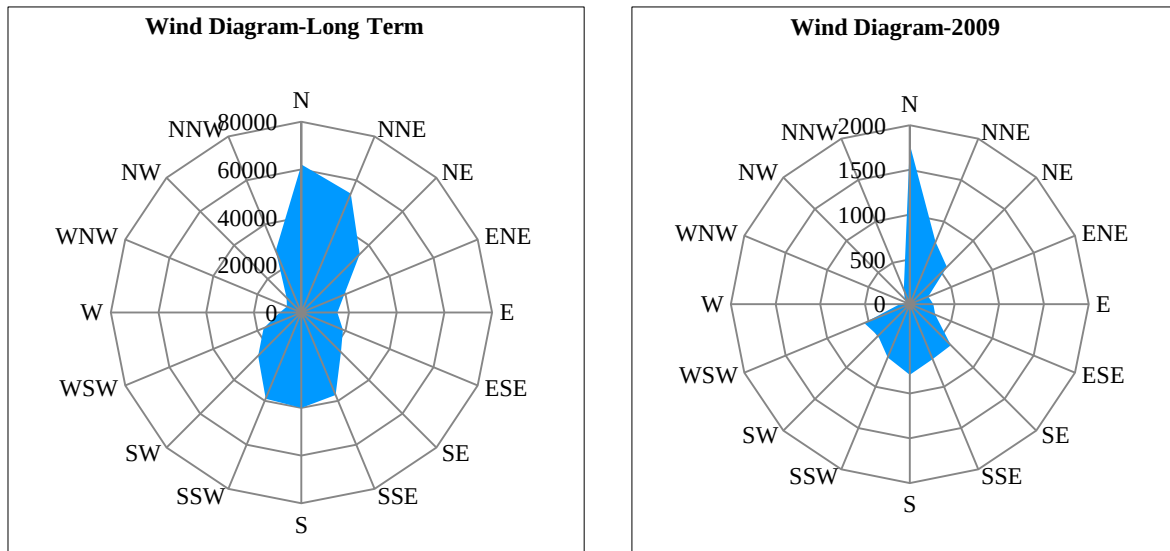


Figure 9-3: Wind direction frequency distribution diagrams for Adana station

9.5.2 Emissions

The Project will comprise of construction and operation phases; therefore air quality effects of the Project have been considered for these two phases. These effects are explained in the following section.

9.5.2.1 Construction Phase

The construction activities will be carried out in two steps. First step is earthworks (first 6 months of construction work) and it covers the land arrangement activities of the Project area. Significant pollutant of this step will be dust generated from excavation, load on trucks and transportation and the release of engine emissions from construction equipment and vehicles at the construction sites. Second step of the construction phase is building construction (main construction) (30 months after the completion of earthworks). In this step, movement of construction equipment such as cement mixers, trucks, backhoes will cause particulate matter emissions from land and engine emissions.

In order to calculate dust and engine emissions, emission factors were used. Particulate matter emission factors are taken from Regulation on the Industrial Air Pollution Control Regulation (IAPCR) Annex-12 Table 12: Emission Factors used to Calculate Dust Emissions. Engine emissions are considered in two categories as road and non-road machine emissions. Road emissions cover emissions from vehicles which are used for transportation/carrying operations. Non-road emissions arise from mobile machinery which does not travel on road. Road emission factors are derived from *The EMEP/EEA Air Pollutant Emission Inventory Guidebook 2013-Exhaust Emissions from Road Transport - Tier 3 Emission Factors* and non-road emission factors are taken from *The EMEP/EEA Air Pollutant Emission Inventory Guidebook 2013-Non-Road mobile sources and machinery*. Since the dust emission specifications have important differences between land based emissions and engine emissions, they have not been evaluated under same context.

Dust emissions emitted from earthwork activities (excavation, loading, transport, etc.) and vehicle movements are calculated by using IAPCR Annex-12 emission factors. Road and non-road equipment emissions are also calculated. To calculate emission factors, it is assumed that trucks are

rigid, heavier than 32 tons with full capacity and have Euro 4 technology. No corrections (age, engine type etc.) have been made on emission factors. Engine power of non-road equipment is taken as 130 kWh. Details of these calculations are provided in the Air Quality Assessment and Modeling Report presented in Annex I-2.

Dust Emissions

Earthwork Activities: Earthwork activities will be completed in 6 months as part of the total construction phase. In this phase, 600,000 m³ soil will be excavated and carried to storage site designated by the municipality or to filling sites. Assumptions that were used in calculating the dust emissions from earthwork activities are given in Annex I-2. Total emissions are calculated for controlled and uncontrolled conditions as 13.9965 kg/h and 27.993 kg/h respectively.

Main Construction Activities: Main construction covers rough construction, mechanical works, electricity works, trim works and landscape works and these activities will last about 30 months and vehicle movements (transportation of all necessary materials) which cause dust emissions will take 6 months within the 30 months. In order to assess the worst case scenario, it is assumed that transportation of materials will be done continuously during this 6 month period. Assumptions that were used in calculating the dust emissions from main construction activities are given in Annex I-2. Total emissions are calculated for controlled and uncontrolled conditions as 2.70645 kg/h and 5.4129 kg/h respectively.

Engine Emissions

As mentioned in the previous section, engine emissions are split into two categories as road and non-road vehicle emissions. Vehicle types, quantities and working times during the construction phase are shown in Table 9-11.

Table 9-11: Equipment that will be used during the construction phase

Phase	Road			Non-Road		
	Equipment	Number	Working Day	Equipment	Number	Working Day
Earthworks	Truck	30	180	Excavator	12	180
				Bulldozer	2	90
				Grader	2	90
				Loader	1	90
				Backhoe	3	180
				Roller	1	30
	Total	30	-	Total	21	-
Main Construction	Truck	20	180	Crane (Mobile)	6	240
				Concrete Mixer	20	240
				Mobile Concrete Pump	3	240
				Backhoe	2	300
				Mobile Concrete Pump (for trimworks)	2	200
				ConcreteMixer(for trimworks	15	180
				Crane (Mobile) (for trimworks)	16	240
	Total	20	-	Total	64	-
Finishing	Asphalt Truck	20	30	Finisher	2	30
	Total	20	-	Total	7	-

Table 9-12 shows emission calculations for equipment shown in Table 9-11.

Table 9-12: Engine emissions

Pollutant	Type	Emission Factor	Emission Per Vehicle (kg/h)	Phase						Limit Value*
				Earthwork		Main construction		Finishing		
				Number of Vehicle	Emission (kg/h)	Number of Vehicle	Emission (kg/h)	Number of Vehicle	Emission (kg/h)	
NO _x	Road	4.70902	0.002354	30	0.07062	20	0.04708	20	0.04708	40
	Non-Road	3.5	0.455	21	9.555	64	29.12	7	3.185	
CO	Road	0.74319	0.003716	30	0.11148	20	0.07432	20	0.07432	50
	Non-Road	3.5	0.455	21	9.555	64	29.12	7	3.185	
PM	Road	0.03544	0.000017	30	0.00051	20	0.00034	20	0.00034	1
	Non-Road	0.2	0.026	21	0.546	64	1.664	7	0.182	
SO ₂	Road	0.0016	0.0016	30	0.048	20	0.032	20	0.032	6
	Non-Road	0.0016	0.0016	21	0.0336	64	0.1024	7	0.0112	
VOC	Non-Road	0.5	0.065	21	1.365	64	4.16	7	0.455	3
HC	Road	0.04639	0.000023	30	0.00069	20	0.00046	20	0.00046	-

*According to IAPCR Annex II Table 2.1.

Results are calculated for the worst case scenario which considers operation of all vehicles at the same time, which is unlikely.

The maximum combined dust emission activities and engine flowrate for PM is 28.539 kg/h (0.546 kg/h +27.993 kg/h) during earthworks and 7.077 kg/h (1.664 kg/h +5.4129 kg/h) during main construction under r uncontrolled conditions. Therefore, PM modeling is needed.

9.5.2.2 Operation Phase

There will be a trigeneration system during operation phase, which is planned to include 2 natural gas fired gas engines each with a capacity of 4.3 MW thermal power. In addition to trigeneration system, a heating boiler system with 40 MW thermal power will be used. Total thermal power of operation phase will be 48.6 MW.

Since the fuel to be used at the proposed trigeneration system and boiler system is natural gas, main pollutant resulting from combustion process will be NO_x. In order to calculate these emissions, *The EMEP/EEA Air Pollutant Emission Inventory Guidebook 2013-Small Combustion-Table 3-36 Tier 2 Emission Factors for Non-Residential Sources, reciprocating engines burning gas fuels* emission factors were used for gas engines and *Table 3-33 Tier 2 Emission Factors for non-residential sources, medium sized (> 1 MWth to ≤ 50 MWth) boilers burning natural gas* emission factors were used for boilers. The technical information about the 4.3 MW engine unit is obtained from the manufacturer. Minimum stack height of the trigeneration and boiler system is calculated using PK 3781 software developed by the German air pollution control regulation TA LUFT in accordance with VDI 3781 standard. Minimum stack height is calculated as 10 m. According to the technical information sheets for the gas engine and boiler, stack heights of 16 m for the gas turbine and 12 m for the boiler were considered in the modeling study. Emission values, amount of pollutants and the characteristics of the stack gas are provided in Annex I-2.

NO_x Emissions

There are two factors causing NO_x emissions through combustion process. First one of these factors is the nitrogen content of the fuel. Nevertheless, other NO_x emission source of higher concern is the oxidation of free nitrogen in the air at high temperature during combustion. The factors, which will determine the mentioned emissions from the proposed trigeneration and boiler systems are boiler firing technique, combustion temperature and pressure, etc.

According to RCAPOI, Annex-5, stack gas NO₂ emission standards of gas engine and boiler are 60 mg/Nm³ with 5% O₂ in volume and 800 mg/Nm³ with 3% O₂ in volume, respectively. NO₂ emissions from the proposed plant will be approximately 60 mg/Nm³ in dry base. NO₂ emissions from the boilers will be approximately 240 mg/Nm³ in dry base. Therefore, the emission levels comply with the pertinent limit value.

9.5.3 Dispersion Modeling Results

9.5.3.1 Construction Phase - Ground Level PM₁₀ and PM Deposition Concentrations

Modeling studies are carried out for dust parameters for construction activities (earthworks and main construction phases). Ground level concentrations (GLC) of PM₁₀ and PM Deposition, determined from the modeling studies are listed in Table 9-13 for uncontrolled working conditions and Table 9-14 for controlled working conditions. PM₁₀ Air Pollution Contribution Values and Total Pollution Values calculated according to background monitoring results are shown in Table 9-15. Since the earthworks will continue less than one year (will last for 6 months) and main construction activities are calculated considering a worst case scenario that covers a period of 6 months, only monthly values have been calculated as long term values instead of annual values.

Table 9-13: Construction phase maximum GLC Values determined from the modeling studies for uncontrolled conditions

Parameter	Averaging Period	Maximum GLC Values and coordinates (µg/m ³ for PM ₁₀ , mg/m ² .day for PM Deposition)		National Limit Values (µg/m ³)				EU Limit Values (µg/m ³)	WHO Limit Values (µg/m ³)
		Earthworks	Main construction	2014	2015	2016	2017		
PM ₁₀	Hourly (max.)	215.27 (708965, 4100810)	41.82 (708965, 4100810)	-	-	-	-	-	-
	Daily (90.73%)	74.13 (708965, 4100810)	9.89 (708965, 4100810)	100	90	80	70	50	50
	Monthly	47.87 (708802, 4100092)	9.86 (708802, 4100092)	60	56	52	48	40	20
PM Deposition	Monthly	36.82 (708972, 4100425)	6.45 (708972, 4100425)	390				-	-

Table 9-14: Construction phase maximum GLC values determined from the modeling studies for controlled conditions

Parameter	Averaging Period	Maximum GLC Values and coordinates ($\mu\text{g}/\text{m}^3$ for PM_{10} , mg/m^2 .day for PM Deposition)		National Limit Values ($\mu\text{g}/\text{m}^3$)				EU Limit Values ($\mu\text{g}/\text{m}^3$)	WHO Limit Values ($\mu\text{g}/\text{m}^3$)
		Earthworks	Main construction	2014	2015	2016	2017		
PM_{10}	Hourly (max.)	107.63 (708965, 4100810)	20.91 (708965, 4100810)	-	-	-	-	-	-
	Daily (90.73%)	37.06 (708965, 4100810)	4.94 (708965, 4100810)	100	90	80	70	50	50
	Monthly	23.93 (708802, 4100092)	4.93 (708802, 4100092)	60	56	52	48	40	20
PM Deposition	Monthly	18.41 (708972, 4100425)	3.22 (708972, 4100425)	390				-	-

Table 9-15: PM_{10} and PM Deposition Air Pollution Contribution Values (APCV) and Total Pollution Values (TPV) of construction phase for controlled conditions

Parameter	Location	Phase	Background Concentration ($\mu\text{g}/\text{m}^3$)	APCV* ($\mu\text{g}/\text{m}^3$)		(TPV)** ($\mu\text{g}/\text{m}^3$)	National Limit Values ($\mu\text{g}/\text{m}^3$)				EU Limit Values ($\mu\text{g}/\text{m}^3$)	WHO Limit Values ($\mu\text{g}/\text{m}^3$)
			LTV for PM_{10} /STV for PM deposition	Period	Value	LTV/STV	2014	2015	2016	2017		
PM_{10}	Monitoring Station***	Earthworks	54	STV	2.83	56.83	100	90	80	70	50	50
				LTV	3.09	57.09	60	56	52	48	40	20
		Main construction	54	STV	0.47	54.47	100	90	80	70	50	50
				LTV	0.33	54.33	60	56	52	48	40	20
	Baseline Measurement Location 1	Earthworks	73	STV	21.44	94.44	100	90	80	70	50	50
				LTV	19.47	92.47	60	56	52	48	40	20
		Main construction	73	STV	4.86	77.86	100	90	80	70	50	50
				LTV	3.54	76.54	60	56	52	48	40	20
	Baseline Measurement Location 2	Earthworks	53	STV	37.07	90.07	100	90	80	70	50	50
				LTV	19.88	72.88	60	56	52	48	40	20
PM Deposition (mg/m^2 .day)	Baseline Measurement Location 1	Earthworks	83	STV	18.41	101.41	390				-	-
		Main construction		STV	6.44	89.44					-	-
	Baseline Measurement Location 2	Earthworks	53	STV	13.42	66.42					-	-
		Main construction		STV	4.70	57.70					-	-
	Baseline Measurement Location 3	Earthworks	12	STV	12.49	24.49					-	-
		Main construction		STV	4.37	16.37					-	-
	Baseline Measurement Location 4	Earthworks	31	STV	13.08	44.08					-	-
		Main construction		STV	4.85	35.85					-	-

*APCV value represents the modeled concentration.

**TPV value represents sum of APCV and background concentration.

***annual average PM_{10} value for year 2012 – source: MEUP-Air Quality Monitoring Network website.

Based on the modeling results, average maximum GLC dispersion of PM_{10} and PM deposition during earthwork and main construction activities are shown in Figure 9-4 for controlled conditions (also presented in Annex I-2). PM_{10} emission dispersion is to the south direction as a result of the prevailing winds and the topography.

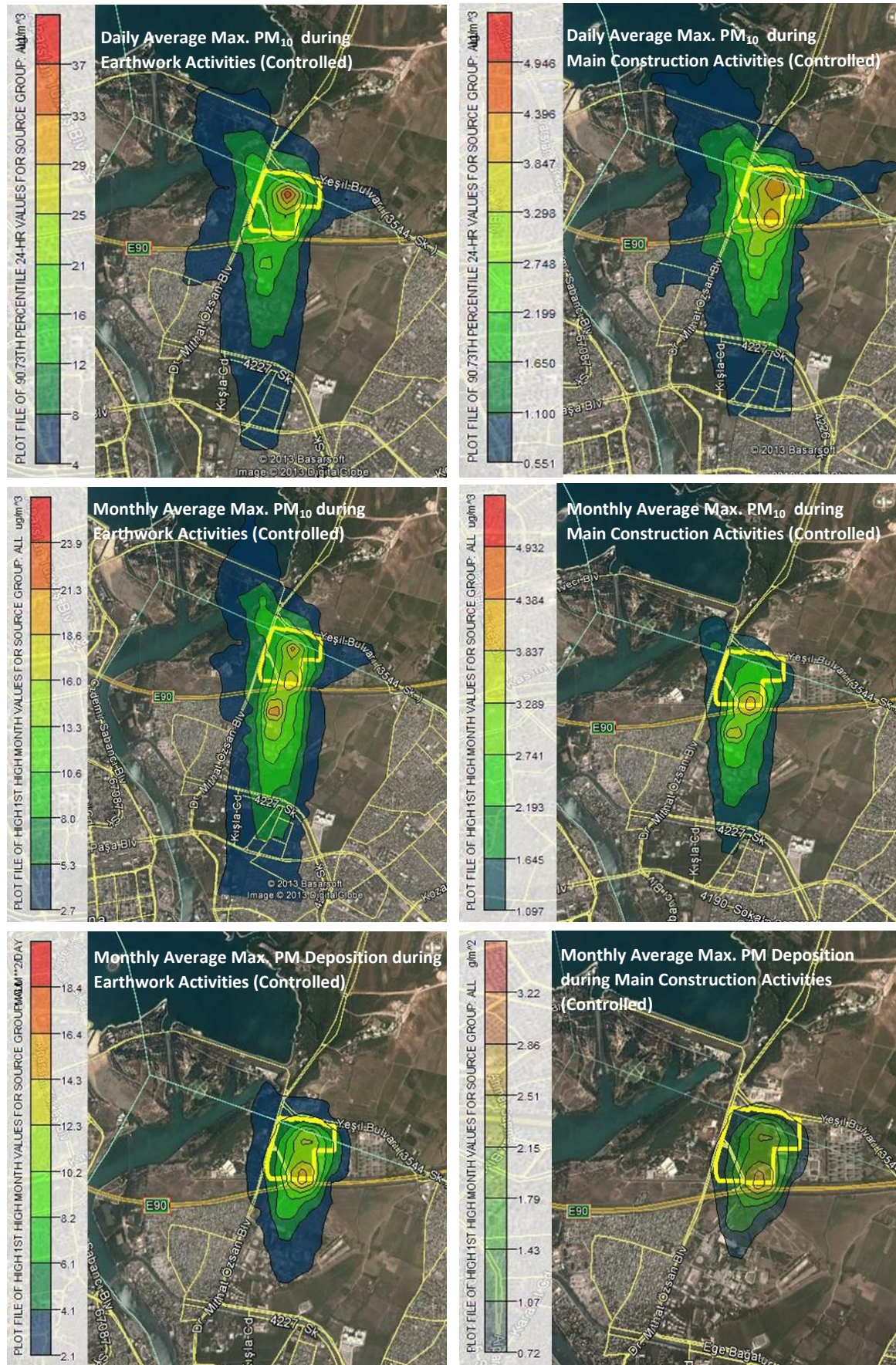


Figure 9-4: Average maximum GLC dispersion of PM₁₀ and PM deposition during earthwork and main construction activities under controlled conditions (Project site boundaries are shown with yellow lines)

As shown in Table 9-13, daily and monthly GLC values of PM₁₀ to be originated during earthworks in uncontrolled working conditions are 74.13 µg/m³ and 47.87 µg/m³, respectively and 9.89 µg/m³ and 9.86 µg/m³, respectively for main construction. The daily and monthly GLC values of PM₁₀ during earthworks are below the national limit values (as earthwork phase will be completed at the latest in 2015) to comply with the RAMAQ but exceeds the limit values to comply with EU Directives and WHO Guidelines. The GLC values of PM₁₀ during main construction activities are below both national and international limit values. Monthly PM Deposition values for earthworks and main construction under uncontrolled conditions are 36.82 µg/m³ and 6.45 µg/m³, respectively and these values are lower than the limit values given in IAPCR.

As shown in Table 9-14, daily and monthly GLC values of PM₁₀ generated during earthworks in controlled working conditions are 37.06 µg/m³ and 23.93 µg/m³, respectively and 4.94 µg/m³ and 4.93 µg/m³, respectively for main construction. These values are lower than the limit values to comply with the RAMAQ, EU Directives and WHO Guidelines (except for the slight exceedance of WHO limit value during earthworks). Monthly PM Deposition values for earthworks and main construction under controlled conditions are 18.41 µg/m³ and 3.22 µg/m³, respectively and these values are lower than the limit values given in the IAPCR.

GLC values of PM₁₀ originated from the construction phase in the PM₁₀ air quality monitoring points are presented in Table 9-15 for controlled conditions. In accordance with Table 9-15, Total Pollution Value of PM₁₀ originated from earthwork activities is lower than (or very close to) the short term limit values of working period (for year 2014/2015 as Phase is expected to be completed at the latest in 2015). According to the table, Total Pollution Value of PM₁₀ generated from main construction activities is lower than the short term limit values of working period. Based on baseline measurements conducted, it can be seen that the baseline measurement location results exceed the long term limit values. Even though Air Pollution Contribution Values are acceptable according to limit values, long-term Total Pollution Value of PM₁₀ originated from Project exceed limit values attributable to the high background PM₁₀ concentrations. Total Pollution Values of PM deposition from earthwork activities and main construction are lower than short term the limit values.

9.5.3.2 Operation Phase - Ground Level NO₂ Concentrations

Modeling studies were performed for NO₂ parameter for operation activities (for emissions from the trigeneration system and boilers). Average maximum GLC's of NO₂ determined from the modeling studies are listed in Table 9-16. GLC values estimated in the monitoring station and the associated limit values are presented in Table 9-17.

Table 9-16: Operation phase GLC values determined from the modeling studies

Parameter	Averaging Period	Values (µg/m³) and coordinates	National Limit Values* (µg/m³)		EU Limit Values (µg/m³)	WHO Limit Values (µg/m³)
			Year			
			2017	2024		
NO ₂	Hourly (99.71%)	44.00 (708966, 4102925)	270	200	200	200
	Annual	2.06 (708966, 4100425)	54	40	40	40

Table 9-17: Air Pollution Contribution Values of operation phase

Location	Background Concentration ($\mu\text{g}/\text{m}^3$)	Period	APCV ($\mu\text{g}/\text{m}^3$)	Total Pollution Value (TPV) ($\mu\text{g}/\text{m}^3$)	Limit Value
	LTV				
Monitoring Station*	25	Short Term (STV)	44.00	69.00	200
		Long Term (LTV)	2.06	25.06	40

*Annual average NO_2 value for year 2012 – source: MEUP-Air Quality Monitoring Network website

As shown in Table 9-16, hourly and annual GLC values of NO_2 to be originated from the trigeneration and boiler systems are $44.00 \mu\text{g}/\text{m}^3$ and $2.06 \mu\text{g}/\text{m}^3$, respectively. These values are significantly lower than the associated limits to be complied by the year 2024 which are set forth by the RAMAQ and international limit values. The modelling results given in Table 9-17 show that the total NO_2 parameter values for operation activities for emissions from the trigeneration and boiler systems comply with regulatory limit values.

Hourly and annual average maximum GLC dispersion of NO_2 during operation phase are shown in Figure 9-5. Pollutant dispersion is in south and north directions due to the effects of the prevailing winds and the topography.

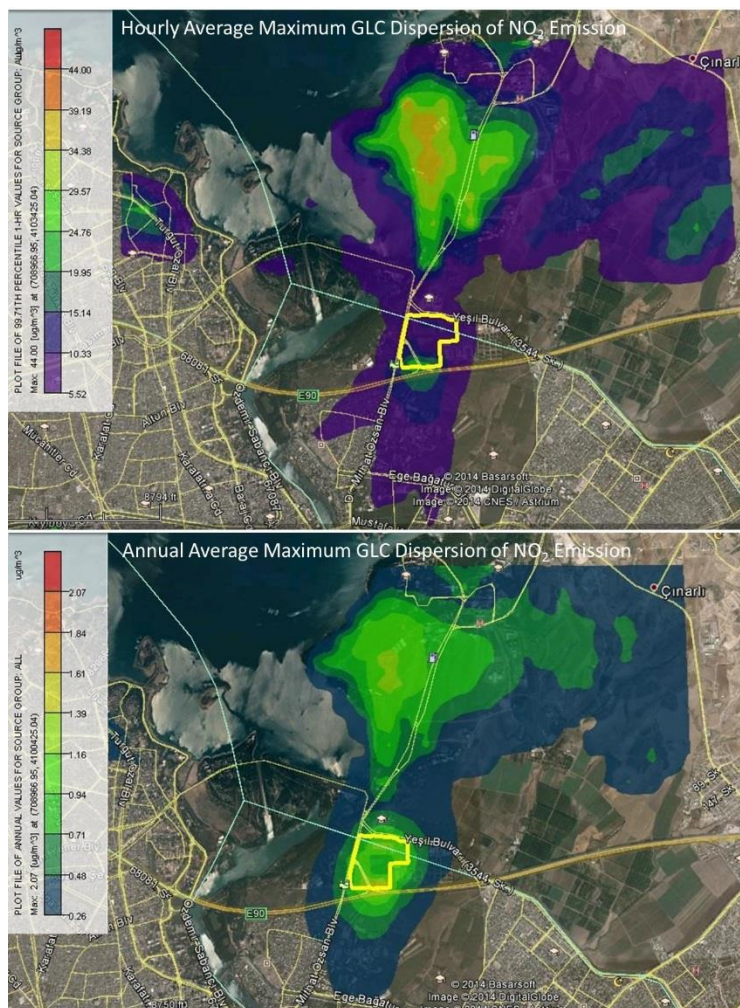


Figure 9-5: Average maximum GLC dispersion of NO_2 during operation phase (Project site boundaries are shown with yellow lines)

9.6 Greenhouse Gases

Greenhouse gases simply can be described as gases that trap heat in the atmosphere. These gases allow sunlight to reach earth surface unimpeded. Visible part of the sunlight which is shortwave energy heats the surface and invisible long wave energy reradiate to the atmosphere. Greenhouse gases absorb long wave energy, thereby allowing less heat to escape back to space, and trapping it in the lower atmosphere. Greenhouse gases are responsible for the greenhouse effect, which ultimately leads to global warming. The main anthropogenic source of the greenhouses gases is burning of fossil fuels.

For the purposes of monitoring, verification and reporting of the greenhouse gases, Regulation on the Monitoring of Greenhouse Gases (RMGG) (Official Gazette date/no: 25.04.2012/28274) was released. This regulation covers the procedures and principles for activities which are included in Annex-I of the mentioned regulation. In the regulation, greenhouse gases are listed as CO₂, CH₄, N₂O, HFCs, PFCs and SF₆.

As mentioned above, main source of the greenhouse gases is burning of fossil fuels. Fossil fuel burning activities will be conducted in both construction and operation phases of the Adana Integrated Health Campus project. Greenhouse gases will be emitted from vehicle engines during the construction phase and the trigeneration system during the operation phase. Vehicle emissions are excluded from RMGG Annex-I and combustion activities are considered above 20 MW limit. Since the total thermal power of the trigeneration plant and boiler will be 48.6 MW, the plants will be subject to RMGG if they work together at full capacity. Despite this, CO₂ emissions are calculated for the trigeneration plant and boilers using Ingovernmental Panel on Climate Change (IPCC) emission factors.

- Default Emission Factor for Natural Gas: 56,100 kg gas/TJ
- Fuel Consumption = 214 GJ/h = 0.214 TJ/h
- CO₂ Emissions = 0.214TJ/h x 56,100 kg/TJ =12,005 kg/h CO₂ emissions (105,163 ton/year)

9.7 Impacts on Air Quality

9.7.1 Impacts during Construction

During the construction of the Project, dust emissions will arise from earth movements, transport of construction materials and resources, transport of excavated soils outside the Project area, working of machinery and vehicle movements inside the Project area. There will be also gas emissions from construction vehicles and equipment such as generators, excavators, bulldozers, trucks, cars. Air dispersion modeling study (for PM₁₀ and PM dispersion) was undertaken to estimate the air quality impacts associated with the construction. Within the scope of the modeling study, construction activities were considered in two phases as earthworks and main construction. In accordance with the result of the modeling studies, daily and monthly GLC values of PM₁₀ to be generated during the construction phase in controlled working conditions are 37.06 µg/m³ and 23.93 µg/m³, respectively for earthworks and 4.94 µg/m³ and 4.93 µg/m³, respectively for main construction. These values are significantly below the associated limit values stipulated in the RAMAQ, EU directives and WHO Guidelines (except for the slight exceedance of WHO limit value during earthworks). On the other hand, when the long-term total pollution value is considered, it is seen that the above mentioned limit values are exceeded. However, this is related with the high

ambient background air quality values and not directly associated with the emissions from the Project.

Transport of construction materials and transport of excavated soils outside the Project area will result in emissions related to construction traffic which may have the potential to affect the ambient air quality. The majority of the construction materials and the excavated soils are expected to be transported through the E-90 Motorway and Mithat Ozsan Boulevard on which some settlements are passed along the way that may be affected by the emissions. Considering that this type of transportation will be temporary and those settlements in their current situation are located adjacent to the motorway, it is considered that the impacts will be of minor significance.

9.7.2 Impacts during Operation

There will be impacts on the air quality from the health campus during the operation phase which will be mainly related with the emissions from the trigeneration and boiler systems and fugitive emissions (released from sources such as medical waste storage areas, medical technology areas and isolation wards) that may be potentially contaminated with biological agents, pathogens, or toxic materials. It is expected that necessary exhaust/treatment systems will be included in the design of the health campus to eliminate mentioned emissions and no significant impacts will occur. There will be also impacts related to increase in emissions from road traffic during the operation of the health campus.

In order to identify the impacts from the trigeneration and boiler systems, air dispersion modeling study was undertaken for the NO₂ parameter which is the significant emission source from the sources. Hourly and annual GLC values of NO₂ estimated from the trigeneration system and boilers are 44.00 µg/m³ and 2.06 µg/m³, respectively. These GLC values are significantly below the associated limit values defined in the RAMAQ, EU Directives and WHO Guidelines. When the total contribution of NO₂ to ambient air quality is considered, it is seen that the total NO₂ parameter value is lower than the regulatory limit values.

In addition, there will be a generation of greenhouse gas emissions during the operation of the trigeneration and boiler systems which is calculated as 105,163 tons CO₂/year. According to the IFC Performance Standard 3, for projects that produce more than 25,000 tons of CO₂ equivalent annually, there is a need to quantify the direct and indirect emissions annually. The Project will be expected to meet this requirement and undertake necessary actions to minimize the greenhouse gas emissions.

9.8 Mitigation

9.8.1 Mitigation of Air Quality Impacts during Construction

An Air Quality Control and Monitoring Plan will be prepared, which will include mitigation measures that will be taken to reduce the dust emissions during construction. Additionally, air pollutants will be monitored at nearby sensitive locations to ensure minimal impacts in accordance with the Air Quality Control and Monitoring Plan.

The following mitigation measures will be implemented to address dust emissions during construction:

- Minimal particulate emission from the construction activities will be maintained by good management and housekeeping practices and use of dust suppression methods. Water spraying will be performed at dust generating areas inside the Project area especially during dry weather conditions.
- Turkish Regulation on the Control of Excavated Soils, Construction and Demolition Wastes (Official Gazette Date/No: 18.03.2004/25406) will be followed which requires taking necessary measures to minimize dust emissions during excavations.
- Excavated soils will be stockpiled (as necessary) at designated areas and will be placed as far as possible from the settlements in the south. Dusty and loose materials will be properly covered or top layers will be kept moist.
- Screens will be placed as necessary at the construction site to reduce dust emissions.

The following mitigation measures will be implemented to minimize dust emissions related to transport of materials during construction:

- Vehicle speed limits will be applied inside the Project area. Truck operators will be trained to comply with speed limits and good construction site practices.
- Trucks carrying excavated soils will be covered before leaving the construction area.
- Transfer roads for material supply will avoid passing through residential areas as far as possible.
- Transfer roads will be sprayed with water as necessary (for example using mobile bowsers) to prevent significant dust emissions especially in dry weather conditions.

Exhaust Emissions

- The construction equipment and trucks will be maintained regularly to keep them in good working condition to minimize exhaust emissions caused by poor performance.
- Low sulphur fuel will be preferred as far as possible.
- Engines of the equipment/trucks will be prevented from idling and running unnecessarily.
- A Construction Traffic Management Plan will be prepared and implemented which will decrease the impacts of the traffic load resulting from the construction activities. This, in turn, will lower the exhaust emissions from the truck movements.

9.8.2 Mitigation of Air Quality Impacts during Operation

The Air Quality Control and Monitoring Plan to be developed will include mitigation measures that will be taken to minimize emissions during operation. In addition, the Air Quality Control and Monitoring Plan will cover measurements of air pollutants at nearby sensitive locations as necessary. The Air Quality Control and Monitoring Plan will include details of sampling locations, monitoring frequency, methods of sampling for each parameter, applicable regulatory limits and will require analysis of samples by accredited laboratories.

The most significant pollutant emitted from natural gas fired trigeneration and boiler systems is NO₂. In order to reduce stack emissions from the trigeneration system, a catalytic converter system will be used which is already considered during the modeling study (the trigeneration system will include a catalytic converter as reported by the manufacturer). A catalytic converter is a device that uses a catalyst to convert hydrocarbons, NO_x and CO compounds into harmless compounds. Efficiency of the reduction system will be monitored periodically.

An IHC Traffic Management Plan will be prepared and implemented which will decrease the impacts of the traffic load resulting from the operation activities. This, in turn, will lower the exhaust emissions from the vehicle movements.

9.9 Residual Impacts

Impacts from air emissions during the construction phase can be effectively mitigated through good management practices and implementation of mitigation measures mentioned above. For this reason, it is assumed that the residual impacts on air quality will not be significant.

Based on the results of the dispersion modeling studies, the residual impacts from emissions generated by the operation of the proposed Project, mainly due to operation of the trigeneration and boiler systems, are predicted to be minimal.

10.0 NOISE

10.1 Introduction

This chapter presents the assessment of the noise impacts that will be generated by the construction and operation of the Project. In order to evaluate the impact of noise due to the Project activities, a noise modeling study was undertaken covering the Project area and its surroundings, for excavation/earthworks, main construction and operation phases.

In addition to the noise modeling study, baseline noise measurements were conducted at the nearest receptors in different directions in order to have background data prior to the start of the construction of the Project.

The results of the noise modeling study were compared with the Turkish and IFC standards considering cumulative noise level that is the sum of modeled noise level and background noise levels.

The impact significance criteria that are used related to noise are presented below.

Impact Significance	Description
Negligible	- Cumulative noise level does not result in change in background level
Minor	- Cumulative noise level above the IFC standard limit value and resulting in an increase of background noise level by 1 dBA
Moderate	- Cumulative noise level above the IFC standard limit value and resulting in an increase of background noise levels by 3 dBA
Major	- Cumulative noise level above the IFC standard limit value and resulting in an increase of background noise level by more than 3 dBA

10.2 Definitions and Methodology

10.2.1 Definitions

Before explaining the studies that were undertaken, it would be helpful to provide definitions of basic acoustical terms and concepts, as given below.

Sound: Sound is vibrational disturbance, exciting hearing mechanisms, transmitted in a predictable manner determined by the medium through which it propagates. To be audible, the disturbance must fall within the frequency range 20Hz to 20,000Hz.

Noise: Noise is typically defined as "unwanted sound", sound being the human sensation of pressure fluctuations in the air. Sound levels are expressed in decibels (dB) on a logarithmic scale, where 0 dB is nominally the "threshold of hearing" and 120 dB is nominally the "threshold of pain".

Background (Baseline) noise: Prevailing noise in a specified environment measured in the absence of the noise being studied.

Decibels (dB): It is the unit describing the amplitude of the sound. The human hear responds to sound logarithmically. The bel is logarithm of the ratio of the two powers and decibel is 1/10 bel.

Frequency: The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or Hz.

Sound pressure level (L_p): It is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standard reference level. The commonly used "zero" reference sound pressure in air is 20 μ Pa RMS (root mean square) which is usually considered as the threshold of human hearing (at 1 kHz).

Sound power level (L_w): Ten times the logarithm of the ratio of the sound power under consideration of the standard reference power of 1 pW (10^{-6} W). The quantity obtained is expressed in decibels.

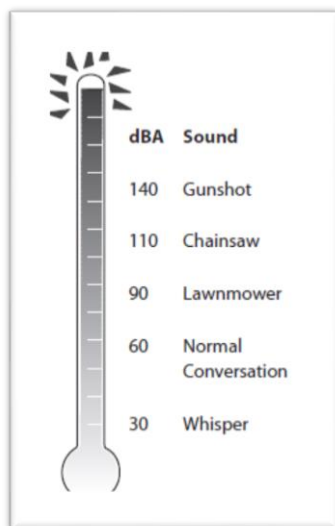
Equivalent Sound Level (L_{eq}): Quantifies the noise environment as a single value of sound level for any desired duration. L_{eq} correlates well with the effects of noise on people. L_{eq} is also sometimes known as Average Sound Level.

L_{10} : Sound pressure level that is exceeded 10% of the time of measurement.

L_{90} : Sound pressure level that is exceeded 90% of the time of measurement.

A-Weighting: A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response, it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted and the units are in decibels (dBA).

Several methods are present to characterize sound. The most common is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Studies have shown that the A-weighted level is closely correlated with annoyance.



C-Weighting: A measure of sound pressure level designed to reflect the response of the human ear, for higher levels above 100 dB when the human ear's response is flatter.

L_{Aeq} : A weighted equivalent sound pressure level.

L_{Amax} : The maximum A weighted sound pressure level detected in the measurement time domain.

LCeq: C weighted equivalent sound pressure level.

Point Source: A source of sound which is concentrated to a point.

Area Source: A source of sound which is distributed over an area.

Line Source: A source of sound emanating from a linear geometry.

The threshold of perception of the human ear is approximately 3 dB and a 5 dB change is considered to be clearly noticeable to the ear. This is primarily due to the logarithmic measuring metric typically associated with decibels. The perceived change with regard to decibel levels is shown below:

Change in sound level	Perceived change to human ear
± 1 dB	Not perceptible
± 3 dB	Threshold of perception
± 5 dB	Clearly noticeable
± 10 dB	Twice as loud
± 20 dB	Four-fold change

10.2.2 Methodology

Noise Modeling

The noise model was developed using the commercial noise modeling software IMMI from Woelfel. The important parameters for the modeling and the methods used are described below.

The information on ground topography and buildings is important to be included in the noise model, since sound propagation is strongly affected by the terrain levels as obstacles and by the buildings between sources and receivers as barriers. To develop the noise model of the Project, the ground topography data was obtained for an area of 12.5 km² area from the Digital Elevation Model Dataset from NASA, Reverb Earth Science Discovery tool as shown in Figure 10-1.

The surrounding buildings and facilities were digitized manually using the Google Earth imagery. The number of stories and height of the surrounding buildings are based on field observations. The height of the surrounding buildings is presented in Figure 10-2.

Meteorological data (average relative humidity, average temperature, wind frequencies and directions as obtained from General Directorate of Meteorology) was entered to noise mapping software.

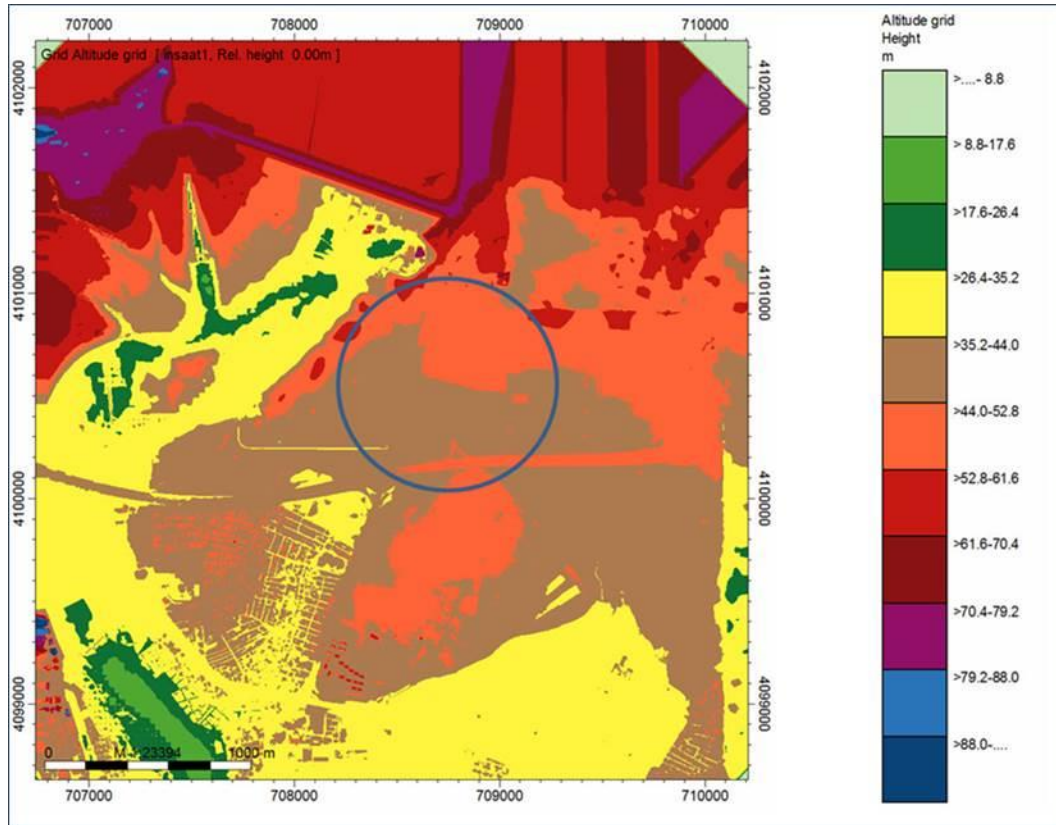


Figure 10-1: Terrain levels of the Project area (Project area falls inside the blue circle)



Figure 10-2: Building heights around the Project area (Project area is indicated by yellow line)

The noise model was developed with the commercial noise modeling software IMMI v2011-2. The calculations were carried out according to ISO 9613 standard which is recommended by the Turkish Regulation on the Assessment and Management of Environmental Noise (Official Gazette Date and Number: 10.06.2010/27601).

The ISO 9613-2:1996 standard was used for calculating the noise from the machinery and equipment such as exhaust, turbine, generator, engine and construction equipment. L_w of each source was entered into the noise model. L_w denotes the loudness of the equipment. There are three different approaches for determining L_w as described below:

- First method is to calculate L_w from L_p measurements (Sound power levels of existing equipment which will be used at the beginning of the project were calculated from measurements performed in the Project as detailed in relevant sections).
- Second method includes using reference values. In order to determine L_w of construction machine and equipment, Roadway Construction Noise Model User's Guide (RCM) of the U.S. Federal Highway Administration was used. This guide includes sound pressure levels of various construction equipment. L_w was calculated based on the information submitted in this guide.
- Last approach is the calculation of L_w from engine powers of equipment which are planned to be used in the Project. This L_w prediction approach is more theoretical and mainly depends on conversion of engine power to acoustical power.

In addition to L_w , the type of the noise source is an important parameter for the noise model. Different types of noise sources can be used in the model including point, line and area sources. Because of the mobility and dynamic behaviors of the construction equipment, they were modeled as an area source.

Another important parameter for the noise model is the ground absorption (G). Ground absorption varies between 0 to 1 for hard-reflective surfaces and soft-absorptive surfaces, respectively. When calculating the noise propagation, G for land area was assumed to be 0.5 and G for the Seyhan River and the DSI channel was assumed to be 1.

The noise prediction model used in this study is limited with the defined noise sources as described in the next sections of this chapter. There may be other noise sources that cannot be foreseen at this stage. For this reason, modeling results provide information on noise propagation based on the noise sources considered.

Project Phasing and Noise Modeling Conditions

Within the scope of the Project, noise modeling was undertaken considering three phases as below:

- Phase 1 (0-6 months): Earthworks
- Phase 2 (7-36 months): Main construction works
- Phase 3 (after 36 months): Operation phase

As indicated above, the construction activities are separated in two phases. Excavation and main construction works will be undertaken within the immediate Project area. Although several equipment and machinery will not be used continuously during construction, all types of equipment and machinery are assumed to be operated together to assess the worst case scenario.

10.3 Environmental Noise Standards and Guidelines

10.3.1 Turkish Regulations

Noise

Environmental noise is regulated by the Turkish Regulation on the Assessment and Management of Environmental Noise (Official Gazette Date/Number: 07.03.2008/26809). The regulation sets noise limits applicable to various areas (e.g. industrial areas, residential areas or combination of both) for three time periods (day, evening and night time). Noise limits for construction sites are given in Table 10-1.

Table 10-1: Environmental noise limits for construction sites

Type of activity (construction, demolition and renovation)	Leq-daytime (dBA) Day (07:00 - 19:00)
Building	70
Road	75
Other sources	70

In accordance with the mentioned regulation, construction activities inside or close to residential areas are not allowed to be conducted within evening and night time periods unless a consent is obtained from the relevant authorities. The construction working hours for the Project will be between 08:00 to 18:00 which falls to the daytime period. If needed, consent will be obtained from Adana Provincial Directorate of Environment and Urban Planning for undertaking construction activities during evening and night time.

Related to the operation phase of the Project, there is no defined limit value for noise emission sources of hospital activities to the surrounding buildings in the Turkish Regulation on the Assessment and Management of Environmental Noise. The most important noise source inside the IHC during the operation phase will be the trigeneration system which is regarded as industrial noise and evaluated with respect to the environmental noise limits for industrial facilities as defined in the Turkish Regulation as given in Table 10-2. Table 10-2 presents maximum allowable environmental noise levels that shall be met at the nearest off-site receptor.

Table 10-2: Environmental noise limits for industrial facilities (Leq-dBA)

Areas	Day (07:00 - 19:00)	Evening (19:00 - 23:00)	Night (23:00 - 07:00)
Areas where sensitive receptors are located including education, culture, health, summer houses and camping areas	60	55	50
Commercial and residential areas where residential buildings dominate	65	60	55
Commercial and residential areas where workplaces dominate	68	63	58
Industrial areas	70	65	60

The Project area is selected to fall within the area “Areas where sensitive receptors are located including education, culture, health, summer houses and camping areas” and therefore the associated noise limits are applicable to the operation of the trigeneration system during the

operation phase of the Project. In addition, the mentioned regulation requires that the noise level at the nearest sensitive area (e.g. residential building) shall not exceed the baseline noise levels by more than 5 dBA.

In addition, the Turkish Regulation on the Assessment and Management of Environmental Noise defines indoor noise levels for sensitive areas including health facilities as given in Table 10-3. These limits were also considered in assessing the impacts from the trigeneration system during operation phase.

Table 10-3: Indoor noise limits for health facilities (Leq-dBA)

Health Facilities	Closed window	Open window
Inpatient treatment institutions, dispensary, polyclinic, nursing center and similar	35	45
Resting and treatment rooms	25	35

Vibration

The Turkish Regulation on the Assessment and Management of Environmental Noise also sets limits for ground vibrations to be perceived at very sensitive and sensitive receptors. The relevant limits for the Project are those limits that are set for piling activities during construction and for construction machinery as given in Table 10-4. However, it is important to note that there will be no pile driving during the construction of the Project and only vibrations related to construction machinery can be considered.

Table 10-4: Maximum allowable ground vibration limits for pile driving and construction machinery

Area	Maximum Allowable Vibration Velocity (peak value in mm/s) (Frequency band between 1 Hz to 80 Hz)	
	Continuous vibration	Intermittent Vibration
Residential areas	5	10
Industrial and commercial areas	15	30

10.3.2 IFC Guidelines

IFC General EHS Guidelines sets limits for noise for two types of receptors and two time periods, as given in Table 10-5.

Table 10-5: IFC noise level guidelines (one hour Leq-dBA)

Receptor	Daytime (07:00 - 22:00)	Nighttime 22:00 - 07:00
Residential areas	55	45
Commercial/industrial areas	70	70

The guideline requires that noise levels should not exceed the limits given in Table 10-5 or result in a maximum increase of 3 dB in background levels at the nearest receptor location off-site.

10.4 Baseline Measurements

Baseline environmental noise measurements were conducted in September 2013 at the nearest receptors to the Project area in different directions (4 measurement locations). The measurements at each location were conducted for 24 hours. The measurement locations are shown in Figure 10-3. The measurements were conducted by Frekans Çevre Ölçüm Mühendislik Danışmanlık Tic. Ltd. Şti. The measurement report is presented in Annex J-1.



Figure 10-3: Background noise sampling locations

The measurement locations are described below:

- Location 1 is the nearest residential building.
- Location 2 is located in a residential area (TOKI buildings).
- Location 3 is located in an educational area (school) and nearby the measurement location construction activities of another school was ongoing at the time of the measurement.
- Location 4 is located in sports facility (riding center).

The distance of the measurement locations at the nearest receptors to the Project boundary at different directions are presented in Table 10-6. The results of the baseline measurements (considering time periods defined in Turkish Environmental Noise Regulation) are provided in Table 10-7. It should be noted that limits provided in IFC standards are based on hourly noise. The hourly noise measurement results are given in Annex J-1.

Table 10-6: Distance of measurement locations to the Project boundary

Measurement Location	Direction	Distance to Project area boundary (m)	Usage
1	South	44	Residential
2	East	285	Residential
3	North	172	School
4	West	202	Sports facility – Riding center

Table 10-7: Results of baseline noise measurements at receptors

Measurement Location	Start Time / End Time	Noise					
		A Weighted					
		Leq dB(A)	L 10 dB(A)	L 90 dB(A)	Lday dB(A)	Leved B(A)	Lnight dB(A)
1	12.09.2013 18:38 13.09.2013 18:38	61.3	59.6	49.0	60.13	66.22	56.52
2	12.09.2013 19:34 13.09.2013 19:34	56.46	58.0	48.6	58.18	56.19	51.29
3	12.09.2013 20:00 13.09.2013 20:00	54.9	56.8	47.0	69.48	53.04	47.72
4	12.09.2013 02:21 13.09.2013 02:21	57.5	60.6	46.4	53.62	57.91	60.13

The baseline measurements showed the following:

- Evening time noise levels are higher than the daytime noise levels at Location 1, which is considered to be attributable to the evening traffic at the highway.
- Daytime noise level at Location 3 is high related to the adjacent ongoing school construction.
- Evening time and night time noise levels at Location 4 are higher than daytime noise level which is attributable to the activities inside the riding center at those time periods.

10.5 Noise Sources

This section provides information on the noise sources during construction and operation phases of the Project.

10.5.1 Construction Noise

Noise sources during construction will include earthworks (Phase 1) and main construction activities (Phase 2). The quantities of machines and equipment that will be required for earthworks and main construction activities are given in Table 10-8. All equipment are assumed to work together to assess the worst case scenario during each phase of construction.

Table 10-8: Machine and equipment for earthworks and main construction activities

Machine/ Equipment	Quantity	
	During earthworks	During main construction activities
Truck	30	40
Excavator	12	-
Dozer	2	-
Grader	2	-
Loader	1	-
JCB	3	2
Roller	1	5
Crane	-	6
Mobile Crane	-	22
Concrete Mixer	-	35
Mobile Concrete Pump	-	5
Fixed Concrete Pump	-	2
Kalinite Pump	-	2
Finisher	-	2

Table 10-9 provides information on the sound power levels of the machines and equipment that were calculated based on the noise levels of each machine/equipment obtained from Roadway Construction Noise Model User's Guide (RCM) of the U.S. Federal Highway Administration. Table 10-9 also provides the quantities of the machines/equipment for earthworks (Phase 1) and main construction activities (Phase 2) and the sound power levels for each type of machine/equipment and the total sound power level for each phase. Sound power levels (L_w) in Table 10-9 were calculated by using L_{Amax} obtained from RCM. Usage factor (% operational time) accounts for the time that the machine/equipment is in use over a specified time period. The sound power levels were calculated by using the formula: $L_w = L_{Amax} + 10 \log(U.F) + 20 \log(15)$.

Table 10-9: Sound power level calculations of construction machines/equipment and total sound power level for earthworks (Phase 1) and main construction phases (Phase 2)

Machine/Equipment	Impact/Impulse Noise	$L(A)_{max}$ @15 m.	Operation Time (%)	Phase 1		Phase 2	
				Quantity	L_w (dBA)	Quantity	L_w (dBA)
Truck	No	84	40	30	118.3	40	119.6
Excavator	No	85	40	12	115.3	-	
Dozer	No	85	40	2	107.6	-	
Grader	No	85	40	2	107.6	-	
Loader	No	80	40	1	99.5	-	
JCB	No	80	40	3	104.3	2	102.6
Roller	No	85	40	1	104.5	5	111.5
Crane	No	85	15	-		6	108.1
Mobile Crane	No	85	15	-		22	113.7
Concrete Mixer	No	85	40	-		35	120.0
Mobile Batch Pump	No	82	20	-		5	105.5
Batch Plant	No	82	20	-		2	101.5
Kalinite Pump	No	82	20	-		2	101.5
Finisher	No	84	20	-		2	103.5
Total				121.9		123.9	

As the construction activities will be distributed within the Project area and the machines/equipment will not stay in a fixed location, construction noise sources were defined as an area source in the noise modeling. The areas of sound sources and sound power level per area (L_w'') are provided in Table 10-10.

Table 10-10: Sound power level per area (L_w'' (dBA))

Phase 1		Phase 2	
Area (m ²)	L_w'' (dBA)	Area (m ²)	L_w'' (dBA)
328,820	66.7	328,820	68.7

10.5.2 Operational Noise

Noise sources during operation will be the equipment related to the trigeneration system. A schematic illustration of the trigeneration system is presented in Figure 10-4.

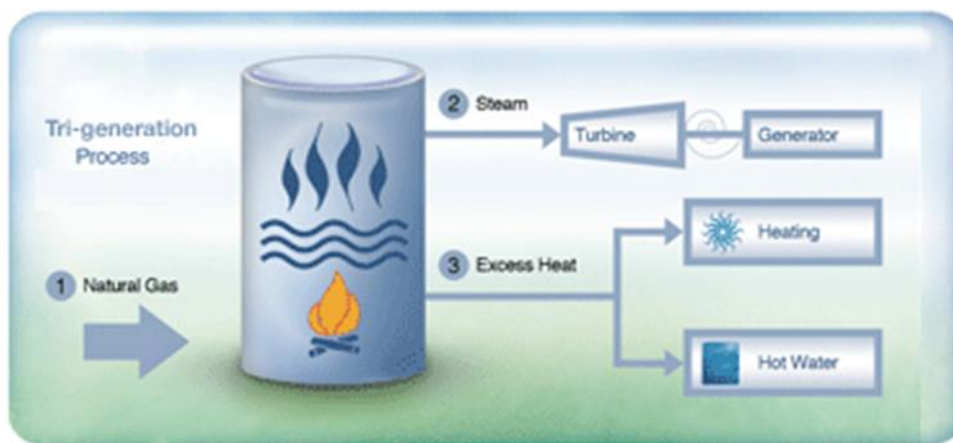


Figure 10-4: Schematic representation of the trigeneration system

The main noise sources of the trigeneration system are the gas engines. The capacity of the trigeneration system is 8.6 MW which consists of 2 gas engine units each with a capacity of 4.3 MW. Noise emission values of the 4.3 MW engine unit are supplied by the manufacturer and presented in Table 10-11.

Table 10-11: Sound power levels of a 4.3 MW engine unit @ 1 meter

Engine Noise Level	Frequency								Sum Level dBA
	63	125	250	500	1000	2000	4000	8000	
Exhaust Noise dB(lin)	131	124	122	121	117	115	113	109	133.8
Air-borne Noise dB(lin)	99	109	104	101	99	99	104	101	112.5

The engine units will use natural gas as fuel. The values in Table 10-11 are obtained from the technical data sheet which provides values for an engine unit during operation at 100% capacity. In order to assess the worst case scenario, capacity of the 2 engines are taken as maximum. During modeling study, air-borne noise levels and exhaust noise levels given in Table 10-11 are entered into the model for the generator room and the stack, respectively. It is also important to note that the current planning is that only one of the gas engines will be operated, however the noise modeling considered operation of the 2 gas engines in order to assess worst case scenario. The

trigeneration system will be located inside the technical unit building in the IHC as shown in Figure 10-5 (shown with a blue circle line).

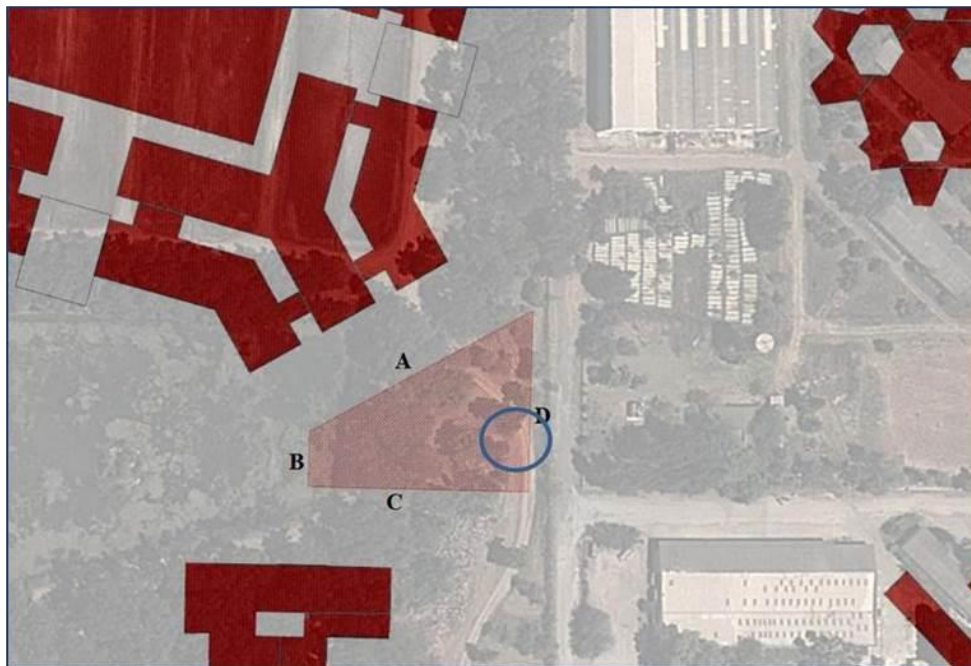


Figure 10-5: Trigeneration system and stack location and sides of technical unit building (A to D)

Considering the location of the trigeneration system inside the technical unit building, noise that will be reaching to the walls on each side of the technical unit building (as shown with A, B, C and D in Figure 10-5) is calculated by using the following formula which gives sound level in depending on the distance: $L_2 = L_1 - [20 \text{ Log } (r_1/r_2)]$ where; r_1 is the distance; r_2 is the reference distance. Exhaust noise is calculated for 1.5 meter distance by using the same method. The calculated results are shown in Table 10-12.

Table 10-12: Engine noise level depending on distance

Engine Noise Level	Frequency								Sum Level
	63	125	250	500	1000	2000	4000	8000	
Exhaust Noise	131.0	124.0	122.0	121.0	117.0	115.0	113.0	109.0	133.8
@ 1.5 m	127.5	120.5	118.5	117.5	113.5	111.5	109.5	105.5	129.3
Air-borne Noise	99.0	109.0	104.0	101.0	99.0	99.0	104.0	101.0	112.5
Side A (53 m)	64.5	74.5	69.5	66.5	64.5	64.5	69.5	66.5	78.0
Side B (80 m)	60.9	70.9	65.9	62.9	60.9	60.9	65.9	62.9	74.5
Side C (43 m)	66.3	76.3	71.3	68.3	66.3	66.3	71.3	68.3	79.9
Side D (20 m)	73.0	83.0	78.0	75.0	73.0	73.0	78.0	75.0	86.5

10.6 Noise Mapping and Noise Modeling Results

Based on the implementation schedule of the Project and the construction and operation noise sources explained in the previous sections, noise modeling was conducted for the defined 3 phases. Noise maps were prepared in two different formats. First one is the horizontal grid maps which are prepared considering an elevation of 4 m above the ground level and the second one is the facade noise model. The axis of the horizontal grid maps represents the UTM coordinates in WGS84

coordinate system. Facade noise model helps to understand vertical noise impact on all the stories of the buildings concerned.

Related to the noise modeling for operation, additional parameters that include transmission loss and presence of a silencer in the exhaust system are also considered. Transmission Loss (TL) value of walls of the building (technical unit building) where noise sources (trigeneration system) will be in, is provided from IMMI database. 1/1 Octave band TL values of the walls are presented in Table 10-13. It is assumed that the exhaust system will include a silencer. 1/1 Octave band TL values of the silencer (that provides minimum transmission loss by best fit materials) are presented in Table 10-14.

Table 10-13: Transmission loss value (wall)

f(Hz)	16	31,5	63	125	250	500	1000	2000	4000	8000
R'(dB)	20.0	30.0	42.0	43.0	46.0	51.0	57.0	63.0	66.0	66.0

Table 10-14: Transmission loss value (silencer)

f(Hz)	31,5	63	125	250	500	1000	2000	4000	8000
R'(dB)	8.0	12.0	16.0	21.0	30.0	37.0	37.0	35.0	27.0

It is considered in the noise modeling that construction activities will be undertaken between 08:00 – 18:00 during the daytime period and operation activities to continue 24 hours. It is important to note that both horizontal grid maps and facade maps show the noise levels that are based directly on the Project activities as described in Section 10.6.1 and 10.6.2. Cumulative noise levels (sum of the noise levels generated by Project activities and background noise) are provided in Section 10.6.3.

10.6.1 Construction Phase

Horizontal Grid Maps

Horizontal grid maps for noise propagation modeling of Phase 1: Earthworks and Phase 2: Main Construction Activities are presented in Figure 10-6 and Figure 10-7, respectively. Based on the horizontal grid map, it is seen that the noise levels at the nearest residential buildings vary between 55 dBA to 65 dBA during Phase 1 and 60 dBA to 65 dBA during Phase 2. The detailed horizontal grid maps for measurement location 1 and its surroundings are provided in Figure 10-8 and Figure 10-9 for Phase 1 and Phase 2, respectively. Based on the detailed horizontal grid maps, the noise levels at the nearest residential buildings (Location 1 and surroundings) will vary between 57 dBA to 63 dBA during Phase 1 and 59 dBA to 64 dBA during Phase 2. The detailed horizontal grid maps for other measurement locations and surroundings are presented in Annex J-2.

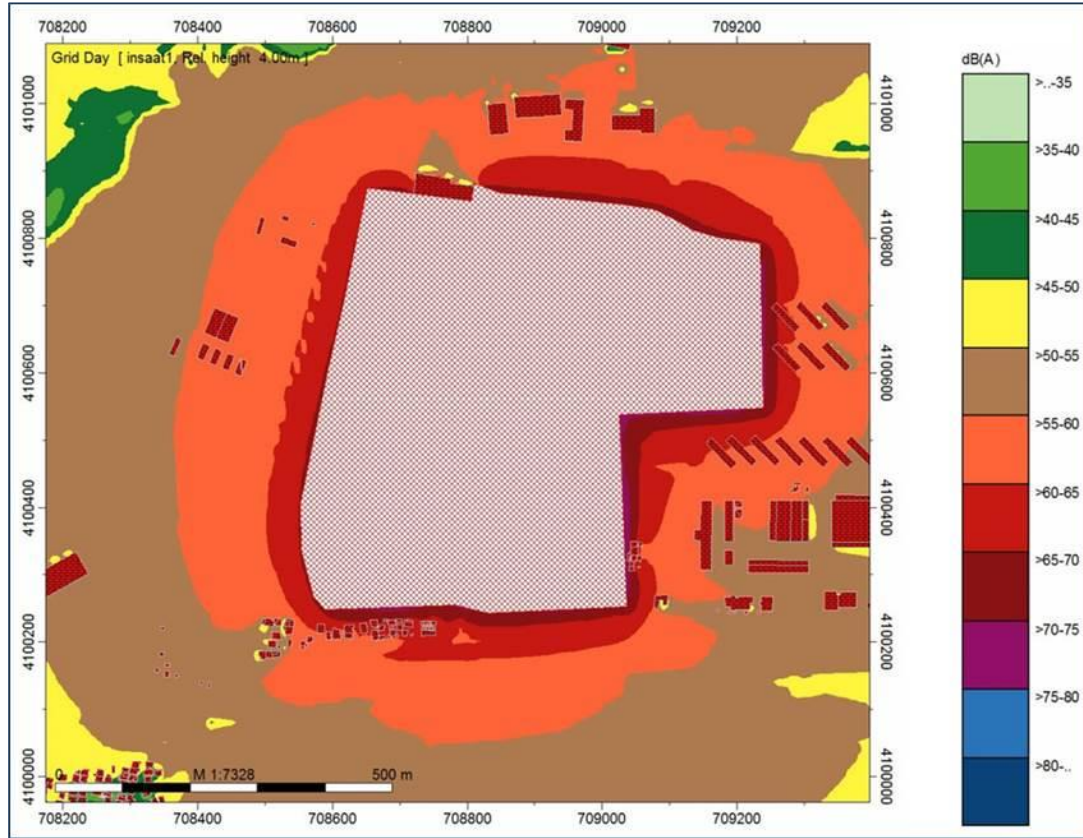


Figure 10-6: Noise propagation model for Phase 1 (0-6 months)

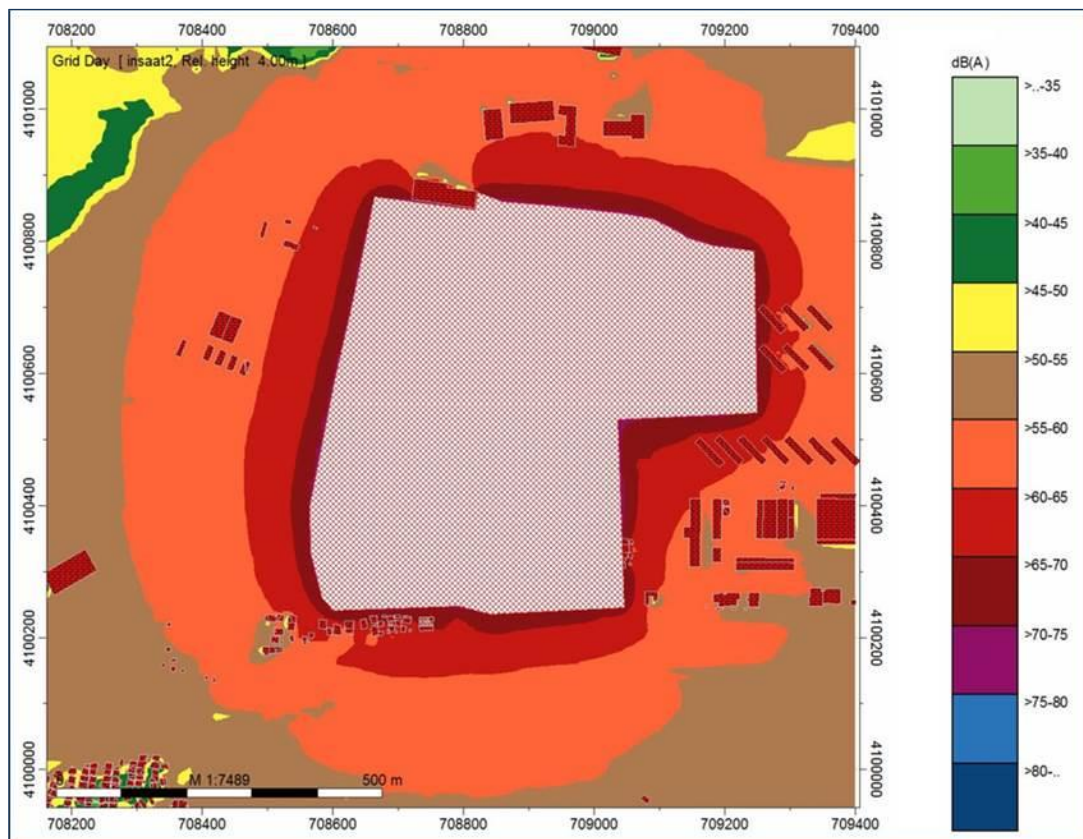


Figure 10-7: Noise propagation model for Phase 2 (7-36 months)

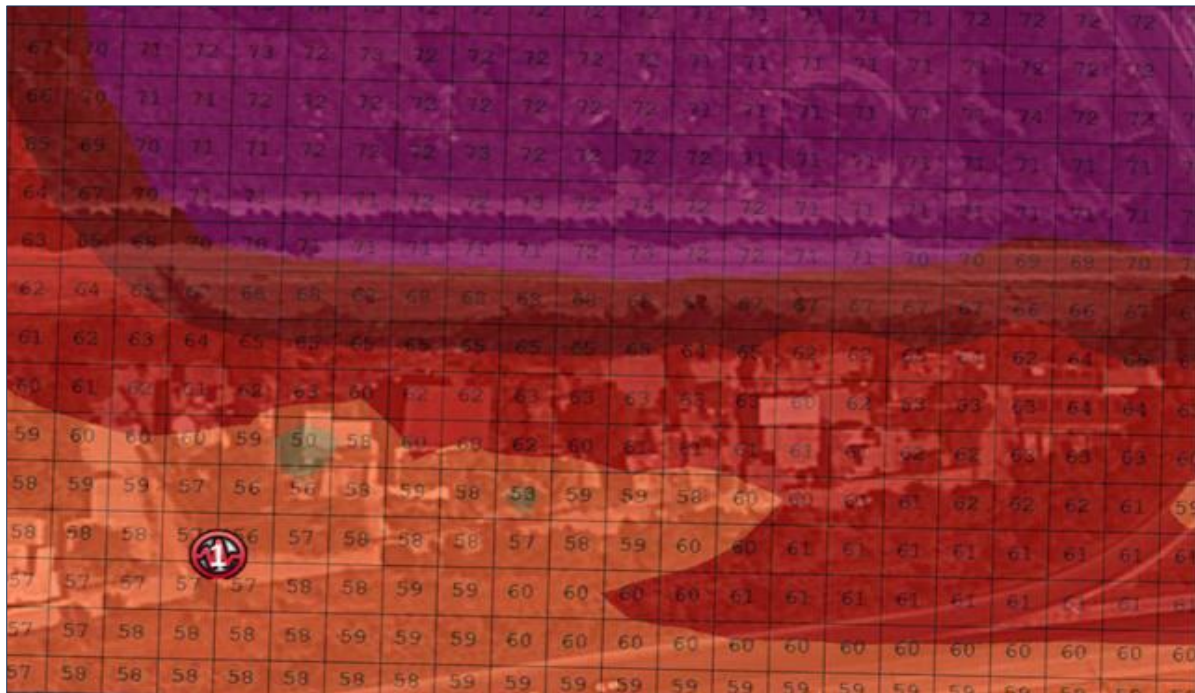


Figure 10-8: Detailed horizontal grid map showing Location 1 and surroundings for Phase 1 (noise levels at an elevation of 4 m above ground level)

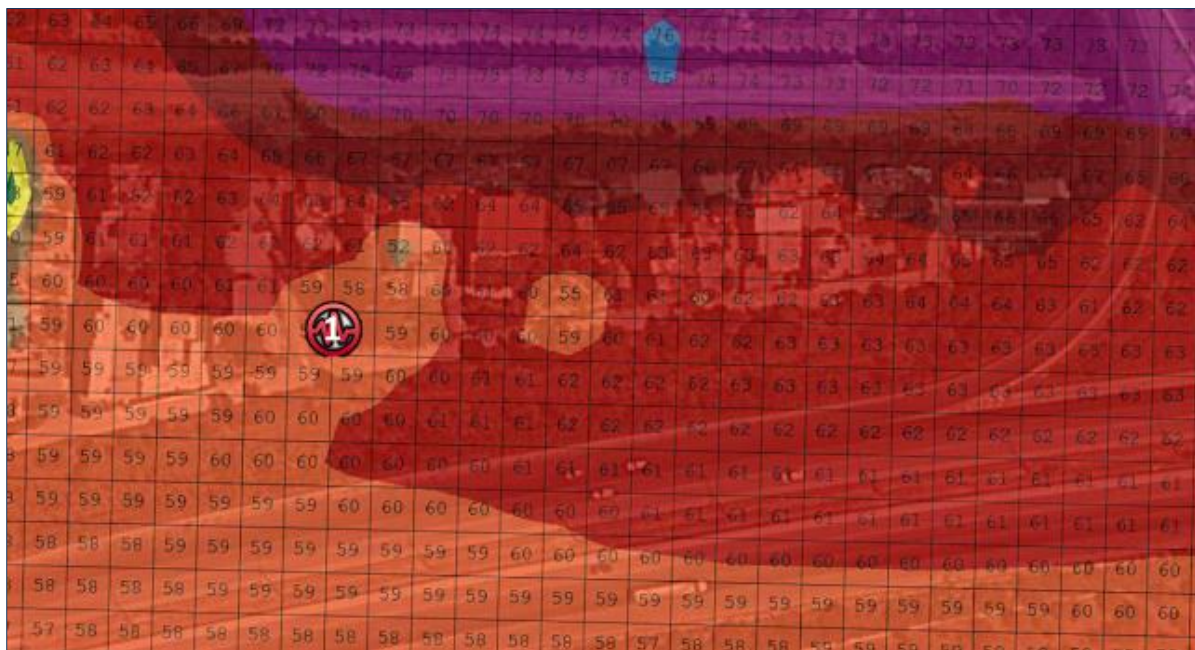


Figure 10-9: Detailed horizontal grid map showing Location 1 and surroundings for Phase 2 (noise levels at an elevation of 4 m above ground level)

Noise Level Calculations at Facade of Residential Buildings

Noise levels were calculated at the facades of the receptors around the Project area. This section provides facade maps for Phase 1 and Phase 2 at Location 1 as presented in Figure 10-10 and Figure 10-11, respectively. It is found that the maximum noise level at the facade of the building at

Location 1 will be 55-60 dBA during Phase 1 and 60-65 dBA during Phase 2. Facade maps for other receptors are provided in Annex J-2.



Figure 10-10: Facade noise level calculations, measurement location 1, Phase 1

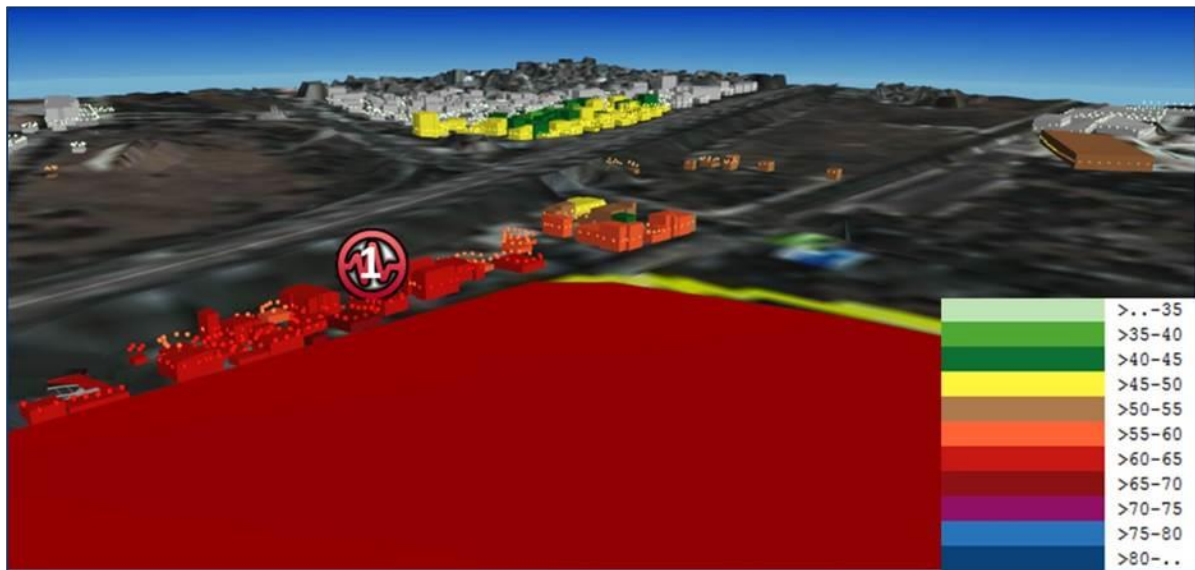


Figure 10-11: Facade noise level calculations, measurement location 1, Phase 2

10.6.2 Operation Phase

Horizontal Grid Maps

Horizontal grid map for noise propagation modeling of Phase 3: Operation Phase is presented in Figure 10-12.

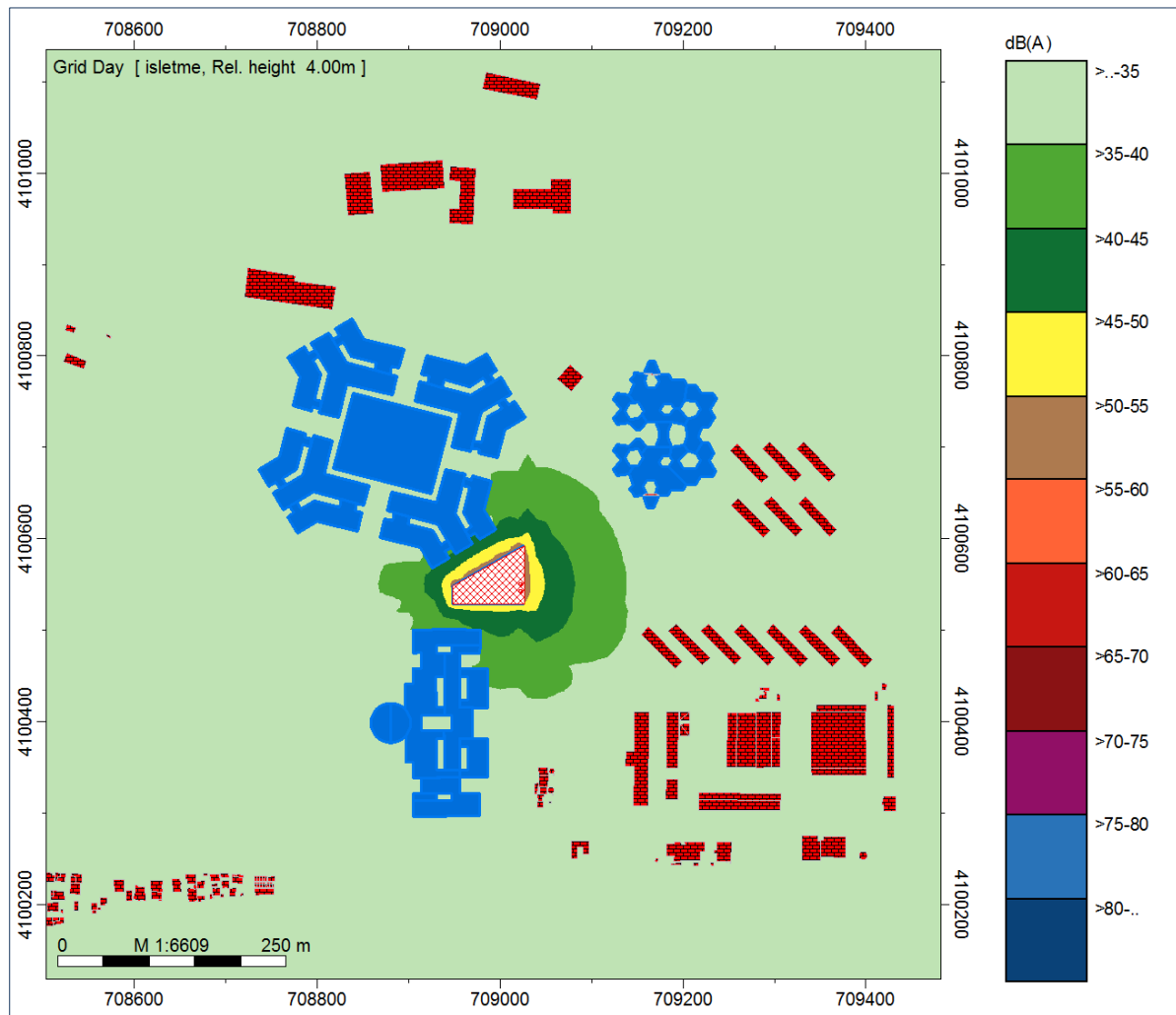


Figure 10-12: Noise propagation model for operation phase

As can be seen from Figure 10-12, the noise level at the receptors around the IHC will be less than 35 dBA during the operation phase which is directly related with the IHC activities (i.e. operation of the trigeneration system).

10.6.3 Noise Modeling Results

Table 10-15 presents the results of the noise modeling study for construction phase (Phase 1 and Phase 2) and for operation phase (Phase3) including cumulative noise levels that takes into account both the modeled noise level as a result of the Project activities and the measured background noise level.

Table 10-15: Noise modeling results (Leq, dBA)

Existing background noise level (dBA)			Modeling result* (dBA)			Cumulative noise Level (dBA)			Change in background level (dBA)		
No	Date and Time	Result Leq(A)	Construction Phase 1	Construction Phase 2	Operation Phase 3	Construction Phase 1	Construction Phase 2	Operation Phase 3	Construction Phase 1	Construction Phase 2	Operation Phase 3
1	07:38:40-08:38:40	56.6	53.8	55.4	19.1	58.4	59.1	56.6	1.8	2.5	0.0
	08:38:40-09:38:40	56.4	53.8	55.4	19.1	58.3	58.9	56.4	1.9	2.5	0.0
	09:38:40-10:38:40	56.2	53.8	55.4	19.1	58.2	58.8	56.2	2.0	2.6	0.0
	10:38:40-11:38:40	56.4	53.8	55.4	19.1	58.3	58.9	56.4	1.9	2.5	0.0
	11:38:40-12:38:40	56.3	53.8	55.4	19.1	58.2	58.9	56.3	1.9	2.6	0.0
	12:38:40-13:38:40	56.6	53.8	55.4	19.1	58.4	59.1	56.6	1.8	2.5	0.0
	13:38:40-14:38:40	55.8	53.8	55.4	19.1	57.9	58.6	55.8	2.1	2.8	0.0
	14:38:40-15:38:40	57.5	53.8	55.4	19.1	59.0	59.6	57.5	1.5	2.1	0.0
	15:38:40-16:38:40	66.9	53.8	55.4	19.1	67.1	67.2	66.9	0.2	0.3	0.0
	16:38:40-17:38:40	59.2	53.8	55.4	19.1	60.3	60.7	59.2	1.1	1.5	0.0
	17:38:40-18:38:40	59.8	53.8	55.4	19.1	60.8	61.1	59.8	1.0	1.3	0.0
2	07:34:16-08:34:16	55	46.6	48.7	17	55.6	55.9	55.0	0.6	0.9	0.0
	08:34:16-09:34:16	57.6	46.6	48.7	17	57.9	58.1	57.6	0.3	0.5	0.0
	09:34:16-10:34:16	59.5	46.6	48.7	17	59.7	59.8	59.5	0.2	0.3	0.0
	10:34:16-11:34:16	62.4	46.6	48.7	17	62.5	62.6	62.4	0.1	0.2	0.0
	11:34:16-12:34:16	56.4	46.6	48.7	17	56.8	57.1	56.4	0.4	0.7	0.0
	12:34:16-13:34:16	56.7	46.6	48.7	17	57.1	57.3	56.7	0.4	0.6	0.0
	13:34:16-14:34:16	58.4	46.6	48.7	17	58.7	58.8	58.4	0.3	0.4	0.0
	14:34:16-15:34:16	57.7	46.6	48.7	17	58.0	58.2	57.7	0.3	0.5	0.0
	15:34:16-16:34:16	57.8	46.6	48.7	17	58.1	58.3	57.8	0.3	0.5	0.0
	16:34:16-17:34:16	57.5	46.6	48.7	17	57.8	58.0	57.5	0.3	0.5	0.0
	17:34:16-18:34:16	57.3	46.6	48.7	17	57.7	57.9	57.3	0.4	0.6	0.0
	18:34:16-19:34:14	58.4	46.6	48.7	17	58.7	58.8	58.4	0.3	0.4	0.0
3	08:00:34-09:00:34	60.3	48.5	50	11.4	60.6	60.7	60.3	0.3	0.4	0.0
	09:00:34-10:00:34	54.1	48.5	50	11.4	55.2	55.5	54.1	1.1	1.4	0.0
	10:00:34-11:00:34	54.9	48.5	50	11.4	55.8	56.1	54.9	0.9	1.2	0.0
	11:00:34-12:00:34	57.2	48.5	50	11.4	57.7	58.0	57.2	0.5	0.8	0.0
	12:00:34-13:00:34	51.7	48.5	50	11.4	53.4	53.9	51.7	1.7	2.2	0.0
	13:00:34-14:00:34	56.6	48.5	50	11.4	57.2	57.5	56.6	0.6	0.9	0.0
	14:00:34-15:00:34	57.7	48.5	50	11.4	58.2	58.4	57.7	0.5	0.7	0.0
	15:00:34-16:00:34	60.4	48.5	50	11.4	60.7	60.8	60.4	0.3	0.4	0.0
	16:00:34-15:00:34	60	48.5	50	11.4	60.3	60.4	60.0	0.3	0.4	0.0
	17:00:34-18:00:34	55.6	48.5	50	11.4	56.4	56.7	55.6	0.8	1.1	0.0
4	18:00:34-19:00:34	51.7	48.5	50	11.4	53.4	53.9	51.7	1.7	2.2	0.0
	07:21:14-08:21:14	47.7	54.9	56.7	19.6	55.7	57.2	47.7	8.0	9.5	0.0
	08:21:14-09:21:14	47.1	54.9	56.7	19.6	55.6	57.2	47.1	8.5	10.1	0.0
	09:21:14-10:24:14	48.4	54.9	56.7	19.6	55.8	57.3	48.4	7.4	8.9	0.0
	10:21:14-11:21:14	48.8	54.9	56.7	19.6	55.9	57.4	48.8	7.1	8.6	0.0
	11:21:14-12:21:14	50.7	54.9	56.7	19.6	56.3	57.7	50.7	5.6	7.0	0.0
	12:21:14-13:21:14	55.1	54.9	56.7	19.6	58.0	59.0	55.1	2.9	3.9	0.0
	13:21:14-14:21:14	56.5	54.9	56.7	19.6	58.8	59.6	56.5	2.3	3.1	0.0
	14:21:14-15:21:14	57.3	54.9	56.7	19.6	59.3	60.0	57.3	2.0	2.7	0.0
	15:21:14-16:21:14	54.4	54.9	56.7	19.6	57.7	58.7	54.4	3.3	4.3	0.0
	16:21:14-17:21:14	54.5	54.9	56.7	19.6	57.7	58.7	54.5	3.2	4.2	0.0
	17:21:14-18:21:14	55	54.9	56.7	19.6	58.0	58.9	55.0	3.0	3.9	0.0
	18:21:14-19:21:14	54.7	54.9	56.7	19.6	57.8	58.8	54.7	3.1	4.1	0.0

*Modeling results are based on exact coordinates at the receptor points. The horizontal noise mapping (i.e. Figure 10-6, Figure 10-7, Figure 10-8, Figure 10-9, Figure 10-12) are generated using horizontal grids which use interpolation methods. This feature will provide noise values that are different than exact noise levels at the receptor as shown in the above table.

10.7 Impacts

Main noise sources during construction activities include use of construction machinery and equipment during excavation works and main construction works and construction traffic related to the transportation of excavated soils and construction materials. Increased noise levels during construction activities have the potential to result in negative impacts to the background noise levels including health risks at nearest sensitive receptors. The actual impact level due to construction activities will depend also on aspects such as the type of equipment to be used, time period and duration, and the perception of specific noise patterns (e.g. continuous, regular intervals, irregular). No piling or blasting which are important sources of vibration will be conducted at the Project site. For this reason, potential vibration impacts will be related to the truck movements and use of construction machinery at the Project site. Increase in vibration may result in disturbance to the occupiers of dwellings and other noise sensitive buildings that are close to the Project site boundaries. The transfer of construction materials to the site and excavated materials off-site for disposal may cause disturbance particularly to the residents at the south boundary of the Project area as a result of frequent truck movements, however it is not clear at this stage whether the trucks will use the side road located at the south boundary or the north boundary during the transportation of excavated materials.

Main noise sources during operation phase include the operation of the trigeneration system and the increase in road traffic from the operation of the facility. In addition, there will be ambulance helicopter movements causing occasional noise. As reported by ADN PPP A.Ş., an average of 1 cycle/day and on peak, 3 cycles/day are expected (depending on the severity and priority of the possible incident) for helicopters that will come to the Adana IHC helipad. Maximum sound levels from individual helicopter operations are expected to be short in duration and comparable to other community noise sources measured. As with some existing community noise sources, helicopter arrivals and departures would have the potential to affect speech intelligibility for short periods of time. Lower ambient levels at night could make the helicopter noise more prominent and as a result, the helicopter operations may cause sleep disturbance at night. However given that very low number of helicopters is expected to be used at the facility, the noise impacts are expected to be negligible.

In view of the above, in order to predict the impacts of the Project on the existing background noise conditions, baseline noise measurements and a sound propagation modeling study was conducted as described in detail in above sections. The construction activities are separated into two phases as earthworks and main construction activities, which will be undertaken between 08:00 – 18:00 during the daytime period. Operational activities (operation of the trigeneration system considered in operational noise modeling) are considered to continue 24 hours. The results of the noise modeling revealed the following:

- Existing background noise levels are above the IFC daytime limit value of 55 dBA at Location 1 and Location 2 (which are the nearest residential buildings) which result in the cumulative noise levels to be above the 55 dBA limit value. The increase in background noise levels at Location 1 varies between 0.2 to 2.1 dBA during Phase 1, and 0.3 to 2.8 dBA during Phase 2 which is considered as minor to moderate impact. At Location 2, the cumulative noise levels are very close to the background noise levels resulting in very small increases in the background in the range of 0.1 to 0.7 dBA which is considered as minor impact. As a result,

the increase in existing background noise levels are within the range of IFC standards and no mitigation is required.

- Existing background noise levels are above the IFC daytime limit value of 55 dBA at Location 3 (school) in the majority of the hourly noise levels which results in the cumulative noise levels to be above the 55 dBA limit value. The increase in background noise levels in those hours varies between 0.3 to 1.1 dBA during Phase 1 and Phase 2 which is considered as minor impact. For those hours when the existing background noise level is below the IFC daytime limit value of 55 dBA, cumulative noise levels either does not exceed the IFC limit value or result in an increase in background noise levels in the range of 0.9 to 1.4 which is considered as minor to moderate impact. As a result, the increase in existing background noise levels are within the range of IFC standards and no mitigation is required.
- Existing background noise levels are below the IFC daytime limit value of 55 dBA at Location 4 (sports facility-riding center) in the majority of the hourly noise levels, particularly in the morning and in the afternoon. On the other hand, cumulative noise levels at those hours exceed the IFC daytime limit value of 55 dBA and the increase in the existing background noise levels varies between 2 to 10.1 dBA during Phase 1 and Phase 2 which is considered as moderate to major impact. Particularly, the increase in existing background noise levels (5.6 to 10.1 dBA) is high during the morning time compared to the increase (2 to 4.3 dBA) in the afternoon. As a result, IFC limit values and maximum allowable increase of the existing background noise levels by 3 dBA are exceeded and therefore mitigation measures are required.
- During operation phase, cumulative noise levels do not result in a change in existing background noise levels and the associated impact is considered as negligible.
- Cumulative noise levels at all locations during Phase 1 and Phase 2 are below the limit value of 70 dBA defined in the Turkish Regulation on the Assessment and Management of Environmental Noise for construction sites.

Based on the results of the modeling study, it can be concluded that the IFC noise limit values will be exceeded during construction phase at Location 4 during parts of the daily working hours. However this impact will be temporary and observed only during the construction period. As mentioned before, the noise modeling study considered operation of all types of equipment and machinery at the same time to assess the worst case conditions. Considering this approach, the exceedence of background noise levels are expected to be lower than the calculated values. On the other hand, it is important to note that there may be other sources which were not foreseen at this stage and may have an additional impact on noise levels. For this reason, it is important that regular monitoring is conducted particularly during the construction phase to understand whether any changes occur with respect to modeling results.

10.8 Mitigation Measures

The following mitigation measures will be taken during the construction and operation phases in order to ensure that noise limit values set in the standards are met:

- 'Low-noise' equipment will be used during construction and operational phases as far as possible. Where construction equipment is provided with sealed acoustic covers or enclosures, these will be kept closed whenever the machines are in use.
- Machines will be shut down or throttled down to a minimum when not in operation.

- Maintenance procedures will be implemented in order to keep equipment in good working condition to minimize extraneous noises caused by poor performance.
- Construction activities will be carried out during daytime.
- Necessary consent will be obtained from Adana Provincial Directorate of Environment and Urban Planning for undertaking construction activities during evening and night time, if needed.
- Noisy activities taking place within construction sites will be located away from the residential areas as far as possible.
- Noise related to daytime traffic during construction will be properly managed to include measures such as using the side road at the north boundary of the Project area to the extent possible to minimize impacts on the residents at the south boundary of the Project area.
- On-site structures such as containers, offices, hoardings will be used to screen sensitive receptors from noise sources as far as possible. Where necessary movable noise barriers (2-2.5 m high) will be used to ensure receptor noise levels are less than the limit values adjacent to noisy activities.
- Awareness among construction workers will be increased regarding noise mitigation.
- A Noise Control and Monitoring Plan will be set up during the construction phase to measure noise levels at the closest sensitive receptors (4 locations as identified in the ESIA report) for 24 hours. It is suggested that noise monitoring measurements are conducted monthly, except for location 4. At location 4, bimonthly measurements are suggested in the first 3 months of construction to identify the need for noise barriers to be located east/southeast boundary of the Project area. If levels at receptors exceed the standards, measures will be taken to reduce noise levels so that the limit values are met.
- Vibration levels will be monitored upon a grievance is made by the nearby residents and if the standards are exceeded, measures will be taken to reduce vibration.
- Impact from increase in traffic due to operation phase will be assessed separately following the traffic study assessment.
- All noise generating equipment and machinery during operation will be placed in buildings with isolated walls, and the design of the technical unit building and selection of silencers are made such that the indoor noise levels at the hospitals do not exceed the regulatory standards.

10.9 Residual Impacts

Construction phase noise impacts will be temporary and can be mitigated with the implementation of measures mentioned above. Therefore, the residual impact is estimated to be negligible.

No residual impact is expected on nearest receptors by the operation of the trigeneration system during the operation phase. Residual impact, if any, related to increase in road traffic during operation phase can only be identified followed by the traffic assessment study.

11.0 TRAFFIC IMPACT

11.1 Scope

This chapter describes the potential traffic conditions that may develop during construction and operation phases of the Project. The following conditions are described:

- Existing baseline
- Planned expansion of the existing light railway system
- Potential traffic conditions during construction and operation phases

The assessment is based on the review of the following documents:

- Adana Urban Traffic Report, AMM Urban Council Publications, 2012
- Adana Phase II Light Railway System Environmental Impact Assessment Report, 2013
- Information from MoH and ADN PPP A.Ş. on patient and traffic forecasts

A traffic study is being undertaken presently to assess the impacts of the increase in traffic from the IHC operation and the results are not known yet. The traffic assessment study is expected to be completed by mid-September 2014. However, a potential significance criteria table that can be used to assess the impact is given below:

Impact Significance	Description
Negligible	- Temporary and small increase (<10%) in local traffic in the immediate surroundings of the Health Campus which have sensitive receptors (schools)
Minor	- Small increase (<10%) in local traffic in the immediate surroundings of the Health Campus which have sensitive receptors (schools) but still within the design carrying capacity of the transport system
Moderate	- Moderate increase (<50%) in traffic for public and private transport systems in the Yuregir region but still within the design carrying capacity of the transport system
Major	- Major increase (>50%) in road traffic for public and private cars in the Yuregir region resulting but still within the design carrying capacity of the transport system - Existing transport system is close to or above design carrying capacity of the transport system and the increase of the traffic due to operation no matter how small results in exceeding the design carrying capacity of the transport system in the Yuregir region

11.2 Existing Conditions

The physical development of Adana, the fifth largest city in Turkey, has been guided by the Seyhan River which separates the city in the north-south direction and by the D-400 international main road which runs in the east-west direction. A low-density residential area has been developed on the south side of the city center, while a high-density area prevails on the north side. The population of the Adana city is presently 2,125,635 million (2012 data). The Adana Urban Traffic Report provides the following information given in Table 11-1 on public transport:

Table 11-1: Transport mode and capacity in Adana

Mode of Transport	Number	Daily Capacity
Passenger bus operated by municipality	230	105,000
Passenger bus operated by private sector	418	160,000
Passenger minibus operated by private sector	1,085	230,000
Dedicated bus transport (bus, midi-bus, minibus) for schools, public sector and private sector	2,385	Not Stated
Private cars	205,823	Not Stated
Vehicles participating in the Adana traffic (motorbikes, midi-bus, small trucks and large trucks)	10,974	Not Stated
Adana light rail surface metro line		660,000 (only 2% is presently being used)

The interstate roads (D-400), Adana Ring road (E-90) and intercity roads and existing roads within the urban setting are shown in Figure 11-1. Figure 11-2 shows the traffic load on D-400 which is the major interstate road into and out of the Adana Metropolitan Area. Figure 11-3 and Figure 11-4 shows the road network near the Project area. Figure 11-5 shows the roads used for the public transport.

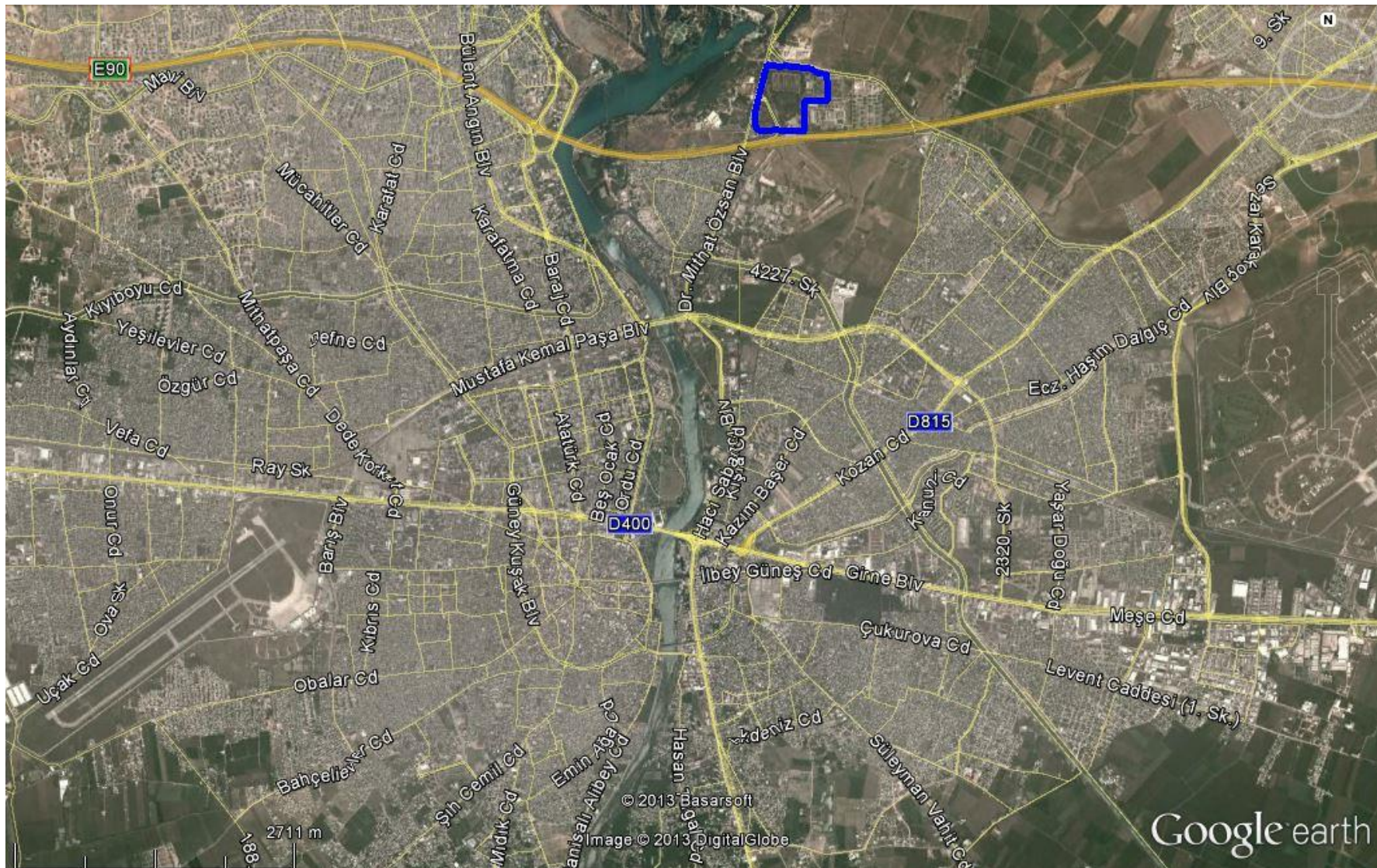


Figure 11-1: Roadways in the Adana Metropolitan Area (Project area is indicated by blue line)



OTOYOLLAR VE DEVLET YOLLARI TRAFİK HACİM HARİTASI 2012 MOTORWAYS AND STATE ROADS TRAFFIC FLOW MAP

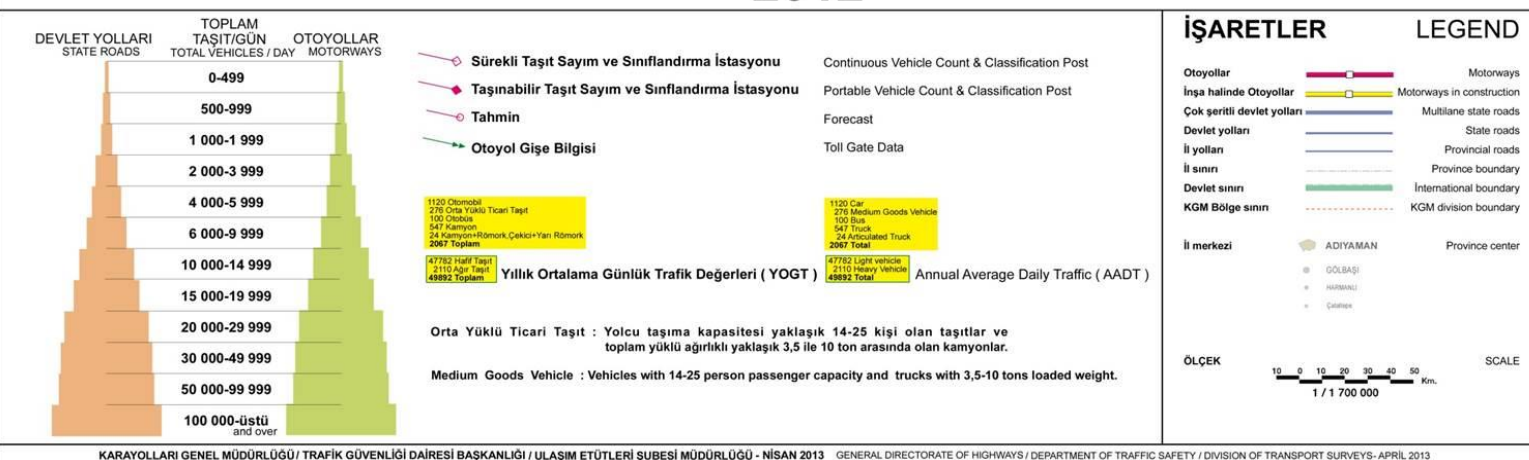


Figure 11-2: Annual average daily traffic values on D-400 (Source: 2012 Motorways and State Roads Traffic Flow Map, General Directorate of Highways, Department of Traffic Safety, Division of Transport Surveys, April 2013)

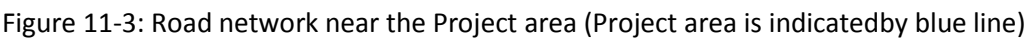




Figure 11-4: Road network near the Project area (Project area is indicated by blue line)

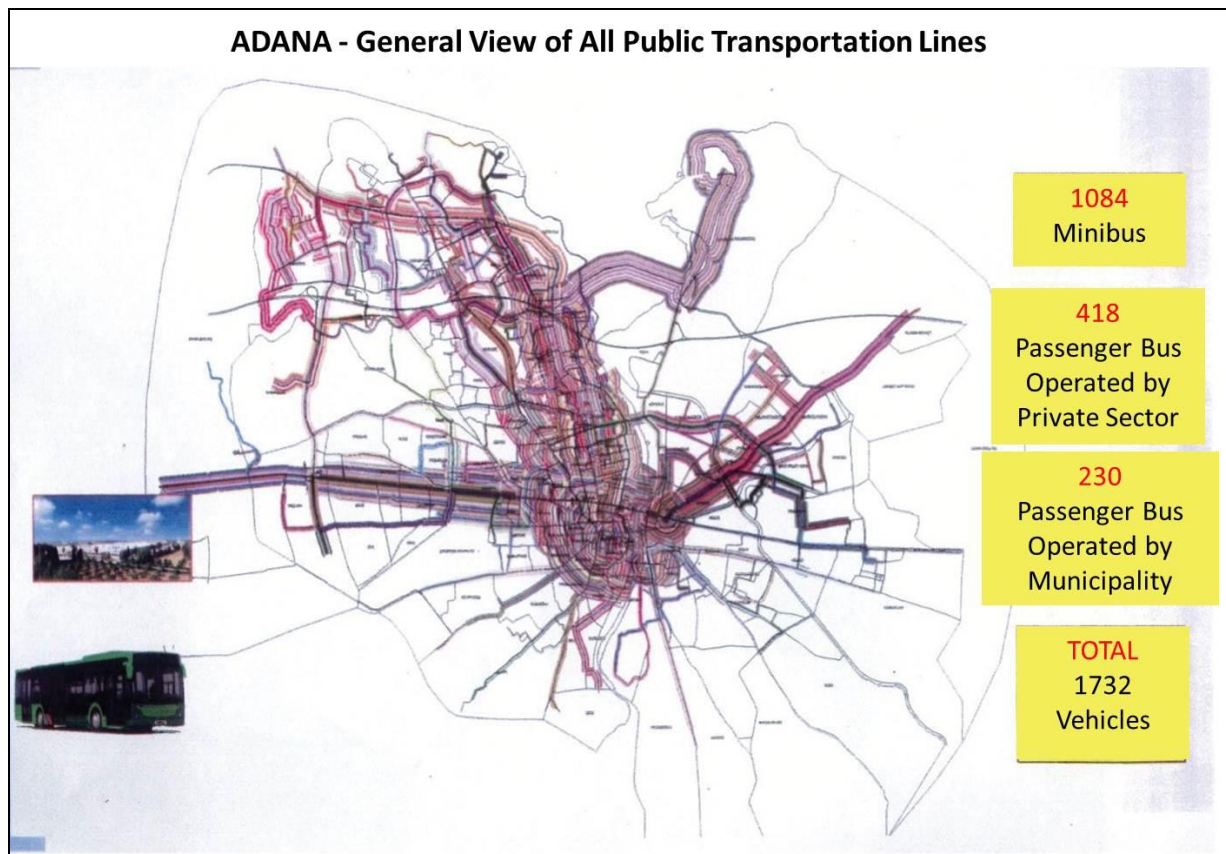


Figure 11-5: Roads used by vehicles for public transportation (Adana Urban Traffic Report, 2012)

The Adana Urban Traffic Report (2012) indicates the following problems and remedial proposals with the existing traffic conditions in the Metropolitan area:

- There is little integration with the light railway system (metro) and the main bus station, city center, hospitals, university and the airport. There needs to be an integrated approach to link the metro, the state highways and the railroad system.
- New roads need to be built to improve the existing road system including roads across the Seyhan River. The existing roads crossing the river cannot meet the needs of the traffic.
- The existing metro lines are not operating to full capacity. The existing road lines parallel to the metro line need to be taken out of commission to increase the use of the metro system. The metro lines need to extend to the Cukurova University and the urban settlement area of Saricam District. The University campus represents a capacity of 50,000 people with students and working personnel.
- New traffic infrastructure needs to be developed for handling the north-south traffic loads.
- The number of vehicles used for public transport entering the center of the city needs to be reduced. There is an overload on the existing roadway system.
- There needs to be an increased public awareness on public transportation. There needs to be an overhaul on the use of the public transport system to improve efficiency.
- Preferred roadway lines need to be developed so that the University, airport, Main Bus Station and hospitals are linked via direct lines.

The roads that can presently be used for access to the Project site are shown in Figure 11-3 and Figure 11-4. The main road that can be used is the Mithat Ozsan Boulevard which is presently used

as the main road accessing the Cukurova University. This road is reported to be subject to heavy traffic by students and workers of the university. The road extends from the Metropolitan Center and is also accessible directly from the Adana Ring Road E-90. Presently, the vehicles routes used for public transportation do not cross this road along the boundary of the Project site but use the roads built on the Seyhan Dam to carry passengers to and from the Cukurova University.

11.3 Integration of the Health Facility Area into AMM Transportation Planning

The AMM transportation planning has incorporated the presence and needs of the Project area and the surrounding developments with the planned improvement of the road system nearby the Project area and the extension of the existing metro line. The revised version of the 1/5,000 scaled Saricam-Yuregir Zoning Plan (which has been approved as explained in *Chapter 5: Land Use and Zoning*) includes the planned clover-leaf road junction project which will replace the existing road which links the E-90 to the Mithat Ozsan Boulevard through the road crossing the present land area of the Project. The Project boundaries and the clover-leaf road junction as allocated in the zoning plan are shown in Figure 11-6.

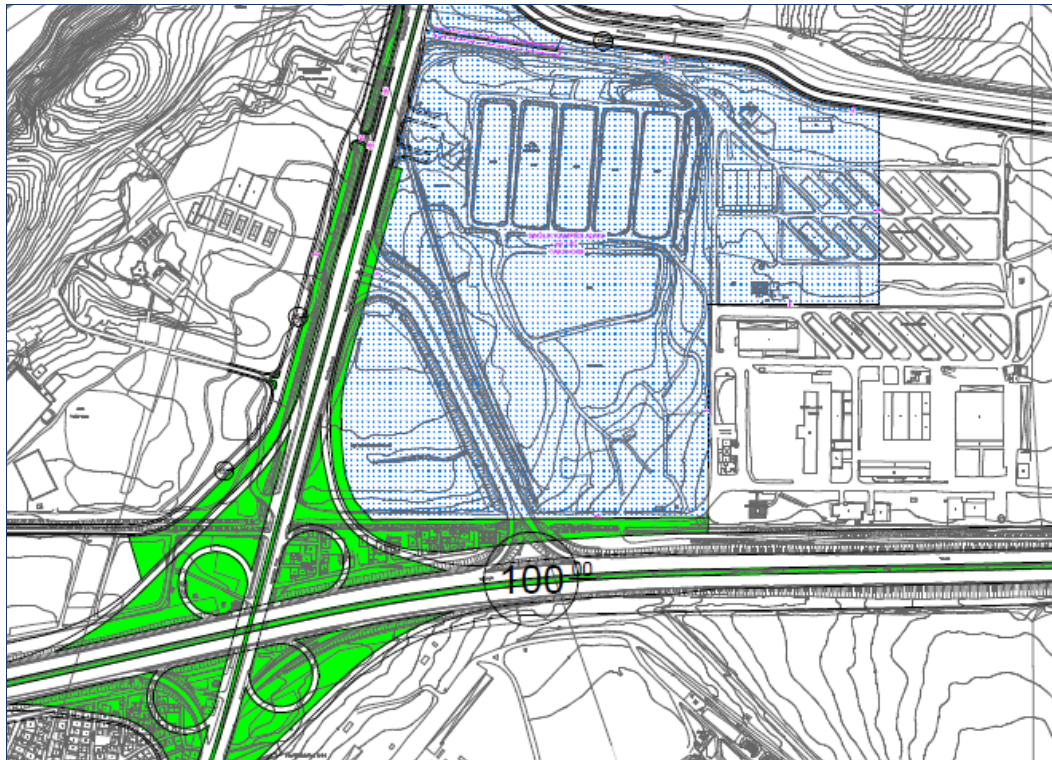


Figure 11-6: Revised version of the zoning plan including the planned clover-leaf road junction (Blue shaded area indicates the Project area)

AMM has developed the "Rail Transport System" project based on a two-phase railway transport facility for the intensively used transport routes in order to solve the traffic problem of the city and reduce the traffic load. Within this framework, "Adana Rail Transport System – Phase II" project is planned to be built and operated by AMM. The existing Adana metro line is a 13,926 m long two-track line of which 3,521 m is underground, 5,332 m is elevated and 5,073 m is at surface level (Figure 11-7). The line starts from the metro-car depot west of the existing Hospital for Mental Health. Following Turgut Ozal Boulevard, the line reaches Anadolu Lycee, then turns south and follows Alparslan Turkes Boulevard, crosses Turkish State Railroad System (TCDD) rail tracks near

the City Hall and enters Southern Adana passing the D-400 state road. It then heads to the west of the Kocavezir Commercial Center and the Hurriyet Police Station until it reaches the Seyhan River. Crossing the river just north of the Regulator Bridge, the line heads north, again crossing the D-400 state road and ends next to Yuregir Bus Terminal. The system can transport 43,200 passengers per-hour both-ways and 660,000 per day. Presently, it is reported to carry only 2% of the total capacity.

The scope of Adana Rail Transport System – Phase II Project comprises the construction activities to extend the existing Adana Rail Transport System – Phase I which lies between the Hospital Station and Akincilar Station, in the northeast direction towards Cukurova University, Balcali Hospital and the planned Stadium Area, followed by the commissioning of this new line. Phase II of Adana Rail Transport System will start at Akincilar Station where Phase I ends and will be passing through Balcali Station towards its final destination, i.e. the planned Stadium. The planned Phase II of Adana Rail Transport System will have a length of 10.3 km. There will be 7 stations within the scope of this line at the locations shown in Figure 11-7.

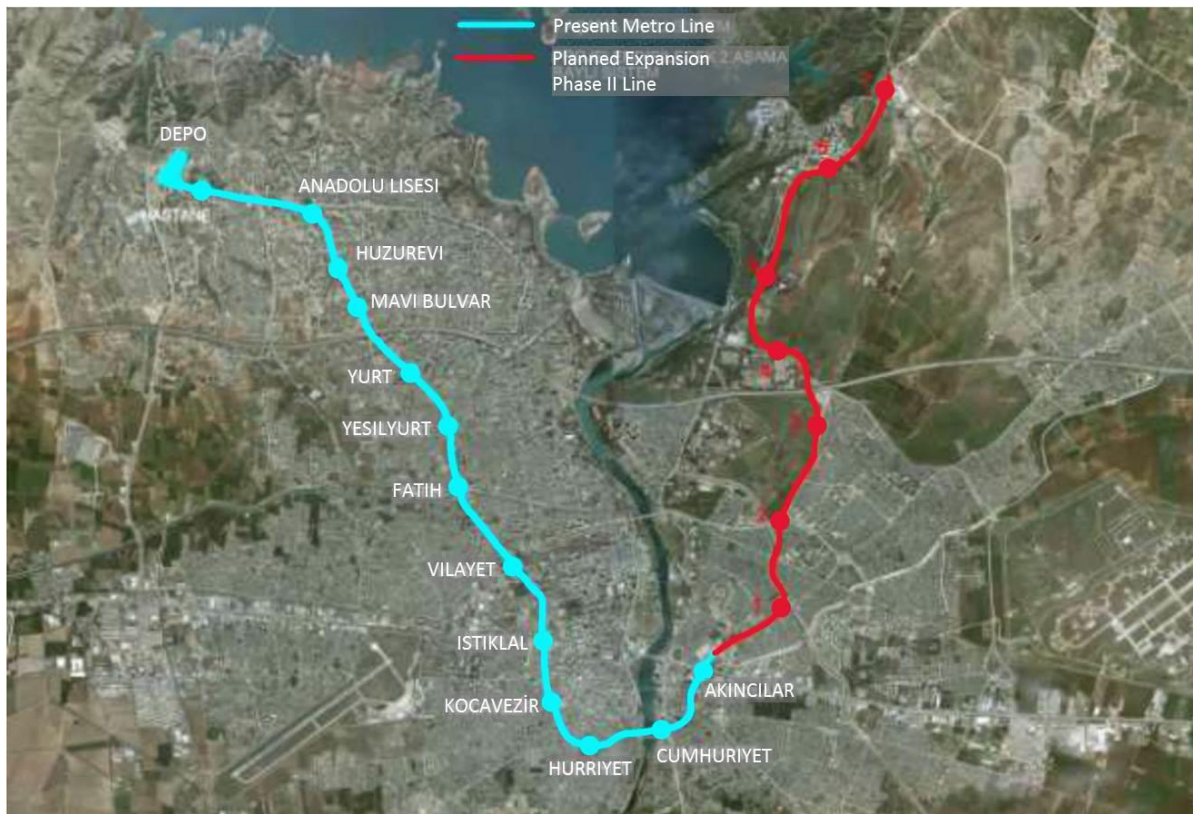


Figure 11-7: Present metro line (blue) and planned expansion Phase II lines (red)

The implementation of the Phase II line will ease the mass transportation in the direction to Cukurova University, Balcali Hospital, Fevzi Cakmak Student Hostel, Teknokent (Technological Center), Congress Center, TOKI State Hospital (Numune Hastanesi), Baskent Hospital, TOKI Houses and other destinations.

The station of TOKI Houses (4th station) will be the closest to the Project area. The station's location aims at providing service to the residents of TOKI Houses at a distance of 200 meters from the station. The Phase II Adana Rail Transport System is included in the 1/5,000 scaled Saricam-Yuregir Zoning Plan and shown in Figure 11-8.



Figure 11-8: Planned Phase II metro line on 1/5,000 scaled Saricam-Yuregir Zoning Plan (Project boundaries schematically shown)

Table 11-2 shows the total number of passengers projected to use the metro based on the feasibility study conducted for the Phase II Adana Rail Transport System. Table 11-3 shows the number of passengers using the station closest to the Adana IHC.

Table 11-2: Number of total passengers

Year	Number of Total Passengers in Peak Hour (One way)	Number of Total Passengers in Peak Hour (two ways)	Number of Total Daily Passengers (two ways)	Number of Total Annual Passengers (two ways)
2030	21,305	42,106	489,460	166,906,026

The number of passengers getting on and getting off in the closest station to the Health Campus at the year 2030 for 24 hours and peak hours are given in Table 11-3.

Table 11-3: Number of passengers getting on / getting off in 24 hours (Year 2030)

	Balcali – Hospital Direction			Hospital – Balcali Direction		
	Getting on	Getting off	Section*	Getting on	Getting off	Section*
The closest station to the Health Campus	6,533	3,635	86,925	2,547	5,140	100,246

*Number of passengers inside the train within two stations (Except passengers getting on/getting off)

11.4 Adana IHC Construction and Operation Phase Induced Traffic Conditions

The projected external traffic conditions during construction, operation and internal traffic are as follows:

- Approximately 500 trucks will be travelling to and from the construction site for a period of six months during the excavation phase of the construction activities. Approximately 300 trucks will be travelling to and from the construction during the main construction period.
- A preliminary traffic assessment has been conducted by ADN PPP A.Ş. to identify the vehicle traffic load that will be generated from the operation of the IHC. It is estimated that 14,000 vehicles will visit the facility daily with the peak traffic being between 8:00-14:00 with an estimated average vehicle traffic load of 8,000.
- The only vehicle entrance and exit will be directly from the Mithat Ozsan Boulevard. However, up to 14,000 vehicles will enter and exit the IHC daily for transportation purposes. No information on the road network within the IHC Project area is presently available.
- There is no detailed information on the existing traffic load near the Project area and the internal site traffic plan. Furthermore, there is no information on how the medical staff, patients and other workers will potentially use the organized transport or private means to reach the IHC.

11.5 Potential Impacts

Considering the conditions discussed in above sections, it can be concluded that there will be an increasing congestion in the existing traffic conditions based on the fact that the existing traffic loads near the IHC site is already high, and the planned expansion of the Phase II metro line and the passenger capacity do not seem to handle the number of visitors to the IHC and the number of the projected vehicular, personnel, patient and visitor traffic. The magnitude of the impact cannot be quantified at this point but it is likely to be between medium to large impact even after the startup of the Phase II metro line. It is not clear presently how the travel for personnel entering and exiting the IHC will be undertaken between the metro line station and the IHC area. Given the increase in the demand for transportation use and lack of database on the existing transportation conditions near the IHC, there is a need for a detailed traffic study to be conducted. The study should establish the existing conditions as well as predict the future transportation infrastructure capabilities and usage once the IHC becomes operational.

The Project traffic load will create additional air pollution from vehicles. Emissions include particulate emissions from diesel engines, NO_x, volatile organic compounds, carbon monoxide and various other hazardous air pollutants including benzene. The concentrations of air pollutants and adverse respiratory health effects will be greater near the roads than at some distance away from the road.

Road noise may become a nuisance on the population near the IHC, near intersections and on uphill sections.

Unless properly designed and managed, the traffic entering the campus may create congestion within the campus area. This will increase the time to enter the premises and create undue noise and air pollution within the IHC.

11.6 Potential Mitigation Measures

The following actions will need to be conducted to understand the potential adverse impacts created by the increased traffic during the construction and operation phases of the IHC:

- Traffic study: identify the existing baseline conditions for the road network near the IHC site including the roads that are likely to be used by vehicles to reach the IHC. This should also take into account the traffic modeling for future conditions when the Phase II metro line will be operational. A quantification of the transportation alternatives (i.e. use of metro line, use of private cars, use of public road transport) will need to be undertaken. The traffic study has been initiated at the time the ESIA report was being completed.
- IHC Traffic Management Plan: develop and implement a management plan within the campus that will take into account vehicular traffic, emergency conditions, pedestrian traffic entering, exiting and internal traffic. The plan should extend to take into consideration the pedestrian traffic generated from the Phase II metro line station near the campus. The traffic management plan will be developed once the traffic study is completed.
- Address potential noise and air pollution loads that may be generated from the traffic loads predicted by the traffic study.

12.0 ECOLOGY

12.1 Introduction

This chapter presents an assessment of the potential impact of the Project on terrestrial ecology and resources of nature conservation interest. Baseline information on terrestrial ecology has been collected through an ecological walkover survey conducted on 04.09.2013 by flora and fauna experts. Information collected during the site visit was supported by desktop studies. Moreover, brief desktop review was conducted by an ornithologist.

Data obtained from the field surveys were evaluated according to the national legislation and international conventions that Turkey is a party on different aspects of ecology. The Turkish regulations and international conventions that are relevant to the project include the following:

- Environmental Law (Law No: 2872) (Official Gazette-OG- Date/Number: 16.08.1983/18132)
- Regulation on Wildlife Protection and Wildlife Development Areas (OG Date/Number: 08.11.2004/25637)
- Law on Terrestrial Hunting (Law No:4915) (OG Date/Number: 11.07.2003/25165)
- Bern Convention on Protection of Europe's Wild Life and Living Environment (acceded by the Decision of the Council of Ministers dated 9 January 1984 and published in the Turkish Official Gazette dated 20 February 1984 and no. 18318);
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (acceded by Law no. 4041 and published in the Official Gazette dated 20 June 1996 and no. 22672)
- Convention on Wetlands of International Importance (Ramsar Convention) (1971)

Moreover, the standards of the International Union for the Conservation of Nature (IUCN) were considered. IUCN maintains a List of Threatened Species (the IUCN Red List) which is a widely recognized, global approach for evaluating the conservation status of plant and animal species. It provides taxonomic, conservation status and distribution information on taxa that are facing a high risk of global extinction.

It is important to note that there was an artificial pond inside the Project site which was created by extracting water from the nearby DSI irrigation channel and also was discharging water back into the same channel. As reported, the DSI was responsible from this artificial pond. During the time of ecological field survey, there was water in the artificial pond and this chapter considers this situation where necessary. However, the water of the pond was recently drained by the DSI and presently there is no such ecological character inside the Project site.

The approach to the assessment of impacts on terrestrial ecology has followed the methodology described in section 1.4.5 of *Chapter 1: Introduction*.

12.2 Terrestrial Flora

12.2.1 Methodology

Terrestrial flora studies covered a field study conducted in September 2013 and literature review in order to identify the local habitat characteristics and vegetation cover within the Project site, as well as to make an inventory of flora species. The endemism and threat/protection status of species were taken as basis for evaluation. The outcome of terrestrial flora studies is mostly based on the

field study. Although the timing of field study was a little late in terms of vegetation, it was quite suitable to identify plant species inhabiting the Project site.

Flora list was prepared in accordance with the phylogenetic order in Turkish flora; ferns, open seed plants (Gymnospermae) and closed-seeded plants (Angiospermae). Families under each group are also listed according to the phylogenetic order in the Turkish flora. Species are listed with their author names, English names (if available), phytogeographic regions, endemism, threat categories for endemic and rare species and their relative abundance in the area. Samples collected at the Project site were transformed into herbarium material and identified by using “Flora of Turkey and the East Aegean Islands” by Davis, 1965-1988. While determining threat status of endemic and rare flora species, the Red Data Book of Turkish Plants (Ekim *et al.*, 2000) which was prepared in accordance with 1994 IUCN Red List Categories and Criteria, was utilized.

12.2.2 Overview of Baseline Conditions

The Project site is located within the city and a significant portion of the site is covered by plantation species (Photo 1). Hedgerow plants at the site include Cupressus sempervirens (Mediterranean cypress), Acacia cyanophylla (Orange wattle), Acacia dealbata (Silver wattle) and Pinus pinea (Stone pine), while trees that have been planted at the site (which has an alluvial soil structure) in order to store excess water and lower the water table can be listed as Eucalyptus camaldulensis (River red gum), Pinus brutia (Turkish pine), Fraxinus excelsior (European ash), Morus alba (White mulberry), Ficus carica (Common fig), Celtis australis (European nettle tree), Brachychiton populneus (Kurrajong) and Olea europaea (Olive tree). Among these species, the site is mostly covered by river red gum trees (Photo 2) indicating that before the river red gum tree plantation, the site had a saturated water-table with a swamp/semi-arid swamp structure. The water at the site, however, did not occur naturally, but instead was transported through an irrigation channel into an artificial pond (water of the artificial pond has been recently drained) (Photo 3). The photograph of the open land surrounding the plantation (with river red gum trees) site is also seen in Photo 4. In relation to this, the dominant vegetation in the area and the water system do not carry natural characteristics but are of an artificial structure that have been created at the site.



Photo 1. Mixed forest plantation



Photo 2. River red gum tree plantation at the site



Photo 3. The artificial pond and its surroundings



Photo 4. Open land surrounding the plantation site

Despite the fact that the Project site is composed of plantations, as well as other cosmopolitan and widespread flora species, studies on plant diversity were carried out to identify the elements of the existing system, and determine potential impacts that the Project might cause, as well as any mitigation measures to minimize such impacts.

12.2.3 Terrestrial Flora Inventory of the Project Site

The flora of the Mediterranean Region of Turkey, especially Cukurova and its surroundings are quite well-studied. As explained above, habitats within the proposed Project site and plant species are not natural. The habitats and tree communities at the site have been artificially formed by people. Despite the fact that the site has no natural character, a total of 131 flora taxa that belong to 46 families were identified (see Table 12-1) during field studies of September 2013. All of the tree species identified at the site are plantation trees and the rest of the species are cosmopolitan and widespread flora species.

12.2.4 Threat Status and Endemism of Flora Species

Among 131 plant taxa identified at the site, there are no rare and/or endemic species attributable to the fact that there is no natural habitat within the site. With the absence of a natural habitat, flora species at the site are either those that have been brought to the site for plantation purposes, or other cosmopolitan species. The site, therefore, has no significance in terms of its flora and vegetation characteristics.

Table 12-1: Flora species of the Project site and surroundings and their characteristics

FAMILY	NO	SPECIES	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		T.S.	BERN	CITES				HABITAT					ABUNDANCE			
					R	W		App 1	App 1	App 2	App 3	1	2	3	4		1	2	3	4	
SPERMATOPHYTA																					
GYMNOSPERMAE																					
PINACEAE	1	<i>Pinus brutia</i> Ten	Turkish pine	Plantation									x					x			
	2	<i>Pinus pinea</i> L.	Stone pine	Plantation									x						x		
CUPRESSACEAE	3	<i>Cupressus sempervirens</i> L. var. <i>horizontalis</i> (Mill) Loudon	Mediterranean cypress	Plantation										x					x		
	4	<i>Cupressus sempervirens</i> L. var. <i>pyramidalis</i> (O. Targ.Tozz.) Nyman	Mediterranean cypress	Plantation										x					x		
ANGIOSPERMAE																					
RANUNCULACEAE	5	<i>Ranunculus arvensis</i> L.	Corn buttercup	Mediterranean											x			x			
PAPAVERACEAE	6	<i>Papaver rhoeas</i> L.	Corn poppy	Widespread											x				x		
CRUCIFERAE	7	<i>Descurainia sophia</i> (L.)	Flixweed	Widespread											x				x		
	8	<i>Sinapis arvensis</i> L.	Charlock mustard	Widespread											x				x		
	9	<i>Thlaspi perfoliatum</i> L.	Cotswold pennycress	Widespread											x			x			
	10	<i>Arabis verna</i> (L.) DC.		Mediterranean											x				x		
	11	<i>Ochthodium aegyptiacum</i> (L.) DC.		Widespread											x					x	
	12	<i>Hirschfeldia incana</i> (L.) Lag.-Foss.	Shortpod mustard	Widespread											x				x		
	13	<i>Capsella bursa-pastoris</i> (L.) Medik.	Shepard's purse	Widespread											x				x		
RESEDACEAE	14	<i>Reseda lutea</i> L. var. <i>lutea</i>	Wild mignonette	Widespread											x				x		
CAPPARACEAE	15	<i>Capparis spinosa</i> L. Var. <i>spinosa</i>	Caper	Widespread											x				x		
CISTACEAE	16	<i>Cistus creticus</i> L.	Pink rock rose	Mediterranean									x						x		
PORTULACACEAE	17	<i>Portulaca oleracea</i> L.	Common purslane	Widespread											x				x		
CARYOPHYLLACEAE	18	<i>Minuartia hamata</i> (Hausskn.) Mattf.		Widespread											x				x		
	19	<i>Holosteum umbellatum</i> L. var. <i>Umbellatum</i>	Jagged chickweed	Widespread											x				x		
GUTTIFERAE	20	<i>Hypericum triquetrifolium</i> Turra	Wavy-leaf St.John's wort	Widespread											x				x		
GERANIACEAE	21	<i>Erodium cicutarium</i> (L.) L. Herit subsp. <i>cicutarium</i>	Common stork's bill	Widespread											x				x		
MALVACEAE	22	<i>Malva neglecta</i> Wallr.	Common mallow	Widespread											x				x		
	23	<i>Lavatera cretica</i> L.	Cornish mallow	Widespread											x				x		
	24	<i>Alcea striata</i> (DC.) Alef. Subsp. <i>satriata</i>		Widespread											x				x		
LINACEAE	25	<i>Linum trigynum</i> L.	Southern flax	Mediterranean											x				x		
CHENOPODIACEAE	26	<i>Chenopodium botrys</i> L.	Oak goosefoot	Widespread											x				x		

FAMILY	NO	SPECIES	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		T.S.	BERN	CITES				HABITAT				ABUNDANCE				
					R	W			App 1	App 1	App 2	App 3	1	2	3	4	1	2	3	4	5
	27	<i>Chenopodium murale</i> L.	Goosefoot	Widespread											x			x			
AMARANTHACEAE	28	<i>Amaranthus blitoides</i> S. Wats.	Matweed	Widespread									x				x				
	29	<i>Amaranthus retroflexus</i> L.	Redroo amaranth	Widespread											x						
POLYGONACEAE	30	<i>Polygonum equisetiforme</i> Sibth. & Sm.		Widespread										x	x		x				
	31	<i>Rumex conglomeratus</i> Murray	Clustered dock	Widespread										x	x		x				
ANACARDIACEAE	32	<i>Pistacia lentiscus</i> L.											x					x			
LEGUMINOSAE	33	<i>Cercis siliquastrum</i> L. subsp. <i>siliquastrum</i>	Judas tree	Plantation									x					x			
	34	<i>Acacia dealbata</i> Link	Silver wattle	Plantation									x					x			
	35	<i>Acacia cyanophylla</i> Lindley	Orange wattle	Plantation									x					x			
	36	<i>Prosopis farcta</i> (Banks & Sol.) Macbride	Syrian mesquite	Widespread									x					x			
	37	<i>Robinia pseudoacacia</i> L.	Black locust	Plantation									x					x			
	38	<i>Melilotus alba</i> Desr.	Bokhara clover	Widespread										x				x			
	39	<i>Trigonella monantha</i> C.A.Meyer subsp. <i>monantha</i>		Iran-Turan											x			x			
	40	<i>Trifolium arvense</i> L. subsp. <i>arvense</i>	Haresfoot clover	Widespread											x			x			
	41	<i>Ononis spinosa</i> L. subsp. <i>leiosperma</i> (Boiss.) Sirj.	Spiny restharrow	Widespread										x	x			x			
	42	<i>Medicago sativa</i> L.	Alfaalfa	Widespread											x			x			
ROSACEAE	43	<i>Potentilla recta</i> L.	Sulfur cinquefoil	Widespread											x			x			
	44	<i>Sanguisorba minor</i> Scop. Subsp. <i>muricata</i> (Spach)Brig	Salad burnet	Widespread											x			x			
	45	<i>Rubus sanctus</i> Schreber		Widespread									x	x				x			
MYRTACEAE	46	<i>Eucalyptus camaldulensis</i> Dehnh.	River red gum	Plantation									x								x
LYTHRACEAE	47	<i>Lythrum salicaria</i> L.	Purple loosestrife	Avrupa-Sibirya										x					x		
ONAGRACEAE	48	<i>Epilobium hirsutum</i> L.	Great willowherb	Widespread										x					x		
CUCURBITACEAE	49	<i>Ecballium elaterium</i> (L.) A. Rich.	Squirting cucumber	Mediterranean											x			x			
HALORAGIDACEAE	50	<i>Myriophyllum spicatum</i> L.	Eurasian watermilfoil	Widespread												x				x	
UMBELLIFERAE	51	<i>Torilis leptophylla</i> (L.) Reichb.		Widespread									x	x				x			
	52	<i>Eryngium creticum</i> Lam.		Mediterranean											x			x			
	53	<i>Daucus carota</i> L.	Wild carrot	Widespread											x				x		
COMPOSITAE	54	<i>Senecio vernalis</i> Waldst. et Kit		Widespread											x			x			
	55	<i>Bidens cernua</i> L.	Eastern groundsel	Widespread										x				x			
	56	<i>Aster subulatus</i> Michaux	Shrub aster	Widespread											x					x	
	57	<i>Inula viscosa</i> (L.) Aiton		Mediterranean										x				x			
	58	<i>Pulicaria dysenterica</i> (L.) Bernh.	Common fleabane	Widespread											x			x			
	59	<i>Conyza canadensis</i> (L.) Cronquist	Canadian	Widespread											x			x			

FAMILY	NO	SPECIES	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		T.S.	BERN	CITES				HABITAT					ABUNDANCE				
					R	W		App 1	App 1	App 2	App 3	1	2	3	4		1	2	3	4		
COMPOSITAE			horseweed																			
	60	<i>Centaurea solstitialis</i> L. subsp. <i>solstitialis</i>	Yellow star-thistle	Widespread												x		x				
	61	<i>Cichorium intybus</i> L.	Common chicory	Widespread												x			x			
	62	<i>Picnoman acarna</i> (L.) Cass.		Mediterranean												x			x			
	63	<i>Carthamus glaucus</i> Bieb. Subsp. <i>glaucus</i>	Glaucous star-thistle	Mediterranean													x			x		
	64	<i>Carlina oligocephala</i> Boiss. & Kotschy subsp. <i>oligocephala</i>		Widespread											x				x			
COMPOSITAE	65	<i>Xanthium strumarium</i> L. subsp. <i>strumarium</i>	Rough cocklebur	Widespread									x		x				x			
	66	<i>Carduus nutans</i> L. sensu lato	Musk thistle	Widespread											x				x			
	67	<i>Logfia arvensis</i> (L.) Holub.	Field cottonrose	Widespread												x			x			
	68	<i>Silybum marianum</i> (L.) Gaertner	Milk thistle	Mediterranean												x			x			
	69	<i>Echinops viscosus</i> DC. Subsp. <i>bithynicus</i> (Boiss.) Rech.fil.		Widespread												x			x			
	70	<i>Tragopogon longirostris</i> Bisch. Ex Schultz Bip. Var. <i>longirostris</i>		Widespread												x			x			
	71	<i>Lactuca serriola</i> L.	Prickly lettuce	Widespread												x			x			
	72	<i>Scolymus maculatus</i> L.		Mediterranean												x			x			
	73	<i>Lapsana communis</i> L. subsp. <i>intermedia</i> (Bieb.) Hayek	Nipplewort	Widespread									x		x				x			
	74	<i>Helminthotheca echioides</i> (L.) Holub.	Bristly ox-tongue	Widespread																	x	
	75	<i>Crepis foetida</i> L. Subsp. <i>rhoeadifolia</i> (Bieb.) Celak	Stinging hawk's beard	Widespread													x		x			
	76	<i>Crepis sancta</i> (L.) Babcock	Haws's beard	Widespread													x		x			
	77	<i>Crupina crupinastrum</i> (Moris) Vis.	Southern crupina	Widespread															x			
OLEACEAE	78	<i>Jasminum officinale</i> L.	Common jasmine	Culture									x						x			
	79	<i>Fraxinus excelsior</i> L. subsp. <i>excelsior</i>	European ash	Euro-Siberian									x						x			
	80	<i>Olea europaea</i> L. var. <i>europaea</i>	Olive tree	Plantation									x						x			
GENTIANACEAE	81	<i>Centaurium erythraea</i> Rafn subsp. <i>turcicum</i> (Velen.) Melderis	European centaury	Widespread											x				x			
ASCLEPIADACEAE	82	<i>Cynanchum acutum</i> L. subsp. <i>acutum</i>	Pateroi	Widespread									x	x					x			
BORAGINACEAE	83	<i>Echium italicum</i> L.		Mediterranean											x				x			
	84	<i>Heliotropium lasiocarpum</i> Fisch. & Mey.		Widespread											x				x			
	85	<i>Heliotropium hirsutissimum</i> Grauer		Mediterranean											x				x			
	86	<i>Cynoglossum creticum</i> Miller	Blue hound's tongue	Widespread											x				x			

FAMILY	NO	SPECIES	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		T.S.	BERN	CITES				HABITAT				ABUNDANCE				
					R	W		App 1	App 1	App 2	App 3	1	2	3	4	1	2	3	4	5	
	87	<i>Echium plantagineum</i> L.	Viper's bugloss	Mediterranean											x			x			
	88	<i>Anchusa azurea</i> Miller var. <i>azurea</i>	Italian bugloss	Widespread											x		x				
	89	<i>Rochelia disperma</i> (L. fil.) C. Koch var. <i>disperma</i>		Widespread											x			x			
SOLANACEAE	90	<i>Physalis alkekengi</i> L.	Bladder cherry	Widespread											x			x			
SCROPHULARIACEAE	91	<i>Kickxia lanigera</i> (Desf.) Hand.-Mazz.		Mediterranean											x			x			
	92	<i>Verbascum sinuatum</i> L. var. <i>sinuatum</i>	Wavyleaf mullein	Mediterranean											x		x				
CONVOLVULACEAE	93	<i>Convolvulus arvensis</i> L.	Field bindweed	Widespread											x			x			
VERBANACEAE	94	<i>Verbena officinalis</i> L.	Common vervain	Widespread								x		x			x				
LABIATAE	95	<i>Lamium amplexicaule</i> L.	Henbit deadnettle	Widespread										x				x			
	96	<i>Teucrium polium</i> L.	Felty germander	Widespread								x						x			
	97	<i>Mentha spicata</i> L. subsp. <i>spicata</i>	Spearmint	Widespread									x					x			
EUPHORBIACEAE	98	<i>Chrozophora tinctoria</i> (L.) Rafin.	Dyer's croton	Widespread											x			x			
	99	<i>Euphorbia microsphaera</i> Boiss.		Iran-Turan											x			x			
	100	<i>Euphorbia serpens</i> Kunth	Matted sandmat	Widespread											x			x			
	101	<i>Euphorbia chamaesyce</i> L.	Prostrate spurge	Widespread											x			x			
MORACEAE	102	<i>Morus alba</i> L.	White mulberry	Plantation								x						x			
	103	<i>Ficus carica</i> L. subsp. <i>carica</i>	Common fig	Plantation								x						x			
ULMACEAE	104	<i>Celtis australis</i> L.	European nettle tree	Mediterranean								x						x			
PLANTAGINACEAE	105	<i>Plantago lanceolata</i> L.	Ribwort plantain	Widespread									x	x				x			
RUBIACEAE	106	<i>Galium verum</i> L. subsp. <i>verum</i>	Lady's bedstraw	Euro-Siberian										x				x			
SALICACEAE	107	<i>Salix excelsa</i> J.F.Gmelin	Common willow	Widespread								x						x			
	108	<i>Brachychiton populneus</i> (Schott. & Endl.) R.Br.	Kurrajong	Plantation								x						x			
PALMAE	109	<i>Chamaerops humilis</i> L.	European fan palm	Plantation								x					x				
LILIACEAE	110	<i>Allium ampeloprasum</i> L.	Wild leek	Mediterranean										x				x			
	111	<i>Asparagus acutifolius</i> L.	Wild asparagus	Mediterranean								x						x			
TYPHACEAE	112	<i>Typha latifolia</i> L.	Common bulrush	Widespread									x						x		
	113	<i>Typha domingensis</i> Pers.	Southern cattail	Widespread									x						x		
GRAMINEAE	114	<i>Poa bulbosa</i> L.	Bulbous bluegrass	Widespread								x						x			
	115	<i>Bromus scoparius</i> L.	Broom brome	Widespread								x						x			
	116	<i>Bromus japonicus</i> Thunb. subsp. <i>japonicus</i>	Field brome	Widespread									x					x			
	117	<i>Phalaris brachystachys</i> Link		Mediterranean										x				x			
	118	<i>Polypogon viridis</i> (Gouan) Breistr.	Annual beard grass	Euro-Siberian										x				x			
	119	<i>Koeleria cristata</i> (L.) Pers.	Prairie junegrass	Widespread											x			x			

FAMILY	NO	SPECIES	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		T.S.	BERN	CITES				HABITAT					ABUNDANCE				
					R	W		App 1	App 1	App 2	App 3	1	2	3	4		1	2	3	4		
	120	<i>Avena wiestii</i> Steudel.		Widespread											x				x			
	121	<i>Dactylis glomerata</i> L. subsp. <i>hispanica</i> (Roth) Nyman	Orchard grass	Mediterranean											x				x			
	122	<i>Setaria viridis</i> (L.) P. Beauv.	Green foxtail	Widespread											x				x			
	123	<i>Echinochloa crusgalli</i> (L.) P. Beauv.	Barnyard grass	Widespread											x				x			
	124	<i>Parapholis incurva</i> (L.) C.E. Hubbard	Coast barbglass	Widespread											x				x			
	125	<i>Bothriochloa ischaemum</i> (L.) Keng	Yellow bluestem	Widespread											x				x			
	126	<i>Chrysopogon gryllus</i> (L.) Trin subsp. <i>gryllus</i>		Widespread											x				x			
	127	<i>Sorghum halepense</i> (L.) Pers. Var. <i>halepense</i>	Johnson grass	Widespread											x				x			
	128	<i>Phragmites australis</i> (Cav.) Trin ex Steudel	Common reed	Euro-Siberian										x					x			
	129	<i>Hordeum bulbosum</i> L.	Bulbous barley	Widespread											x				x			
	130	<i>Hordeum murinum</i> L. subsp. <i>glaucum</i> (Steudel) Tzvelev	Wall barley	Widespread											x				x			
	131	<i>Cynodon dactylon</i> (L.) Pers. Var. <i>dactylon</i>	Bermuda grass	Widespread											x				x			

LEGEND FOR THE FLORA TABLE

ENDEMISM:

R: Regional endemic

W: Widespread endemic

T.S. THREAT CATEGORIES:

BASED ON IUCN CATEGORIES (Ekim *et al.*, 2000)

EX : Extinct

EW : Extinct in wild

CR : Critically endangered

EN : Endangered

VU : Vulnerable

LR : Lower risk

NT : Near threatened

LC : Least concern

DD : Data deficient

BERN (BERN Convention):

App1: Strictly protected flora species

CITES:

App1: Species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.

App2: Species not necessarily threatened with extinction, but their trade must be controlled to avoid utilization incompatible with their survival.

App3: Species protected in at least one country, and their trading is under control by CITES.

HABITAT CLASSES:

1. Eucalyptus plantation site

2. Pond shore

3. Open land surrounding the plantation

4. Freshwater habitat inside the pond

RELATIVE ABUNDANCE IN THE PROJECT SITE:

1: Very rare

2: Rare

3: Medium

4: Abundant

5: Very abundant

12.2.5 Vegetation Characteristics

There are three main types of vegetation within the Project site, which are listed below with their corresponding European Nature Information System (EUNIS) habitat types:

- *Eucalyptus camaldulensis* forest (I2.11)
- Hydrophytic vegetation around the artificial pond (C3.21)
- Ruderal vegetation at the open area surrounding the plantation site (I2.3)

Eucalyptus Camaldulensis Forest:

These forests that have been formed through plantation constitute the most common vegetation within the site. The dominant species of the vegetation are *Eucalyptus camaldulensis*, but there are also trees like *Cupressus sempervirens*, *Acacia cyanophylla*, *Acacia dealbata*, *Pinus pinea*, *Pinus brutia*, *Fraxinus excelsior*, *Morus alba*, *Ficus carica*, *Celtis australis*, *Brahychiton populneus* and *Olea europaea*, which have been carried to the site through plantation. The soil structure on which this vegetation has grown is alluvial. Plantation trees at the site have been selected in order to lower the high water table at the site. As mentioned earlier, this type of vegetation at the site is not natural but has been formed artificially.

Hydrophytic Vegetation:

This vegetation that has grown around the artificial pond has the dominant species of *Phragmites australis*, while other hydrophytic species that have been identified include *Mentha spicata*, *Typha domingensis*, *Typha latifolia*, *Mentha spicata*, *Epilobium hirsutum*, *Lythrum salicaria* and *Pulicaria dysenterica*. This habitat is also not natural but the listed hydrophytic species have inhabited the site in time.

Ruderal Vegetation (Weed Communities):

Species of this vegetation which was identified within the open land around the plantation, are quite widespread. Dominant species are *Oenothera lamarckiana*, *Helminthotheca echioides*, *Scolymus maculatus* and *Aster subulatus*.

12.2.6 Impacts and Mitigation Measures

As explained in above sections, the species identified at the Project site are either those tree species that have been brought to the site or widespread cosmopolitan species. The Project site is mostly covered with the river red gum trees (*Eucalyptus camaldulensis*) which indicates that the water table at the site was initially high. However, as mentioned earlier, water at the site also did not occur naturally but was transported from the nearby DSI irrigation channel into an artificial pond. There will be habitat loss with the development of the Project, however based on the results of studies which indicated that the site has no significance in terms of its flora and vegetation characteristics, no significant impacts will occur. Moreover, the majority of the Project site is vacant with some part currently being used by DSI as a commercial area. The site is also fenced, there are no uses (such as commercial, recreational) by the community inside the Project site and the site does not provide basic ecosystem services related to water catchments, erosion control or provision of critical barriers to destructive fire. Therefore, there will be no impacts related with the

use of the Project site. There will be a need to fell down approximately 300 trees which is not considered as a significant impact considering that the trees at the site are plantation trees and there will be plantation in the future within the health campus area. As a result, the proposed Project is not expected to cause any adverse impacts on flora and vegetation of any degree of significance.

The most important mitigation measures will include the following:

- Necessary correspondence should be made with the relevant forestry directorate, an inventory of the trees should be prepared and the approval of the forestry directorate should be obtained prior to felling down the trees. Communicating with the relevant forestry directorate and obtaining the approval for felling trees is under the responsibility of MoH.
- The most appropriate species to be used for landscaping purposes are those that have already been brought to the site for plantation.

12.3 Fauna

12.3.1 Methodology

A field survey was conducted in September 2013 to identify the fauna species within the Project site. The field study was supported by desktop research. Amphibia, Reptilia, Aves and Mammalia species were assessed and a fauna list was prepared. The identified fauna species were classified according to the Bern Convention, IUCN Criteria, Cites Convention, decisions of Central Hunting Commission of the General Directorate of Nature Conservation and National Parks of the Turkish Ministry of Forest and Water Works and European Union (EU) Birds Directive.

12.3.2 Baseline Conditions and Faunal Species Richness

The field survey form is presented in Table 12-2. The list of faunal elements together with evaluation according to the above mentioned criteria is given in Table 12-3. It was found that none of the identified species within the Project site are endemic or threatened. It was found that most of the animal species determined depend mainly on the artificial pond. Since the field survey is conducted in one day, more animal species could have been identified in a longer survey such as some snake species that use the artificial pond and other animals in water and especially more bird species are expected to be observed in different periods of the year. The view of the ornithologist is provided in section 12.4.

Table 12-2: Field survey form

Survey point:	Long. 36S 0708980 Lat. 4100421	GPS Elev. 42 m	Date 04/09/2013	Project Adana Hospital project
Habitat Description: Modified habitat, artificial pond, Planted Eucalyptus, Pinus brutia, Cupressus sempervirnes, Accacia trees Empty fish ponds Faunal species: • <i>Pelophylax ridibundus</i> (Marsh frog) • <i>Mauremys rivulata</i> (Balkan pound turtle) • <i>Laudakia stellio</i> (Stellion) • <i>Ophisops elegans</i> (Snake-eyed lizard) • <i>Egretta garzetta</i> (Little egret) • <i>Nycticorax nycticorax</i> (Night heron) • <i>Ardea cinerea</i> (Grey heron) • <i>Halcyon smyrnensis</i> (White-breasted kingfisher) • <i>Streptopelia decaocto</i> (Collared dove) • <i>Columba livia</i> (Rock dove) • <i>Francolinus francolinus</i> (Black francolin) • <i>Garrulus glandarius</i> (Eurasian jay) • <i>Corvus corone pallescens</i> (Hooded crow) • <i>Pycnonotus xanthopygos</i> (Yellow-vented bulbul) • <i>Passer domesticus</i> (House sparrow) • <i>Muscicapa striata</i> (Spotted flycatcher) • <i>Nannospalax ehrenbergi</i> (Palestinian blind mole rat)				
				

Table 12-3: Vertebrate species determined and their protection criteria

CLASSIS Ordo	Family	Species (Scientific name)	Species (English name)	Species (Turkish name)	IUCN	BERN	CITES	MAK	EU Bird Directive
AMPHIBIA									
Anura	Ranidae	<i>Pelophylax ridibundus</i>	Marsh frog	Ova kurbağası	LC	App -III	-	-	
REPTILIA									
Testudines	Geoemydidae	<i>Mauremys rivulata</i>	Alkan pound turtle	Balkan çizgili kaplumbağası	NE	App-III	-	-	
Squamata	Agamidae	<i>Laudakia stellio</i>	Stellion	Dikenli keler	LC	App-III	-	App-I	
Squamata	Lacertidae	<i>Ophisops elegans</i>	Snake-eyed lizard	Tarla kertenkelesi	NE	APP-II	-	App-I	
AVES									
Ciconiiformes	Ardeidae	<i>Egretta garzetta</i>	Little egret	Küçük akbalıkçıl	LC	App-II	-	App-I	Ann-I
Ciconiiformes	Ardeidae	<i>Nycticorax nycticorax</i>	Night heron	Gece balıkçılı	LC	APP-II	-	App-I	Ann-I
Ciconiiformes	Ardeidae	<i>Ardea cinerea</i>	Grey heron	Gri balıkçıl	LC	App-III	-	App-II	-
Coraciiformes	Alcedinidae	<i>Halcyon smyrnensis</i>	White-breasted kingfisher	İzmir yalıçapkını	LC	APP-II	-	App-I	-
Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Collared dove	Kumru	LC	App-III	-	App-II	Ann-IIB
Columbiformes	Columbidae	<i>Columba livia</i>	Rock dove	Kaya güvercini	LC	App-III	-	App-III	Ann-IIA
Galliformes	Phasianidae	<i>Francolinus francolinus</i>	Black francolin	Turaç	LC	-	-	App-I	Ann-IIB
Passeriformes	Corvidae	<i>Garrulus glandarius</i>	Eurasian jay	Alakarga	LC	-	-	App-III	Ann-IIB
Passeriformes	Corvidae	<i>Corvus corone pallescens</i>	Hooded crow	Leş kargası	LC	-	-	App-III	Ann-IIB
Passeriformes	Pycnonotidae	<i>Pycnonotus xanthopygos</i>	Yellow-vented bulbul	Arap bülbülü	LC	App-III	-	App-I	-
Passeriformes	Rasseridae	<i>Passer domesticus</i>	House sparrow	Serçe	LC	-	-	App-III	-
Passeriformes	Muscicapidae	<i>Muscicapa striata</i>	Spotted flycatcher	Benekli sinekkapan	LC	APP-II	-	App-I	-
MAMMALIA									
Rodentia	Spalacidae	<i>Nannospalax ehrenbergi</i>	Palestinian blind mole rat	Filistin körfaresi	DD	-	-	-	

The categories and their abbreviations given in Table 12-3 are as follows:

BERN (Bern Convention) - Appendix - II: Strictly Protected Fauna Species (SPFS) - Appendix - III: Protected Fauna Species (PFS)	IUCN Red List Categories (Version 2009.1) - EX (Extinct), RE (Regionally Extinct), EW (Extinct in the Wild) Risk Categories - CR (Critically Endangered), EN (Endangered), VU (Vulnerable) Low Risk Categories - NT (Near Threatened), LC (Least Concern), DD (Data Deficient), NE (Not Evaluated), END (Endemic), NA (Not Applicable for IUCN)
CITES Categories - Appendix-1 List includes species that are threatened with extinction and thus international trade in specimens of these species is prohibited, except when the purpose of the import is not commercial. - Appendix-2 List includes species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. - Appendix-3 List includes species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.	2013-2014 Central Game Commission (MAK) Decrees - Appendix-I: List of wild animals protected by the Ministry of Forestry and Water Works. - Appendix-II: List of game animals protected by MAK. - Appendix-III: List of game animals whose hunting is allowed for certain periods for 2013-2014 season.

Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds: The birds in the scope of EU list are listed as Annex I, Annex II (Part A, Part B); the birds in Annex I are the ones that requires strict protection; while the others are listed in Annex II.

12.3.3 Impacts and Mitigation Measures

None of the fauna species identified within the Project site are endemic or threatened species. It was found that most of the animal species depend mainly on the artificial pond. Although the removal of the artificial pond may have affected the species living there, due to the fact that the water body at the artificial pond was a part of the water system coming from the DSI irrigation channel which is connected to the Seyhan River and faunal species identified are considered to use the Seyhan river system, water dependent species can continue their existence in neighboring aquatic environments. Moreover, the removal of the artificial pond would not have a destructive effect to the ecosystem because of its unnatural pattern, its small size and existence of many other larger water bodies in the vicinity.

The main mitigation measure would be to transfer the animals (especially vertebrate animals such as turtles, frogs and fishes) in the artificial pond to the dam or river before water is drained. As explained before, the water inside the artificial pond has already been drained by the DSI who was responsible from the artificial pond and the species, as reported were transferred to other fish farms/ponds that DSI is operating.

12.4 Birds

Halcyon smyrnensis (White-breasted Kingfisher) is observed at the Project site during the ecological field survey by the flora and fauna experts. The view of the ornithologist is provided below related to the importance of the area in terms of the identified White-breasted kingfisher and related to bird migration routes.

White-breasted Kingfisher

Currently, the Project site is a eucalyptus grove with some open fields and a man-made pond that has been filled with water. Consequently, the land was used by several bird species, including the White-breasted Kingfisher that was observed during the experts' visit. White-breasted Kingfisher is a widespread and not globally threatened species. Turkey lies on the margin of its world range and the species is largely restricted to agricultural land and near wetlands along the Mediterranean coast. In Adana district, it is a very common species along the agricultural ditches and canals in Cukurova basin, hence the great majority of the Turkish population lives there. White-breasted Kingfisher is known to be a resident bird in the Campus of Cukurova University. The Project site can be seen as the fragments of the once more extensive eucalyptus grove that covered a greater extent. Therefore, the species might visit the Project site frequently and even possibly breed in case there are suitable nesting sites, such as ditches and canals. Moreover, it is important to note that eucalyptus is an exotic species in Turkey, thus the Project site is not covered by natural vegetation. In addition, the Project site is completely fragmented and set aside by roads; the Dr. Mithat Ozsan Bulvarı in the west, Yesil Bulvarı (3544th street) in the north, the warehouses of the DSI and TOKI housing development in the east and the highway in the south.

Due to the common nature of the species, very generalist habitat requirements (agricultural lands) and the exotic nature of the Project site, and isolation of the Project site by wide roads, no conservation action for White-breasted Kingfisher is required.

Bird migration

Adana lies on the migratory routes of birds, particularly the birds of prey, storks and pelicans. Most birds leave the Anatolian Plateau probably through Pozanti Pass, fly high above the lowlands of

Adana, crossover or fly around the Bay of Iskenderun and concentrate at Amanos Mountains in Hatay province. The pelicans use Yumurtalik Lagoons for staging and feeding. Therefore, the Project site as well as Seyhan Dam Lake is not on or near the main resting or staging areas for migratory birds.

The migratory birds of prey regularly migrate between 200-500 m, but up to 2,000 m above sea level. Therefore, the development of the Project site is not expected to have any effect on the flying migratory soaring birds, such as eagles, hawks and storks.

The development of the Project site, construction of a large building and changing the vegetation within the Project site, has no relevant impact on the migratory birds.

12.5 Legally Protected Sites

In order to identify the protected sites in the vicinity of the Project area which are under protection by the relevant national legislation, maps and documents from Ministry of Forest and Water Works (MFWW), General Directorate of Nature Conservation and National Parks have been utilized along with the information collected from the following references:

- Geodata (Geographical Information System) of MFWW
- General Directorate of Nature Conversation and National Parks of MFWW
<http://www.milliparklar.gov.tr/belge/yhgs.pdf>
- Key Biodiversity Areas of Turkey (Türkiye'nin Önemli Doğa Alanları Kitabı) – Nature Society (Doğa Derneği)
- Research Article (2012) The Fish Fauna of Seyhan Dam Lake (Adana) – Sibel Alagöz, Deniz Ergüden, M.Ziya Lugal Göksu - Cukurova University, Faculty of Fisheries, Department of Basic Science, Balcali, Adana-Turkey
- UNDP - Preliminary Ecological Assessment of Seyhan River Basin with Reference to Climate Change Predictions - Dr. Uğur Zeydanlı and Hüma Ülgen (April 2009)
- World Database on Protected Areas
http://protectedplanet.net/sites/Seyhan_Delta_Other_Area
- 2013-2023 Draft Master Plan for Ecotourism in Adana – 7th Regional Directorate of Forests and Water Works.

The nearest protected site to the Project area is Seyhan Dam Lake Wildlife Development Area (obtained from GIS Database of MFWW) located approximately at a distance of 500 m to the north of the Project area (shown in Figure 12-1). The dam lake is approximately 4 km wide, 23 km long, and maximum 45 m deep in spring season and the area is maximum 9,200 hectares (Figure 12-2). The Wildlife Development Area covering Seyhan Dam has an area of 11,436 ha and has been registered as a protected area on 05.10.2006 by the Ministry of Environment and Forestry (former ministry and now named as Ministry of Environment and Urban Planning). The target with the declaration of this protected area is to conserve the population of water birds, particularly wintering water birds. The map in Figure 12-3 also shows the boundaries of the protected area, the Project site and the developed areas in the vicinity.

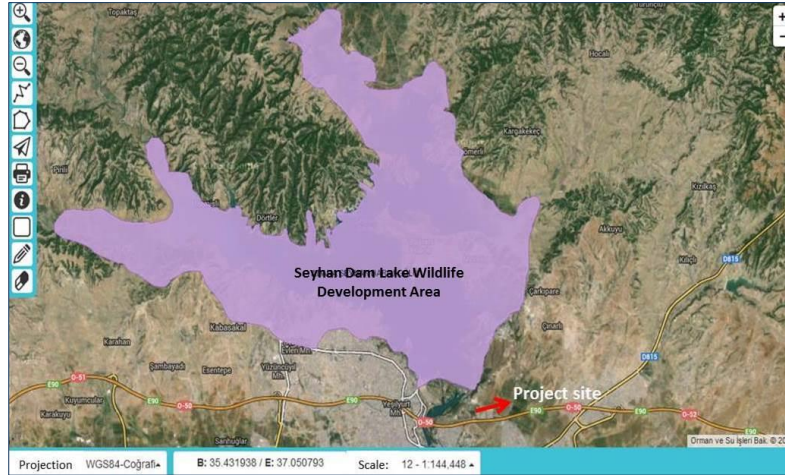


Figure 12-1: Seyhan Dam Lake wildlife development area (Source: Geodata of MFWW)



Figure 12-2: View of the Seyhan Dam Lake

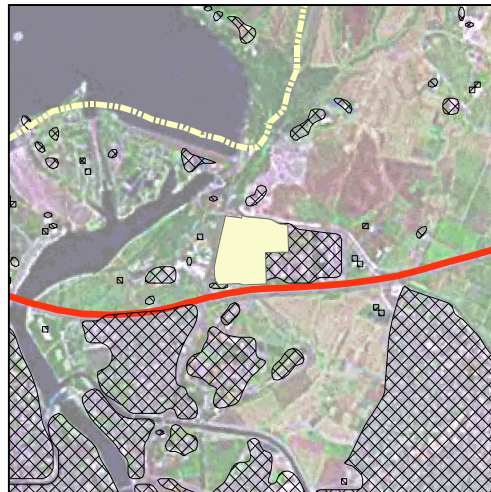


Figure 12-3: Boundaries of the Seyham Dam Lake wildlife development area and the Project site (yellow dashed lines indicate the boundaries of the Seyhan Dam Lake Wildlife Development Area, yellow shaded area indicate the Project site, dashed areas indicate developed areas)

In addition to the Seyhan Dam Lake Wildlife Development Area, there is a small wooded area and degraded small wooded area located at a distance of 140 m to the north of the Project site as shown in Figure 12-4.



Figure 12-4: Wooded areas close to the Project area

No impacts on the Seyhan Dam Lake Wildlife Development Area and the wooded areas are foreseen as a result of the Project activities due to the fact that there will be no direct contact with these areas.

12.6 Key Biodiversity Areas, Important Bird Areas and Important Plant Areas

Key Biodiversity Areas (KBAs) have been identified in Turkey, but there are no regulatory provisions for the identified KBAs except for those that have a legal protected status. The book entitled 'Key Biodiversity Areas of Turkey' published by Doga Dernegi (Nature Society) in cooperation with the Turkish Ministry of Environment and Forestry (former ministry, now Ministry of Environment and Urban Planning) and several conservationists and academics, is the most outstanding source for KBAs in Turkey. According to the book, the closest KBAs to the Project area are Yılanlıkale Hills (30 km to the east), Seyhan Delta (40 km to the south) and Ceyhan Delta (35 km to the southeast). Seyhan and Ceyhan Deltas are also Natural Protected Area and Ramsar Area.

In addition to the KBAs, Important Bird Areas (IBAs) and Important Plant Areas (IPAs) were also identified by Nature Society and WWF Turkey, respectively. According to the available documentation, closest IBAs to the Project site are Bolkar Mountatins (50 km to the west), Aladaglar (55 km to the north) and Seyhan Delta (40 km to the south). The closest IPAs to the Project site are the same areas as with the mentioned IBAs.

Due to the long distance of KBAs, IBAs and IPAs to the Project area, no impacts will occur on these areas as a result of Project activities.

13.0 SOCIO-ECONOMY

13.1 Scope

This chapter presents an assessment of the potential socio-economic impacts of the Project. The issues that were included in Table 1 of the IFC "Good Practice Note: Addressing the Social Dimensions of Private Sector Projects" were considered in the assessment. The following potential socio-economic impacts of the Project were identified:

- Temporary and permanent changes in the study area's population and demographic characteristics due to the Project;
- Direct and indirect employment creation as a result of construction and operation;
- Direct and indirect loss of existing employment and business;
- Wider (regional) economic impacts; and
- Impact of the provision of temporary construction worker accommodation.

A number of other issues related to social factors are addressed in *Chapter 14: Community Health and Safety* and *Chapter 15: Labor and Working Conditions*.

13.2 Social Area of Influence

The social area of the influence of the Project was described in *Chapter 4: Scope of the ESIA and Stakeholder Engagement* as follows:

- Nearby surrounding communities and facilities (described in more detail in *Chapter 5: Land Use and Zoning*):
 - Shanty houses located adjacent to the south boundary of the Project area
 - Residential buildings of Housing Development Administration of Turkey (TOKI), a small shopping center, a mosque and an elementary school located 500 m to the east of the Project area
 - A small sports facility (Ozden Amateur Sports Club) adjacent to the north boundary of the Project area
 - Chamber of Commerce Anatolian High School (currently providing education) and two other schools (not started education yet) located at the north of the Project area
 - Adana Riding Center located at the west of the Project area
- Nearby surrounding neighborhoods: Kislá, Koprulu, PTT, Karacaoglan, Kazim Karabekir, Serinevler, Beyazevler and Ziyapasa neighborhoods
- Neighborhoods on a wider region (approximately within 10 km diameter considering the potential for traffic impacts to be felt up to this distance): 62 neighborhoods in total located in 4 districts (Yuregir, Saricam, Seyhan and Cukurova districts). These are the Yenibaraj, Doseme, Selahattin Eyyubi, Yavuzlar, Dadaloglu, Gazipasa, Cemalpasa, Tahsilli, Akincilar, Yesilyurt, Kiremithane, Kurtulus, Remzi Oguz Arik, Mahfesigmaz, Guzelyali, Resatbey, Sehit Erkut Akbay, Mehmet Akif Ersoy, Saricam, Namik Kemal, Atakent, Mithatpasa, Ulubatli Hasan, Mutlu, Sinanpasa, Ozgur, Kayalibag, Tellidere, Toros, Cinarli, Camlibel, Tepebag, Ulucamii, Yildirim Beyazit, Fatih, Kurukopru, Dedekorkut, Cinarli, Cumhuriyet, Hanedan, Denizli, Hurmali, Karasoku, Ahmet Remzi Yuregir, Sariyakup, Turkocagi, Istiklal, Pinar,

Alidede, Karslilar, Sakarya, Basak, Yesilyuva, Narlica, Sucuzade, Yamacli, Anadolu, Besocak, Emek, Ismetpasa, Huzurevleri and Bahcelievler neighborhoods

- Entirety of the Adana districts as the Project will serve the whole province

The location of the nearby neighborhoods and settlements are given in Figure 13-1. The distance of these neighborhoods and settlements to the Project area are given in Table 13-1.

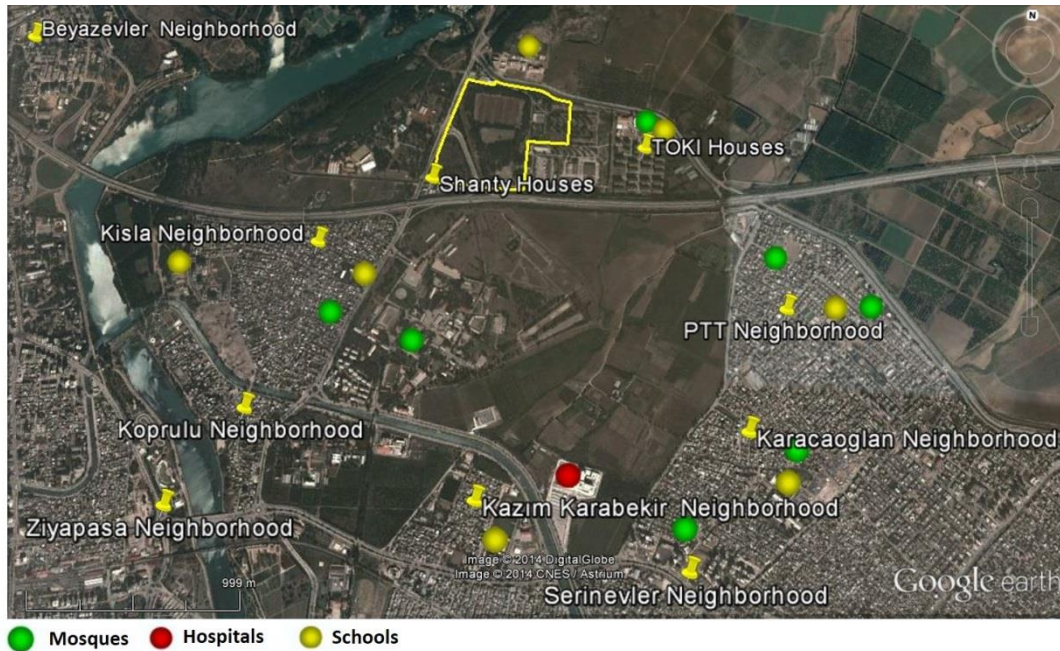


Figure 13-1: Neighborhoods and settlements that are in the vicinity of the Project area (Yellow line shows the Project area boundaries)

Table 13-1: Distance of the neighborhoods and settlements from the Project area

Neighborhoods and Settlements	Distance From Project area (km)
Kista	0.33
Koprulu	1.40
PTT	1.14
Serinevler	1.82
Karacaoglan	1.50
Beyazevler	1.90
Kazim Karabekir	1.50
Ziyapasa	2.00
TOKI Houses	0.27
Shanty Houses	0.02

The public facilities surrounding the Project Area are illustrated Figure 13-2 with the distances given in Table 13-2. Part of the northern boundary of the Project Area is adjacent to the Ozden Amateur Sports Club. The Sports Club is located on an area of 10,000 m². The facility has one swimming pool, cafeteria and two closed football pitches. There are 150 registered members and 10 employees in the facility. In addition to the regular members, the Sports Club has a summer swimming school. Approximately 600-700 trainees attend the summer school in the summer period. The Sports Club is active in football, judo and swimming branches.

Table 13-2: Distance of neighborhoods and settlements from Project area

Name of the facilities	Distance from Project area (km)
Ozden Amateur Sports Club	0.01
Adana Riding Center	0.04
Adana Chamber of Commerce High School	0.24

The Adana Riding Center is located on the western side of the Project area. The facility covers an area of 184,000 m². The facility has 595 members and 45 employees. Members are generally from high income group and between 1000-2000 people visit the facility at weekends. There are three manege facilities, four paddocks, one swimming pool, 11 tennis courts, one football field and one basketball court available in the facility. The facility is active in the fields of riding, swimming and tennis.

The Adana Chamber of Commerce High School is located north of the Project area. The School is built on an area of 45,000 m². The facilities include one school building, two football pitches, two multi-purpose fields (use for basketball, tennis and volleyball) and 100 m² of greenhouse. The School enrolls 870 (470 female and 400 male) students. Sixty three people (60 teachers, 2 janitor and 1 clerk) are employed at the school.

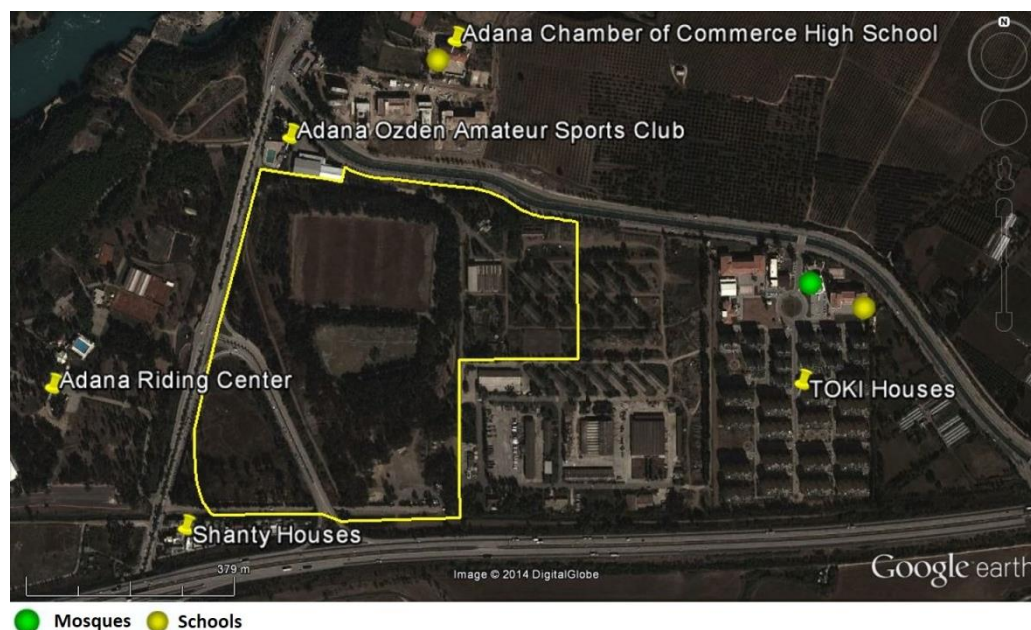


Figure 13-2: Public facilities around the Project area (Yellow line shows the Project area boundaries)

The closest settlements to the Project site are the shanty houses located adjacent to the southern boundary of the Project area and are separated by a side road. According to the 1/5,000 scaled Saricam-Yuregir Zoning Plan, the area is designated as an urban transformation area as explained in *Chapter 2: Project Description* and *Chapter 5: Land Use and Zoning*.

13.3 Socio-Economic Data Gathering

The existing socio-economic data was obtained through the review of secondary sources of information from relevant government authorities and official statistics. Information on the Turkish health sector and the Adana Region together with information on the PPP hospital developments

within the Turkish health sector was also obtained as part of the socio-economic baseline gathering. National and regional data was obtained and assessed for the following aspects relevant to the Project:

- Population and Demographics
- Economy, Employment and Occupations
- Income Distribution
- Education
- Industrial Sector
- Recreation and Tourism
- Health Sector

Local data from surrounding communities was also obtained for the above aspects to the extent possible including information on vulnerable people.

Existing socio-economic data were obtained from the following sources:

- Turkish Statistical Institute (<http://www.turkstat.gov.tr/>).
- Ministry of National Education (<http://adana.meb.gov.tr/>)
- State Planning Organization (<http://www.dpt.gov.tr/>)
- Adana Province Local Governorship (<http://www.adana.gov.tr/>)
- Yuregir District Governorship (<http://www.yuregir.gov.tr/>)
- Adana Metropolitan Municipality (<http://www.adana-bld.gov.tr/>)
- Yuregir Municipality (<http://www.yuregir.bel.tr/>)

In addition, a social survey was conducted in the eight nearby neighborhoods (Kisla, Koprulu, PTT, Serinevler, Karacaoglan, Beyazevler, Kazim Karabekir, Ziyapasa), the two settlements (TOKI Houses and shanty houses, both of the settlement fall within the Kisla Neighborhood boundaries), the two sport clubs (Adana Riding Center and Adana Ozden Amateur Sports Club) and one high school (Adana Chamber of Commerce High School). The survey was conducted between 26th-28th May 2014 with the headmen of the neighborhoods, residents of the two settlements and managers of the sport clubs.

13.4 Existing Conditions

13.4.1 Population and Demographics

The total population of Turkey was 75,627,384 (50.2% male and 49.8% female) according to the "Population Census 2012" conducted by the Turkish Statistical Institute (TSI). The population of Turkey has been increasing annually since the mid 1960's as shown in Figure 13-3. The rate of growth has slowed down since 1986 but continues to result in significant year-on-year population growth. The population information presented in this section was obtained from the official TSI website.

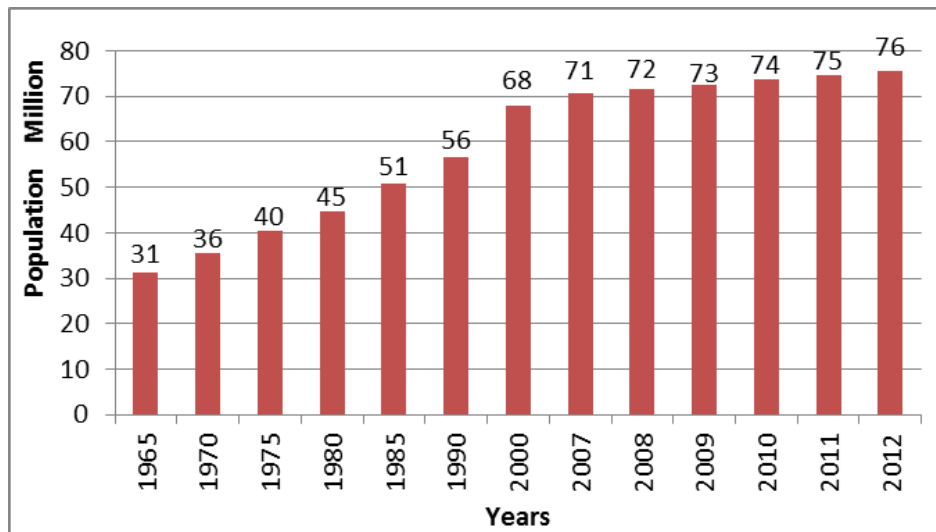


Figure 13-3: National population of Turkey between 1965 and 2012

The population growth in the Adana Province and its districts are given in Table 13-3.

Table 13-3: Population of Adana Province and its districts between 1990 and 2012

Location	Population							
	1990	2000	2007	2008	2009	2010	2011	2012
ADANA	1,934,907	1,849,478	2,006,650	2,026,319	2,062,226	2,085,225	2,108,805	2,125,635
<i>Aladag</i>	23,207	23,579	17,506	18,249	17,494	17,169	17,074	16,951
<i>Ceyhan</i>	161,523	178,543	158,459	158,833	158,368	158,729	158,377	158,767
<i>Cukurova</i>	-	-	-	271,344	331,421	347,941	331,307	340,473
<i>Fekke</i>	21,751	20,890	19,489	19,952	19,332	18,996	18,724	18,055
<i>Imamoglu</i>	33,565	43,361	31,629	31,257	30,968	30,552	30,105	29,700
<i>Karaisali</i>	37,584	35,122	28,740	23,481	23,102	22,981	22,701	22,368
<i>Karatas</i>	26,450	32,375	21,485	22,472	21,671	21,260	21,203	20,896
<i>Kozan</i>	117,704	130,875	123,980	124,669	125,813	127,100	127,804	127,926
<i>Pozanti</i>	23,040	21,756	19,896	21,963	20,425	20,279	20,147	19,812
<i>Saimbeyli</i>	20,700	17,149	17,775	17,671	17,573	17,355	17,104	16,630
<i>Saricam</i>	-	-	-	109,290	115,379	120,325	124,205	132,939
<i>Seyhan</i>	672,121	849,283	1,007,992	752,308	722,852	723,277	757,928	764,714
<i>Tufanbeyli</i>	22,672	20,171	18,279	19,045	18,768	18,072	17,481	17,546
<i>Yumurtalik</i>	20,957	22,575	19,155	19,625	19,239	18,660	18,266	17,929
Yuregir	369,529	453,799	522,265	416,160	419,821	422,529	426,379	420,929

Source: TSI official web site (<http://www.turkstat.gov.tr/>) (Cukurova and Saricam became a district on 22.03.2008)

Adana has similar statistics to the country statistics in terms of population growth. Rapid population growth decreased after 2000 both in Turkey and Adana Province (Figure 13-3, Table 13-3). Yuregir is the second biggest district of Adana with regards to population size and is affected from population changes in Turkey and Adana Province. As seen in Table 13-4 population growth rate of Yuregir district decreased after 2007 as in Turkey and Adana. Adana Province and Yuregir district reflect country statistics according to Figure 13-3, Table 13-3 and Figure 13-4.

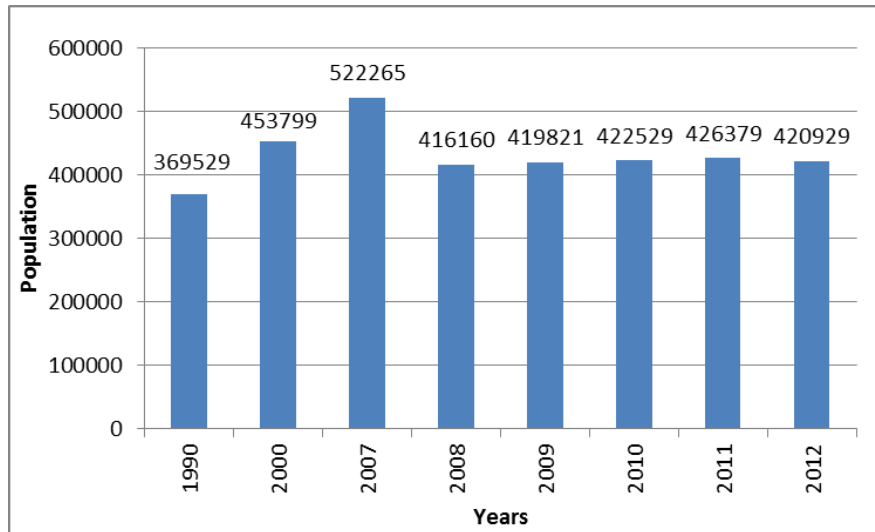


Figure 13-4: Population of Yuregir district between 1990 and 2012

Yuregir district has been divided into the Yuregir and Saricam district centers on 22.03.2008 according to the law on district establishment within the boundaries of metropolitan municipality and other relevant laws. The area of Yuregir district center after the division was reduced to approximately 82,000 hectares.

Population and demographic details of neighborhoods and settlements in the vicinity of the Project area are given in Table 13-4 based on information obtained during the social survey.

Table 13-4: Population of neighborhoods and settlements in the vicinity of the Project area

District	Yuregir						Cukurova	Seyhan	Yuregir	
Neighborhoods and Settlements	Kisla	Koprulu	PTT	Serinevler	Karacaoglan	Kazım Karabekir	Beyazevler	Ziyapasa	TOKI Houses	Shanty Houses
Population	25,000	7,000	15,000	10,000	16,293	8,500	30,000	10,000	5,500	300
Number of Households	7,000	2,000	4,000	2,000	4,000	2,300	8,000	5,000	1,011	70
Average Household Size	3-4	3-4	4	5	4	4	4	4	4-5	4-5

The total population and the gender distribution in Turkey, Adana province and its districts in 2012 is given in Table 13-5. The ratio of the male is higher in countrywide and Yuregir district but in Adana female population is higher than male population.

Table 13-5: Gender distribution in Adana province and its districts, 2012

Location	Total Population	Male	Female
Turkey	75,627,384	37,956,168	37,671,216
Adana	2,125,635	1,061,264	1,064,371
Aladag	16,951	8,621	8,330
Ceyhan	158,767	79,502	79,265
Cukurova	340,473	166,492	173,981
Feke	18,055	9,373	8,682
Imamoglu	29,700	14,782	14,918
Karaisali	22,368	11,179	11,189
Karatas	20,896	10,471	10,425

Location	Total Population	Male	Female
Kozan	127,926	64,239	63,687
Pozanti	19,812	10,237	9,575
Saimbeyli	16,630	8,575	8,055
Saricam	132,939	68,213	64,726
Seyhan	764,714	380,421	384,293
Tufanbeyli	17,546	9,115	8,431
Yumurtalik	17,929	8,983	8,946
Yuregir	420,929	211,061	209,868

Source: TSI official web site (<http://www.turkstat.gov.tr/>)

Adana province has a population made up of relatively young people. Only 5.9% of the population is within the 65 and over age group. On the other hand, population between the 0-14 age and over the 65 age group is equal to 32.7% of the province population. This rate is called the "age dependency ratio" and the average of this ratio for Turkey is 48.42%. Considering that the percentage of the population in the age group of 65 or over is 5.9%, it can be concluded that the high age dependency ratio is due to the young population. The comparison of general demographic indicators in Turkey and Adana is shown in Table 13-6.

Table 13-6: General demographic indicators

Indicators (2011)	Turkey	Adana
Total population	74,724,269	2,108,805
Rural population (%)	28.2	11.6
Urban population (%)	71.8	88.4
0-14 age group population (%)	37.5	26.8
Age 65 and over population (%)	10.9	5.9
Annual population growth (‰)	12.8	11.2
Age dependency ratio	48.4	32.7
Crude birth rate (‰)	17.3	18*
Crude mortality rate (‰)	6.3	3.2*

Source: TSI official web site (<http://www.turkstat.gov.tr/>) *Data belongs to the year 2010

The age profile of the neighborhoods and settlements in the vicinity of the Project area is give in Table 13-7 based on information obtained during the social survey. According to Table 13-7 approximately 46% of the people are young (0-20) in these settlements.

Table 13-7: Age profile of neighborhoods and settlements in the vicinity of the Project area

Neighborhoods and Settlements	Young (0-20) (%)	Middle Age (20-60) (%)	Old (60-60+) (%)
Kisla	40	20	40
Koprulu	45	10	45
PTT	50	20	30
Serinevler	70	30 (Middle age and old)	
Karacaoglan	20	80 (Middle age and old)	
Beyazevler	70	30 (Middle age and old)	
Kazım Karabekir	Low	High (Middle age and old)	
Ziyapasa	30	30	40
TOKİ Houses	High (Young and Middle age)		Low
Shanty Houses	40	40	20

According to Table 13-6 and Table 13-7, it can be concluded that Adana, Yuregir and settlements have relatively young population.

As was noted in Table 13-3, the population increased annually in the Adana province up to 2000. One of the most important reasons for the population increase was the migration into the Adana province from other provinces. Based on the population census of 1985, 429,367 people living in Adana were born outside of the province and this number increased to 490,520 in 1990. This information indicates that approximately 25% of the people living in the Province of Adana were born outside of the province. The population of the province was 1,689,155 based on the 1997 census of which 1,270,640 lived in the center districts and 418,515 lived in rural areas. The majority of the population lived in the rural area until 1970. After 1970, the ratio of the village population to the total population in the province decreased continuously. According to the 1970 census, 49% of the total population lived in villages. This figure had fallen to 25% in the 1997 census. Yuregir district has received migration from Southeastern Anatolia, Eastern Anatolia, Central Anatolia regions and districts such as Ceyhan, Kadirli, Kozan and Aladag. This migration wave (although it has been declining in recent years) has led to an urban sprawl and related infrastructure problems. According to face to face meetings with the headmen, there is no in or out-migration from Koprulu, PTT and Serinevler neighborhoods. Headmen of Karacaoglan and Kazım Karabekir neighborhoods stated that 1000-1500 people have migrated into these neighborhoods from surrounding neighborhoods due to transportation and education opportunities. According to headman of Beyazevler, 1000 to 1500 people left Beyazevler neighborhood in the last 5 years due to high house rent prices.

Information on vulnerable groups in the nearby neighborhoods and settlements were gathered from face to face meeting with headmen and residents of the relevant settlements. Vulnerable groups are defines as people who live with the assistance of others, poor people, old people, female households, physically handicapped people and mentally handicapped people. Face to face meetings with headmen and residents indicated that most poor people and people living with the assistance of others reside in shanty houses. Headmen stated that district governorship supports vulnerable individuals and households. Detailed information about vulnerable groups are given in Table 13-8.

Table 13-8: Information on vulnerable groups in the neighborhoods and settlements in the vicinity of the Project area

Neighborhoods	Vulnerable Groups					
	People Who Live with the Assistance of Others	Poor People	Old People	Female Households	Physically Handicapped People	Mentally Handicapped People
Kisla	Low number	Low number	High number	High number	1-2%	4-5 people
Koprulu	25-30 households	7-8 households	5-6 households	7-8 households	3 households	3 households
PTT	Less than 1%	Less than 1%	-	Exists but number unknown		0.5%
Serinevler	5%	2%	Less than 1%	1-2%	1-2%	1-2%
Karacaoglan	2%	2%	1-2 people	1-2%	0.5%	Less than 0.5%
Beyazevler	1%	1%	-	20-30 households	1-2	1-2
Kazım Karabekir	10%	10%	30-40 people	2-3%	Less than 1%	Less than 0.5%
Ziyapasa	30%	25%	50-60%	5%	100 people	50 people
TOKİ Houses	-	-	-	1-2 households	1-2 people	-
Shanty Houses	40%	30%	1%	10 households	-	-

13.4.2 Economy, Employment and Occupations

Turkey has undergone a significant level of economic growth since 2001. However, the general growth trend since 1971 has been very variable with significant peaks (large positive growth) and troughs (large negative growth) over the years. The most recent economic contraction occurred in 2001 with a 5.7% reduction in real Gross Domestic Product¹ (GDP).

Commercial activities in the Adana province are concentrated in the central district. A significant portion of the trade consists of industry, agriculture and livestock categories. The GDP per capita in the Adana province is USD 2,339. The average GDP per capita in Turkey is USD 2,146 (TSI, 2001). The amount of imports and exports per capita in the Adana province is lower than the country average; however the ratio of exports to imports is considerably above the national average. Industrial, tourism or commercial loan amounts per capita are also lower than the country average. The farmers in Adana, however, maintain their entrepreneurial spirit in spite of all difficulties and the loan amount per urban population is much higher than the national average (DPT, 2003).

Although the foreign trade lags behind, a great part of the production in the province is composed of food, textile, petrochemical and chemical industry products that are sold both in domestic market and neighboring foreign regions. As of 2001, while the fastest developing sector across the country is industry, the fastest developing sector in Adana is the service sector. All sectoral activities in Adana are at a sufficient level presently to provide the needs of the current economic activities².

Based on a study dated 2004 by the State Planning Organization (SPO), Adana metropolitan area (includes Seyhan and Yuregir districts within the scope of the study conducted) ranks 2nd in terms of socio-economic development rating among the 872 districts of Turkey. The employment in the agricultural, industry and service sectors is 23.08%, 20.50% and 56.42%, respectively (2004 data). The socio-economic indicators of metropolitan municipality are given in Table 13-9.

Judging by the employment rate in the Adana province, the services sector is similar to the developed countries due to its high percentage and it is expected that the industrial employment rate will increase in the future. The percentage of workers in agriculture is expected to decrease with increased use of mechanization.

Table 13-9: The socio-economic indicators of Adana metropolitan area* (SPO-2004)

Indicators	Value (Ranking among Districts)
Population	1,303,082 (1 th)**
Urbanization (%)	86.77 (19 rd)
Population Growth (‰)	22.39 (157 st)
Population Density (Person/km ²)	692 (8 th)
Population Dependency Ratio*** (%)	56.48 (467 th)
Average Number of Household	4.53 (544 th)
Employment in Agricultural Sector (%)	23.08 (855 th)
Employment in Industry (%)	20.50 (36 th)
Employment in Service Sector (%)	56.42 (34 th)

¹<http://stats.oecd.org/>

²Adana Metropolitan Municipality, 2010-2014 Strategic Plan

Indicators	Value (Ranking among Districts)
Unemployment (%)	17.11 (27 th)
Literate (%)	87.97 (267 th)
Infant Mortality (‰)	44.51 (303 rd)
Income per Capita	271,265,000 TL (40 rd) = USD 207.07 (according to exchange rate of dollar to TL in 2004)
Tax Revenues (Share in The Country (%))	1.70397 (2 nd)
Agricultural Production (Share in The Country (%))	1.49545 (1 st)
Socio-Economic Development Index/Group	5.71564/ 1 (2 nd)

*The Metropolitan area covers Seyhan and Yuregir districts within the scope of the study. **Numbers in parentheses indicate the order of the district among 872 districts of Turkey. ***Population dependency ratio defines the part of the population that does not work and rely on others for the goods and services they consume.

According to 2010 Adana Chamber of Commerce data, the industrial firms produce up to 4,585 units of consumption goods (food, beverage, tobacco, textile), 3,614 units of intermediate goods (wood and cork, chemical, fertilizer, glass, cement) and 2,900 units of investment goods (agricultural machinery, information processing machines, shipbuilding). There are a total of 74,211 people employed in industrial firms. There are also industrial sites in Adana including Adana Hacı Sabancı Organized Industrial Zone, Kozan Organized Industrial Zone and six other small industrial sites in the province.

According to 2007 Adana Chamber of Industry data, the most important economic sector in the province is the textile sector. The knitted and leather industry (21%), garment and home textile sector (7.6%), machinery and textile spare parts industry (7%), furniture and decoration (6.5%), automotive and spare parts (6.4%), casting, machinery and agricultural equipment industry (6.2%) represent the various components of the industrial production. Most of the production facilities are within the boundaries of Yuregir district.

The total land area of the Adana province is 1,403,000 hectares with 539,000 hectares being suitable for agriculture. The total area that can be potentially irrigated is 527,421 hectares; the present area that is being irrigated is 217,562 hectares. With the completion of the ongoing construction of irrigation projects, approximately 240,000 hectares of land will be used for irrigated agriculture.

The value of the agricultural production per rural population in Adana is higher than the national average. However, there is no available data on how much this is related to the fertility of soil and climate and how much it is related to increase in productivity due to the techniques being used.

The most important contribution to the economy of the province in terms of crop production is provided from grains. The natural ecosystems in Adana are also suitable for vegetable and fruit growing. Fruit growing has increased in recent years due to higher economic returns; local farmers are encouraged to invest in this sector. The Adana province provides 45% of corn production, 50% of soybean production, 34% of peanut production, 30% of citrus production, 12% of watermelon production and 6.5% of wheat production of Turkey. Wheat, barley, oat and rice are grown in Yuregir district parallel to agricultural production in Adana province. Cotton ranks first among the industrial crops. The overview of the agricultural crops is given in Table 13-10.

Table 13-10: Overview of some agriculture activities in Yuregir

Greenhouse							
Low Tunnel				Plastic Greenhouse			
Area (ha)		Production (ton)		Area (ha)		Production (ton)	
1,470		94,950		6		430	
Cooperatives							
Development		Irrigation			Aquaculture		
154		28			11		
Important Agricultural Products							
Corn		Cotton		Wheat		Soybeans	
Area (ha)	Quantity (ton)	Area (ha)	Quantity (ton)	Area (ha)	Quantity (ton)	Area (ha)	Quantity (ton)
2,0187.3	268,595	21,900	71,535	9,750.3	47,801	7,858.3	32,963
Agricultural Dealers*							
Fertilizer		Pesticide			Anal. Lab.		
314		247			10		

Source: TSI (<http://www.turkstat.gov.tr/>)-2012) *Source: Adana Provincial Directorate of Food, Agriculture and Livestock (<http://www.adanatarim.gov.tr/tumlstatistikler.aspx>)

Sheep, goat and cattle livestock breeding is seen to be prevalent in accordance with the available vegetation cover and climate of Adana. Chicken and turkey breeding are also carried out for commercial purposes. Meat, milk and leather products are more among the animal products in Adana. 55.67% of all products and 100% of some products such as leather and white meat are released to the market.

Despite the abundance of resources in Adana and current potential in terms of production, fish harvesting and production is very low, even below 1% of the production of Turkey and generally it is based on hunting. An overview of the husbandry activities including the number of animals are shown in Table 13-11.

Table 13-11: Overview of husbandry activities

Cattle		
Pure Culture Cattle	Hybrid Culture Cattle	Domestic Cattle+Buffalo
22,203	22,533	252
Small Cattle		
Sheep		Goat
18,700		6,229
Poultry		
Broiler	Layer Chicken	Other Fowls
548,500	7,600	957
Apiculture		
New Style Bee Hive	Honey (kg)	Beewax (kg)
62,550	1,413,750	62,550
Aquaculture Production Site		
34		

Source: TSI official web site (<http://www.turkstat.gov.tr/>)

13.4.3 Income Distribution

The net annual disposable income data for households in 2012 for Turkey and the Mediterranean region are given in the Table 13-12 (Specific data for Adana and Yuregir are not available). The Mediterranean region covers the provinces of Antalya, Isparta, Burdur, Adana, Mersin, Hatay,

Kahramanmaraş and Osmaniye. According to TSI, the annual disposable income for the region is below the country average.

Table 13-12: Distribution of annual household disposable income in Turkey and the Mediterranean region in 2012

Income Type	Country Average	Average of Mediterranean Region
Net annual disposable income per household (TL)	26,577	23,340

Source: TSI official website (<http://www.turkstat.gov.tr/>)

Based on the social survey conducted, the average monthly income of the eight neighborhoods in the vicinity of the Project area is 1,463 TL. Kazım Karabekir Neighborhood has the lowest income (1,000 TL/month), Serinevler and Beyazevler neighborhoods have the highest income (1,700 TL/month). The average monthly income in the TOKİ houses is higher (4,000 TL/month) compared to the other neighborhoods and settlements. The average monthly income data in the neighborhoods and settlements in the vicinity of the Project area is given in Table 13-13.

Table 13-13: Average monthly income in neighborhoods and settlements in the vicinity of the Project area

Neighborhoods and Settlements	Average Monthly Income (TL)
Kisla	1,300
Koprulu	1,500
PTT	1,500
Serinevler	1,700
Karacaoglan	1,500
Beyazevler	1,700
Kazım Karabekir	1,000
Ziyapasa	1,500
TOKİ Houses	4,000
Shanty Houses	Less than 500

The available statistics indicate that 16.3% of the population lives under relative poverty threshold (4,515.00 TL per month) in Turkey in 2012 and the number of people of low-income is estimated to be 11,998,000. According to the number of poor people and regional poverty rates, 13.7% of the population is living under the relative poverty threshold (i.e. 3,938 TL/month) in Mediterranean region (specific data for Adana Province is not available) in 2012 and the number of people with low-income is calculated as 1,298,000 in the region. Turkey and Mediterranean region poverty data comparison is provided in Table 13-14.

Table 13-14: Poverty comparison of Turkey and Mediterranean region

Year	Turkey			Mediterranean Region		
	Poverty Threshold (TL)	Number of Poor (Thousand)	Poverty Rate (%)	Poverty Threshold (TL)	Number of Poor (Thousand)	Poverty Rate (%)
2006	2,351	12,548	18.6	1,919	1,438	17.0
2007	3,041	11,163	16.3	2,515	1,284	14.9
2008	3,164	11,580	16.7	2,597	875	10.0
2009	3,522	12,097	17.1	3,027	1,051	11.8
2010	3,714	12,025	16.9	3,558	1,140	12.6
2011	4,069	11,670	16.1	3,818	1,134	12.3
2012	4,515	11,998	16.3	3,938	1,298	13.7

Income level in the region remain below the country average as seen in Table 13-12, both poverty threshold and poverty rate also remain below the country average as can be seen in Table 13-14.

Residence ownership status in the nearby neighborhoods and settlements in the vicinity of the Project area are given in Table 13-15. People living in these neighborhoods are usually the owners of their houses.

Table 13-15: Ownership status of in the neighborhoods and settlements in the vicinity of the Project area

Neighborhoods and Settlements	Owner (%)	Renter (%)
Kisla	50	50
Koprulu	80	20
PTT	85	15
Serinevler	65	35
Karacaoglan	60	40
Beyazevler	40	60
Kazım Karabekir	50	50
Ziyapasa	50	50
TOKİ Houses	75	25
Shanty Houses	99	1

13.4.4 Employment

Based on 2011 TSI data, the unemployment rate in Adana province is 11.4% which is higher than both Mediterranean regional unemployment rate (8.72%) and is also above the general unemployment rate of Turkey (7.9%). Table 13-16 presents the employment data for Turkey and Adana province for 2011. Specific data for Yuregir was not available.

Table 13-16: Employment data for Turkey and Adana Province

	Population of 15 years of age and above	Labor force	Employed	Unemployed	Not in labor force*
Turkey	55,639,000	26,420,000	24,320,000	2,100,000	29,219,000
Adana	1,536,000	671,000	595,000	77,000	864,000

Source: Population and Housing Census, 2 October 2011 (TSI official website)

*Covers those who do not want to work or do not have the ability to work

The economically active portion of the population is low in the province. This portion is expected to increase in the future due to factors such as young population since it is seen that lack of job opportunities, women not working due to traditional judgments, the informal economy and early retirement are the causes of the present low employment.

The employment rate in the neighborhoods and settlements in the vicinity of the Project area are given in Table 13-17. Approximately 40% of the population is economically active in the neighborhoods. In general, people are working in the private sector. Unemployment rate in the surveyed area varies between 10 % and 60%. The average unemployment rate is 40% in the nearby neighborhoods with the shanty houses having the highest unemployment rate (60%), and both of the rates are higher than average of the province.

Table 13-17: Employment status neighborhoods and settlements in the vicinity of the Project area

Neighborhoods	Working Status (%)					
	Private	Public	Self-Employed	Unemployed	Retired	Student
Kisla	30	5	1	10	50	4
Koprulu	14	5	1	10	50	20
PTT	37.5	0.5	1	40	20	1
Serinevler	50	5	10	10	15	10
Karacaoglan	20	20	10	10	30	10
Beyazevler		20		30	30	20
Kazim Karabekir	30	10	5	20	25	10
Ziyapaşa	15	10	5	30	35	5
TOKİ Houses	0.5	95	2	0	2	0.5
Shanty Houses	20	4	1	60	10	5

More than half of the employees are laborers in services sector. Industry sector is the second biggest employment area in the province. Employment by economic activity data for Turkey and Adana are given in Table 13-18. Specific data for Yuregir district is not available.

Table 13-18: Employment data by economic activity for Turkey and Adana province

	Agriculture (%)	Industry (%)	Service (%)
Turkey	22.74	27.16	50.10
Adana	18.96	28.60	52.44

Employment by economic activity data for neighborhoods and settlements in the vicinity of the Project area are shown in Table 13-19. Agriculture is not common in the surveyed area. People are generally laborers in service sector. Between 50% and 99.3% of the employees are laborers in service sector in the neighborhoods and settlements.

Table 13-19: Employment data by economic activity for neighborhoods and settlements in the vicinity of the Project area

Neighborhoods and Settlements	Agriculture (%)	Industry (%)	Service (%)
Kisla	-	10	90
Koprulu	-	30	70
PTT	-	20	80
Serinevler	-	5	95
Karacaoglan	-	20	80
Beyazevler	-	5	95
Kazim Karabekir	-	20	80
Ziyapasa	-	50	50
TOKİ Houses	-	0.3	99.7
Shanty Houses	-	Low	High

13.4.5 Education

Adana Province has one private (Adana Science and Technology University) and one state (Cukurova University) university. Cukurova University provides education with 16 faculties, 5 high schools, 13 vocational high schools, 1 state conservatory, 3 institutes and 25 research and application centers located in Yuregir District. State University has 1,900 academic staff, 11,500 undergraduates, 29,000 graduates and 4,500 master students as of 2012. Adana Science and Technical University provides education with 9 faculties, 1 high school, 2 institutes and 2 application-research centers located in Seyhan District. A total of 65 students were registered in the

newly established university in the academic year of 2013-2014. There is one vocational high school building belonging to Cukurova University in Beyazevler neighborhood.

The number of public education center courses in the Yuregir district and the number of enrollment is given in Table 13-20.

Table 13-20: Courses and enrollment in 2009 in Yuregir district

Type of Course	Number of courses	Number of participants
Vocational courses*	10	N.A
Public education center**	7	5,388

*Source: Yuregir Municipality Cultural Center: (<http://kulturevleri.com>) **Source: Ministry of National Education: (<http://www.meb.gov.tr/baglantilar/okullar/index.asp?ILKODU=1&ILCEKODU=17>)

In addition to the universities, the educational services are provided in 12 pre-schools, 85 primary schools, 67 secondary schools, 15 common high schools, 13 vocational high schools and 2 private schools (1 primary and 1 secondary school) representing a total of 194 educational facilities among which the majority of these facilities are located in the Yuregir District¹. Number of primary, secondary and high schools in the neighborhoods and settlements in the vicinity of the Project area are given in Table 13-21. **Hata! Başvuru kaynağı bulunamadı.**

Table 13-21: Education facilities in the neighborhoods and settlements

Neighborhoods and settlements	Primary and secondary school	High school
Kisla	5	2
Koprulu	1	-
PTT	5	1
Serinevler	2	1
Karacaoglan	2	-
Beyazevler	2	1
Kazımkarabekir	2	3
Ziyapasa	1	1
TOKI Houses	2	1
Shanty Houses	-	-

The information on the educational status for the Yuregir district based on the 2012 population census is given in Table 13-22 which shows that half of those people at primary level education level is men and the other half is women. However, for middle and high school education levels, this ratio is lower for women and only one-third of the graduates from college are women.

Figure 13-5 gives the education status in the surveyed area based on information obtained from face-to-face meetings with the headmen. The average education status in most of the neighborhoods is high school level with the exception of Beyazevler neighborhood and TOKI houses. The proportion of residents having university degrees in Beyazevler neighborhood and TOKI houses is between 60% and 70%, respectively. Approximately 91% of the people living in the shanty

¹ Republic of Turkey Ministry of National Education;
(<http://www.meb.gov.tr/baglantilar/okullar/index.asp?ILKODU=1&ILCEKODU=17>, access on: 28.11.2013)

houses have graduated from primary school. In general, residents of the neighborhoods have graduated from high school.

Table 13-22: Educational status of Yuregir district (2012 Census data)

Age	Gender	Illiterate	Literate but not graduated	Primary School	Elementary School	Secondary School	High School	Academy or Faculty Degree	Master Degree	Post Graduate Degree	Unknown	Total
06-13	Male	2	33,330		145						34	33,511
	Female	10	31,453		197						44	31,704
14-17	Male	29	2,842		13,035		179				57	16,142
	Female	68	3,378		11,482		308				100	15,336
18-21	Male	132	1,416		7,121		4,821	194			133	13,817
	Female	469	2,792		6,040		4,498	238			264	14,301
22-24	Male	121	1,020		4,280		3,856	1,054	2		186	10,519
	Female	574	2,119		3,466		3,286	1,174			296	10,915
25-29	Male	259	1,160	2,413	5,025	231	5,404	2,276	31		1,005	17,804
	Female	946	1,988	4,958	3,074	217	4,265	1,964	36	4	399	17,851
30-34	Male	270	676	4,074	3,853	1,424	5,875	2,002	95	8	558	18,835
	Female	888	1,667	6,752	1,934	1,340	3,929	1,371	83	16	292	18,272
35-39	Male	197	388	3,957	3,337	1,532	4,292	1,521	98	26	319	15,667
	Female	790	1,328	6,023	1,784	1,199	2,620	860	64	20	264	14,952
40-44	Male	158	355	3,729	2,997	1,694	2,662	1,091	68	22	159	12,935
	Female	931	1,349	5,221	1,449	1,140	1,717	448	32	12	191	12,490
45-49	Male	210	406	3,820	2,697	1,520	2,219	630	53	20	178	11,753
	Female	1,232	1,292	5,205	977	918	1,181	211	14	14	227	11,271
50-54	Male	282	397	3,845	1,612	1,037	1,695	390	23	10	145	9,436
	Female	1,608	1,329	4,722	483	526	605	94	3	6	198	9,574
55-59	Male	376	539	4,451	756	850	930	279	32	6	169	8,388
	Female	2,142	1,367	4,024	201	325	267	63	4	5	183	8,581
60-64	Male	401	438	3,601	238	497	453	147	8	1	151	5,935
	Female	2,481	1,129	2,328	44	113	95	28	3		175	6,396
65 +	Male	1,776	1,295	4,360	99	455	283	127	3	2	251	8,651
	Female	7,257	1,613	2,030	16	87	80	21		2	501	11,607
Total		23,609	97,066	75,513	76,342	15,105	55,520	16,183	652	174	6,479	366,643

Source: 2012 Census of Population (TSI website)

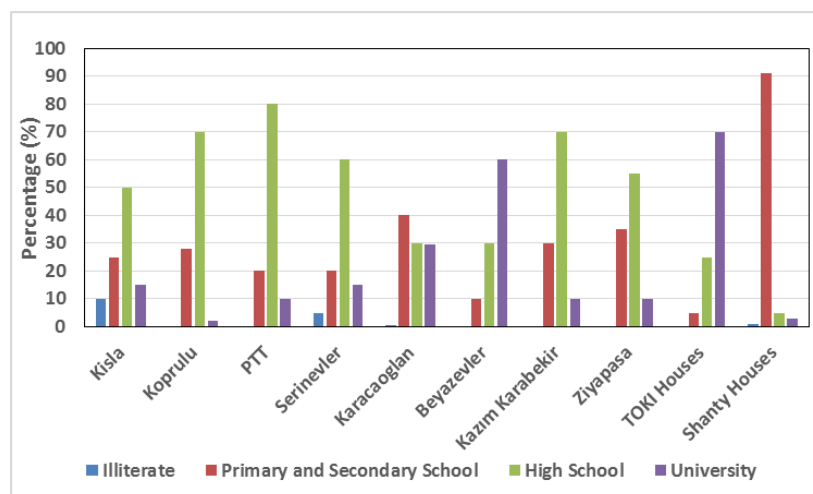


Figure 13-5: Education status in the surveyed area

13.4.6 Recreation and Tourism

There are beaches, lakes, sandy seashores in Karatas and Yumurtalik in Mediterranean coasts, which are very suitable for touristic activities. These coasts are centers of the tourism. It is also possible to benefit from highland tourism in Adana province. Tekir, Burucek, Aladaglar, Horzum, Findikli, Hamidiye, Asar, Asmacik, Armutoluk, Belededik, Meydan, Camliyayla and Kizildag are highland tourism centers in the province where activities such as tracking, cycling and horse-riding can be made. There are six ancient cities located in the Adana p which include Anavarza, Sar, Misis, Magarsos, Ayas and Akoren Touristy Ruins. Surfing is possible in the Seyhan dam lake. Fishing is popular around Seyhan and Ceyhan rivers and the mountain streams have a good supply of trout. Adana also offers many possibilities for hunting at the slopes of Toros Mountains.

13.4.7 Health

The healthcare system in Turkey is being developed under the 2003-2013 Health Transformation Program. The purpose of this program is to increase the quality and efficiency of the healthcare system and enhance access to healthcare facilities with the introduction of a number of reforms which are explained in *Chapter 2: Project Description*. Turkey's total expenditure on health per capita in 2011 was USD 1,160 representing 6.7 percent of total GDP (Table 13-23); this value is still at a low level relative to more developed countries. However, it is expected to grow in line with the gradual introduction of universal healthcare insurance scheme, increase in annual income per head, growing health awareness, a steady rise in life expectancy and the size of the elderly population. Moreover, population in Turkey is growing faster than in the EU. Total healthcare spending is forecasted to rise to about USD 63 billion in 2014, but could be substantially higher if the government fails to restrain public spending on health¹.

Table 13-23: Health statistics of Turkey

Characteristics	Figure
Total population	73,997,000
Gross national income per capita (PPP international \$)	16,940
Life expectancy at birth m/f (years)	73/78
Probability of dying under five (per 1 000 live births)	14
Probability of dying between 15 and 60 years m/f (per 1 000 population)	123/68
Total expenditure on health per capita (Intl \$, 2011)	1,160
Total expenditure on health as % of GDP (2011)	6.7

Source: MoH, Annual Health Statistics, 2011.

The need for health services in Adana province is increasing in parallel to the growing population. Due to its centralized location, Adana province is currently providing health services to both people living in Adana and people coming from the surrounding and further provinces. These aspects are explain in more detail in *Chapter 2: Project Description*.

The number of beds per 100,000 people is 290 in Adana in 2010 while this is 260 for Turkey in 2011 and 554 for European Union (Table 13-24).

¹Republic of Turkey Prime Ministry Investment Support and Promotion Agency
(<http://www.invest.gov.tr/en-US/infocenter/publications/Documents/HEALTHCARE.INDUSTRY.pdf>)

Table 13-24: General health statistics

World Health Organization Data (2010) (100,000 People/Bed)				Beds Occupancy Rate	
World	European Union	Turkey (2011)	Adana (2010)	Turkey (2011)	Adana (2010)**
300	554	260	290*	65.6%	76.4%

Source: Ministry of Health, Annual Health Statistics – 2011, *Ministry of Health, Inpatient Health Facility Planning Guide, 2011 **Source: Adana Province Local Governorship (<http://adana.gov.tr>)

Adana province ranks 18th among the 26 regions for the number of hospital beds per 100,000 people on the basis of the Statistical Regions Level 2¹ (SRL 2) (Table 13-25).

Table 13-25: Number of hospital beds and bed per 100,000 people in terms of Level 2 regions

No.	Region Code	Region Name	Number of Beds	Number of beds per hundred thousand people
1	TRB1	Malatya, Elazig, Bingol, Tunceli	6,059	379
2	TRA1	Erzurum, Erzincan, Bayburt	3,914	364
3	TR51	Ankara	16,027	359
4	TR81	Zonguldak, Karabuk, Bartın	3,432	338
5	TR61	Antalya, Isparta, Burdur	8,262	336
...	...	...	...	...
		Average of Turkey	184,983	262
...	...	...	...	...
17	TR42	Kocaeli, Sakarya, Duzce, Bolu, Yalova	7,388	242
18	TR62	Adana, Mersin	8,668	241

*Source: TSI (2007)

There are 11 state hospitals, 1 psychiatric hospital, 149 family health centers, 31 emergency stations, 1 oral and dental health center, 3 mother and child care and family planning centers, 1 public health laboratory and 4 tuberculosis control dispensary in Adana that are affiliated with MoH. There are also 2 university hospitals and 12 private hospitals in the Adana Province. The bed capacity and number of personnel in these hospitals are presented in Table 13-26. One university hospital (Cukurova University Hospital) and 2 state hospitals (Adana State Hospital and Adana Numune Education and Research Hospital) are located in Yuregir District.

Table 13-26: Information on inpatient treatment institutions

	Number of Institutions		Number of Beds		Number of Personnel		Occupation Rate %		Average Length of Stay	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Ministry of Health	12	11	3,453	3,463	4,962	8,328	72.7	73	4.9	4.8
University	2	2	1,728	1,735	3,555	3,720	93.9	82	5.2	5.2
Private Hospital	11	12	753	920	2,378	3,358	63.2	59	2.4	2.1
Total	25	25	5,934	6,118	10,895	15,406	77.7	74	4.5	4.3

Source: Adana Province Local Governorship website (<http://adana.gov.tr>)

The human resources of these hospitals are summarized in Table 13-27.

¹At SRL 2, 26 territorial units have been determined according to the sizes of population based on economic, social, cultural, geographical and other factors (<http://www.turkstat.gov.tr>)

Table 13-27: Number of health service personnel in Adana

2011	Specialist	Practicing physician/Physician assistant	Dentist	Nurse	Midwife	Other health service personnel	Technical service personnel	Total
First level health institutions*	17	610	9	139	609	766	452	2,602
Inpatient treatment institutions	752	222/120	149	1,871	491	1,216	905	5,726
University hospital	447	38/331	83	641	25	1,208	947	3,720
Private hospital	368	67	5	408	72	494	964	2,378
Private medical centers	206	69	365	85	43	211	1	980
Total	1,790	1,006/451	611	3,144	1,240	3,269	3,269	15,406

Source: Adana Province Local Governorship website (<http://adana.gov.tr>) *First level health institutions include doctor offices within public enterprises, emergency service units, medico social units of universities, first level health units of the Turkish Armed Forces, municipality polyclinics according to the definition provided in Communiqué on the Social Security Institution Health Practice (Official Gazette Date/No: 24.03.2013/28597)

13.5 Impact Assessment for Construction Phase

13.5.1 Direct and Indirect Employment Creation

The maximum workforce that is anticipated during the construction phase of the Project is 1,800 people. Employment of the workers over the 36 month construction and commissioning period will provide a positive employment impact through creating approximately 5,400 person years of employment.

It is the intention that the large majority of the workforce will be sourced locally and the provision of temporary employment will provide a significant benefit to the economy. According to TSI 2007 data, there are 1,639 registered civil engineering-construction companies in Adana province with a workforce of 11,206. Hiring at this level is expected to affect the availability of construction workers for other projects and businesses in the city given the size of the sector in Adana. Workers are likely to be brought from surrounding provinces. However, the scale of permanent employment is not expected to result in any significant long term changes in residential or working population once the Project is finalized.

All construction workers will be employed and remunerated in accordance with the provisions of Turkish law and IFC PS2/EBRD PR2: Labor and Working Conditions.

In addition to the direct employment benefits of the Project, indirect and induced employment benefits will also arise. Indirect employment is that created in providing goods and services to the construction project; induced employment is that created by the expenditure of direct and indirect employees' earnings in the economy. Input-output data for Turkey are not available to allow direct estimation of these effects but using available data from various sources suggests that indirect and

induced employment could amount to the order of 90% of Project jobs¹; that is every person year of direct employment will generate an additional 0.9 person years of indirect and induced employment in the economy.

Total employment creation from the Project could therefore be in the order of 10,650 person years over the construction period. It is generally considered that 10 person years of temporary employment is equivalent in economic terms to about one new full term job so the Project will have a minor impact through creating the equivalent of about 1,060 full time equivalent jobs compared to total unemployment of approximately 77,000 (11.4%) in 2011.

13.5.2 Impact of the Provision of Temporary Workforce Accommodation

ADN PPP A.Ş intends to employ as many construction workers who are based in Adana (and thus have their individual accommodation in the city) as is realistically possible. However, there will be on-site worker accommodations. The camp site will be equipped with the necessary utilities and infrastructure to support their operations including power generation, water supply, sewage treatment and waste management. The specific design of the temporary workforce accommodations has yet to be decided but it will be developed and managed in accordance with the provisions of IFC PS 2/EBRD PR 2: Labor and Working Conditions and the IFC/EBRD guidance on workers accommodation. Relevant information is provided in *Chapter 15: Labor and Working Conditions*.

13.5.3 Impact on Population and Demographics

The introduction of the imported workforce into the city during construction and the creation of a small number of permanent jobs during operation will have no impact on the population of the Yuregir District which is 420,929.

13.5.4 Impact on Social Environment and Infrastructure

Location of camps near the existing communities may present risks to local people. Intrusion in local communities can lead to breakdown in existing community structures and livelihoods. A key objective will be to avoid any impact on the adjacent community or on local services, community facilities and businesses. Unnecessary interactions by the workforce with the local community will be minimized. Movement of non-local workers will be strictly controlled to prevent inappropriate interaction with local people. A strict code of conduct governing activities and behavior will apply to all Project personnel and all personnel will receive training on these requirements. Local goods and services will be used where possible, but onsite utilities, catering and recreational facilities will be provided so that camps do not place unsustainable demands on local resources, facilities or amenities.

Moreover, there are sufficient health facilities in Yuregir district and Adana province and the Project will not increase the demand for associated facilities.

¹ Data developed by the Scottish Government provide employment multipliers for the Construction sector in 2004 of 1.58 for indirect jobs and 1.93 for direct jobs. See <http://www.scotland.gov.uk/Topics/Statistics/Browse/Economy/Input-Output/Downloads>

13.6 Impact Assessment for Operation Phase

13.6.1 Overall Social and Economic Impact Opinion for PPP Healthcare Policy

Tekin and Celik (2010) conducted a political mapping to identify the understanding of PPP Policy in Turkish healthcare infrastructure investment, the position, the interests and influence of the main policy actors. The stakeholders of this study consisted of public, private sector representatives who worked in PPP policy as a financing method in Turkey healthcare infrastructure and other people and groups who are related to the policy. The stakeholders, their position and their power are given in Table 13-28.

Table 13-28: Stakeholders in the study of Tekin and Celik (2010)

Stakeholder Name	Level	Sector	Position	Power
Republican People's Party (CHP)	National	Political	High Opposition	High
Hacettepe University Department of Public Health	National	Academic	High Opposition	Medium
The Turkish Society of Public Health Specialists (Hasuder)	National	NGO	High Opposition	Medium
Nationalist Movement Party (MHP)	National	Political	High Opposition	High
Medical Organization	National	NGO	High Opposition	Medium
Turkish Medical Association	National	NGO	High Opposition	High
Physicians	Local	Public	High Support	Medium
Citizen	Local	Society	High Support	Low
Justice and Development Party (AKP)	National	Political	High Support	High
Deniz Bank	National	Private	High Support	High
World Bank	National	International	High Support	High
UK Embassy	National	International	High Support	High
Association of Public-Private Partnerships	National	NGO	High Support	Medium
The Ministry of Finance	National	Public	High Support	High
Turkish Contractors Association	National	NGO	High Support	High
NKY Architectural Company	National	Private	High Support	High
International PPP Platform Turkey	National	NGO	High Support	High
Recep Akdag (Minister of Health)	National	Public	High Support	High
The Ministry of Health	National	Public	High Support	High
Bureaucrats of Ministry of Health	National	Public	High Support	High
Association of Health Administration and Education	National	NGO	High Support	High
MH Public-Private Partnerships Program Consultant	National	Private	High Support	High
MH Department of Public-Private Partnerships	National	Public	High Support	High
International Financial Institutions	National	International	High Support	High
IMF	National	International	High Support	High
Foreign Consultant Companies	National	Private	High Support	High
Foreign Contractor Companies	National	Private	High Support	High
Local Consultant Companies	National	Private	High Support	High
Local Financial Companies	National	Private	High Support	High
Local Contractor Companies	National	Private	High Support	Medium
The State Planning Agency	National	Public	Low Support	High
Media	National	Private	Low Support	High
Association of Private Hospitals and Health Institutions	National	NGO	Medium Opposition	Medium
Healthcare Providers	Local	Public	Medium Support	Medium
Prime Minister Undersecretary at of Treasury	National	Public	Medium Support	Medium
The Privatization Administration	National	Public	Medium Support	High
Recep Tayyip Erdogan (Prime Minister)	National	Political	Medium Support	High

Stakeholder Name	Level	Sector	Position	Power
Association of Patient and Patient Relatives Rights	National	NGO	Non-Mobilized	Low
Patient and Patient Relatives	National	Society	Non-Mobilized	Low
Association of Health Administrators	National	NGO	Non-Mobilized	Medium
The Administration of Social Security Organization	National	Public	Non-Mobilized	High

Source: Senel Tekin P., Celik, Y., Analyzing Public-Private Partnership Policy as a Financing Method in Turkey Health Sector with Political Mapping”, 7th Biennial Conference in Organizational Behavior in Health Care: Mind the Gap: Policy and Practice in the Reform of Health Care, Birmingham, 11-14 April, 2010

13.6.2 Potential for Closure of Existing Hospitals Due to Project Development

In order to provide necessary health services to patients, planning has been made by MoH for all of the identified health regions in Turkey, as indicated in the MoH- Inpatient Facility Planning Guide-Summary Book dated June 2011. According to this guide, several plans were made for Adana Province as well which are detailed in *Chapter 2: Project Description*. These plans include construction of new hospitals which is consistent with the planning of Adana IHC. According to the plans made, the closure of existing hospitals is not made clear. In order to obtain information on this aspect, consultation was made with the manager of MoH-PPP Department and Adana Provincial Health Director. Based on these consultations, it is not clear at this stage whether a hospital or hospitals will be closed in the region, or what the new arrangements will be for existing hospitals (either downsizing the bed capacities or revision of some of the units). It is expected that specific care service stations will be established in the Adana Province. However, it was indicated by the consultees that these issues can be only identified in the long-term.

13.6.3 Impact on Health Quality in the Adana Province

The Project will have a substantial developmental impact as being the largest PPP project in the Adana province and surrounding provinces to date. In particular, the Project is anticipated to fill a substantial need in the Adana province and surrounding areas for an updated and consolidated public healthcare facility to serve the lower-medium income public existing hospitals in the region which are outdated, some over 110 years old, and are poorly maintained. In addition, the present hospitals have some of the highest levels of overcrowding in Europe, with only 290 beds per 100,000 people. In addition, the poor quality of health infrastructure often forces Turkish citizens to make multiple visits to different facilities in order to obtain patient care that normally could be provided at one facility. The Project will eliminate these problems by providing Adana province with better infrastructure and cost-effective, efficient health service delivery. The Project also fulfills a major priority of Turkish Government in forming a part of a wider PPP program that encourages the development of modern health facilities and the provision of world class healthcare services. The government aims to both provide Turkish citizens with more effective and higher quality healthcare, as well as to turn Adana province into a regional hub for medical treatment.

13.6.4 Direct and Indirect Employment Creation

There will be employment opportunities during the operation of the hospital. The workforce requirement during the operation phase is anticipated to be approximately 4,500 in total, with 2,500 health service personnel to be employed by MoH and 2,000 service employees to be employed by ADN PPP A.Ş. It is estimated that 30,000 to 35,000 people (including visitors, patients visiting polyclinics, emergency cases) will come to the facility daily. As explained in section 13.6.2, it

is not known at this point how many existing hospital units may be closed following the startup of the Adana IHC. There are presently 1,061 physicians and 451 physician assistants, 3,144 nurses, 3,269 health service personnel and 3,269 service personnel within the health service personnel in Adana province. The opening of the Adana IHC will most likely create a healthcare work force need that may not be present in the region if the existing hospitals are not closed and work force is reduced in the existing structure.

As previously discussed, the healthcare system is expected to grow in line with the gradual introduction of universal healthcare insurance scheme, increase in annual income per head, growing health awareness, a steady rise in life expectancy and the size of the elderly population in Turkey as well as Adana province. Overall the healthcare direct employment is expected to be positive even if there are plans to close some of the health facilities in the Adana province and transfer MoH staff from these facilities to the Adana IHC.

In addition to the direct employment benefits of the Project, indirect and induced employment benefits will also arise.

13.6.5 Population

The scale of permanent employment is not expected to result in significant long term changes in residential or working population in the immediate Project area. However, development of supporting economic health infrastructure (pharmacies, private doctor services, hotels, service sector) for the Adana IHC may lead to economic development and increase the population of the neighboring settlements.

13.6.6 Economy

Economic impact analysis for the Adana IHC involves assessing revenues generated or lost (by closure or potential downsizing of existing hospitals) by the economic activity as they flow through the local economy, tracking jobs created or lost, pending changes that supports local business, and tax revenues. Analysis includes both direct and indirect benefits. Direct benefits, in the context of the Adana IHC take the form of: 1) revenues generated in the course of the practice of medicine (i.e., the value of output); 2) the wages and benefits that go to administrators, providers and all other employees; 3) the number of jobs created in the hospital; and 4) the taxes that are paid by hospitals and their owners and employees.

Economic activities and businesses that will be supported by the Adana IHC hospitals outside of the hospital industry represent indirect benefits. These *business-to-business* effects include the supplies and equipment purchased by the hospital, administrative services, cleaning and property maintenance services, and clinical and laboratory services that support hospital operations. Additional indirect benefits (sometimes called induced effects) will arise when hospital employees and employees of vendors spend their earnings to support local businesses, which, in turn, pay their employees and pay taxes, etc. 30,000 to 35,000 daily visitors expected at the Adana IHC will be an important source of expenditures for the supporting service sector.

An economic impact analysis was not commissioned as part of the ESIA process, however it can be prudent to assume that the overall economic benefits are expected to accrue from the operation of the Adana IHC despite the potential closure of some of the existing healthcare facilities. This is

partly due to the fact that the health services will be expanding overall with the Adana IHC despite potential closures. The overall health sector is envisioned to increase with increasing healthcare needs which will result in direct and indirect benefits to the economy of Adana province.

13.6.7 Road Traffic

There will be an increase in vehicle traffic with the development of the Project. Vehicle traffic will increase due to the expected large daily visitor volume. This may have an adverse impact on road safety and congestions near the IHC. These topics are discussed in *Chapter 11: Traffic Impact* and *Chapter 14: Community Health and Safety*.

13.7 Mitigations

Most of the envisioned economics and social impacts of the Project are positive. A range of options for mitigation of the few potential adverse socio-economic effects is potentially available for the Project, including the types of measures outlined below. These will be considered during all phases of the Project.

- Construction worker accommodation compounds will be located to minimize adverse effects on the existing population. A Construction Camp Management Plan will be prepared and implemented.
- Recruitment procedures will be in line with ADN PPP A.Ş Human Resources Policy that is to be developed for the Project. This will include the aim to provide opportunities for employment of local workforce to the extent possible considering unskilled, semi-skilled and skilled workforce.
- The Project will seek to maximize the benefits from the Project to local communities in terms of direct and indirect employment, and purchasing of local goods and services during construction. This will include measures such as adopting local employment and purchasing policies, establishing tenders for procurement of subcontracted goods and services at a scale that local businesses can respond to, ensuring opportunities are advertised locally, and providing career training for local people to allow them to obtain jobs with the Project as much as possible.
- The Project will also seek to deliver long term local community benefits through promoting local employment and purchasing local goods and services during the operation of the Project to the extent possible.
- Transportation impacts will be minimized as far as possible with the establishment of a IHC Traffic Management Plan which will be prepared based on the results of the traffic assessment study that is currently being undertaken.

13.8 Residual Impacts

There will be a positive residual impact during construction and operation phases of the Project as a result of local employment opportunities. The local economy will also be positively affected overall by the operation of the Adana IHC. With the implementation of mitigation measures mentioned above and in other relevant chapters of the ESIA report -with the exception of road traffic impact which is still being investigated-, no negative residual impact on socioeconomic conditions is estimated.

14.0 COMMUNITY HEALTH AND SAFETY

14.1 Scope

This chapter provides an assessment of the Project activities that may impact nearby communities during the construction and operation phases and the patients during the operation phase, and sets out the mitigation measures to avoid or minimize the risks together with the residual impacts that are foreseen to remain. The Project area is located within an area where dense residential areas do not exist. The immediate land use around the Project area is described in *Chapter 5: Land Use and Zoning*.

In accordance with the requirements of IFC PS4: Community Health, Safety and Security and the EBRD PR4: Community Health, Safety and Security, the following issues relevant to the Project were covered in this chapter:

- dust, noise and vibration,
- community health and exposure to disease,
- road traffic,
- life and fire safety,
- infrastructure and machine/equipment safety,
- security requirements.

The main information sources that assisted the assessment study were as follows:

- IFC PS 4: Community Health, Safety and Security
- EBRD PR4: Community Health, Safety and Security
- IFC EHS Guidelines for Health Care Facilities
- EBRD Sub-sectoral Environmental and Social Guidelines: Health Services and Clinical Waste Disposal
- Project information provided by ADN PPP A.Ş.

The risks and impacts of the Project, in the context of health and safety of off-site communities, will be managed through a Community Health and Safety Management Plan to be developed and implemented by ADN PPP A.Ş. This plan will include measures to address the identified risks and ensure the disclosure of relevant Project-related information to enable the affected communities to understand the risks and impacts.

Additional management plans related to protection of community health and safety will be required including plans to prevent and respond to incidents and emergencies, as well as plans to protect the health, welfare and security of the community from any adverse effects related to generation of noise and dust, road traffic and security operations, as explained further below.

14.2 Impacts and Risks

14.2.1 Dust and Noise

Impacts related to generation of air and noise emissions during construction and operation of the Project are addressed in appropriate chapters of this ESIA report (*Chapter 9: Air Quality* and *Chapter 10: Noise*) and summarized here.

There will be dust and noise generation during construction activities (including earthworks, operation of equipment, vehicle movements, construction of buildings). Dust emission levels are estimated to remain below regulatory limit values (except for the slight exceedance of WHO limit value during earthworks) as evidenced by the air emissions modeling study. The noise modeling study indicated at three of the locations (at the nearest residential buildings and at school located north of the Project area) where baseline noise measurements were conducted, that cumulative noise levels are either very close to existing background noise levels or the increase in existing background noise levels are not exceeded by more than 3 dBA which is the allowed limit defined in IFC General EHS Guidelines. However, at one of the locations (within Adana Riding Center), IFC limit values and maximum allowable increase (3 dBA) of the existing background noise level are exceeded during parts of the daily working hours. Necessary mitigation measures (i.e. installing noise barriers) will be taken based on the noise monitoring to be conducted. In addition, impacts associated with air and noise emissions will be temporary during the construction phase and can be mitigated through good construction site practices and mitigation measures as mentioned in the relevant chapters.

There will be impacts on the air quality from the health campus during the operation phase which will be mainly related with the emissions from the trigeneration and boiler systems and fugitive emissions (released from sources such as medical waste storage areas, medical technology areas and isolation wards) that may be potentially contaminated with biological agents, pathogens, or toxic materials. It is expected that necessary exhaust/treatment systems will be included in the design of the health campus to eliminate the fugitive emissions and no significant impacts will occur. Related to the trigeneration and boiler systems, results of the air emission modeling study showed that the emission levels will be significantly lower than the regulatory limits. Similarly, the modeling of noise associated with the operation of the trigeneration system showed that the noise levels will be well below the regulatory limits. There will be also impacts related to increase in air and noise emissions from road traffic during the operation of the health campus which is expected to be minimized through implementation of an IHC Traffic Management Plan.

14.2.2 Community Health and Exposure to Disease

Community health issues with respect to the construction of the hospitals are common to those of most industrial facilities, which may include communicable diseases associated with the influx of temporary (construction) and permanent labor. The maximum workforce that is anticipated during the construction phase is 1,800 people. ADN PPP A.Ş. intends to recruit this workforce locally to the extent possible and provide appropriate on-site pre-fabricated facilities to those employees who need accommodation. A Construction Camp Management Plan will be developed and implemented by ADN PPP A.Ş. Therefore, risks associated with influx of workforce, such as introduction of diseases or anti-social behavior affecting local communities are not anticipated.

Related to the operation phase, healthcare wastes may pose the following sources of risk to the community health and safety:

- infectious diseases risk from biological wastes. Diseases that may be transmitted include various forms of hepatitis, e coli infection, tuberculosis and MRSA (bacteria that can lead to serious infections)
- injury and infection risk from wastes containing nuclear material and improperly disposed of sharp instruments
- improper waste recycling risk leading to cross infection due to scavenging of contaminated waste material and illegal use of hypodermic needles as well exposure to the public in accessible locations
- odor and unpleasant appearance risk

The above potential risks will be minimized with the implementation of the Waste Management Plan, Health Care Waste Management System and other mitigation measures as described in *Chapter 8: Material Resources and Waste Management*, and following all the applicable regulatory requirements related to waste management during the construction and operation phases.

14.2.3 Road Traffic

The transport of excavated soil and construction materials during the construction of the Project will result in an increase in road traffic which may pose risks to the community related to accidents, road safety and congestions that may occur near the Project area. However, these risks will be temporary for the duration of the construction phase and can be mitigated through measures identified in relevant chapters of this ESIA report.

The traffic increase during the operation of the IHC will be more important due to the expected large daily visitor volume (estimated as 30,000 to 35,000 people including visitors, patients visiting polyclinics, emergency cases). This will result in an increasing congestion in the existing traffic conditions near the IHC site and also will increase the risk of accidents and road safety. The description of the traffic conditions and potential impacts are described in *Chapter 11: Traffic Impact*. ADN PPP A.Ş. will develop and implement a Traffic Management Plan within the IHC that will take into account vehicular traffic, emergency conditions, pedestrian traffic entering, exiting and internal traffic. Implementation of the IHC Traffic Management Plan will help to minimize the risks to the community.

14.2.4 Life and Fire Safety

Fire safety risks may occur during the construction phase of the Project which may affect particularly the construction workers and the nearby residents depending on the area that the fire is spread. Fire safety risks will be managed through implementation of several mitigation measures explained in relevant chapters of this ESIA Report and specifically preparation and implementation of an Emergency Preparedness and Response Plan during the construction phase. As a result, significant impacts are not expected related to fire.

Related to the operation phase, health facility operations are exposed to life and fire safety risks, as they are accessible to the public. These risks may arise due to the storage, handling and presence of chemicals, pressurized gases and other flammable substances. As explained in *Chapter 2: Project*

Description, The IHC is being designed in accordance with the Regulation on the Protection of Buildings from Fire (Official Gazette Date/No: 19.12.2007/26735). The Technical Specification Requirements provided by the MoH during the bidding process also include requirements related to fire protection to be integrated into the design to include the following:

- Compartmentalization: The standards for fire compartmentation between floors and between compartments will be 1 hour (60 minutes) fire resistance. Sub-compartments and identified fire hazard rooms will be half an hour (30 minutes).
- The fire separation shall be reviewed with local officials during the design process to verify compliance with local codes and regulations. The final compartmentation shall represent the regional firefighting principals.
- Sealants: Intumescent sealants to be used to plug smaller gaps around services penetrations in compartment walls and floors.
- Smoke Barriers: Proprietary mineral wool products as Rockwool to be used to maintain fire separation between compartment floors and walls, and to protect around services penetrations.

In addition to the above, Fire Suppression Systems shall be provided throughout the hospitals as required by Turkish and local codes, and the Fire Alarm System shall be designed and installed in accordance with the requirements of NFPA72 and local codes, as per the Technical Specifications.

Considering that the compliance with national legislation for fire safety and also international standards are already integrated into the design of the IHC and other mitigation measures will be implemented as explained in Section 14.3, impacts from fire are expected to be negligible to the surrounding communities, and in the range of negligible to minor significance to the patients, healthcare personnel and visitors.

14.2.5 Infrastructure Safety

The risk of structural failure will increase in the event of natural hazards such as earthquakes and floods. Earthquake and flooding risks are discussed in *Chapter 6: Geology, Soils and Contaminated Land* and *Chapter 7: Hydrology and Hydrogeology*, respectively.

The Project area lies within a 2nd degree seismic zone. In the event of earthquakes during construction and operation, significant impacts on the community and patients'/workers' health and safety may arise following accidents, spills, fire, etc. related to the seismic incident. Necessary criteria (e.g. appropriate standards, regulations, etc.) will be taken into account in the design of the facilities to address the seismic risks. This will be conducted considering the defined parameters that need to be used in the design of structures located in 2nd degree earthquake zone where the Project site is located. During all construction works, the Regulation on Buildings to be constructed in Seismic Zones (Official Gazette date/no: 06.03.2007/26454) will be complied with. This will minimize the occurrence of incidents and ensure that the risk of structural failures is as low as reasonably practicable in the event of natural hazards.

Risks related to the flooding from the nearby surface water bodies is deemed to be low. Flooding inside the IHC facility may be a concern as a result of inappropriate storm water drainage conditions. Based on official response obtained from DSI, the integrity of the Seyhan Dam is being

monitored since it became operational and adverse conditions were not detected to date. Dam failure risk is deemed to be low based on the DSI declaration.

14.2.6 Security Requirements

Security arrangements to be performed during the construction phase have not been established yet. ADN PPP A.Ş. will perform security arrangements in accordance Turkish regulatory requirements.

Regarding the security during the operation of the IHC, security arrangements for the IHC are described in the Technical Specifications provided by the MoH during the bidding process which require installation of an electronic security system in the IHC that will consist of Closed Circuit Television System (CCTV), Access Control System, Intrusion Detection System and Radio Frequency Identification System (RFID).

Related to the security measures at the FRH, there will be different measures that include walls, fences, remote control steel doors, iron railings, closed circuit camera systems (CCTV), security buildings and security staff. Typical schematic representation of these security measures at different security levels in the FRH are presented in Annex E-3. In addition, the security of the FRH will be managed by the Gendarme, however this issue will be discussed in more detail during the project development, as reported by ADN PPP A.Ş. The security for the prison ward inside the MH will also be under the responsibility of the Gendarme.

14.3 Mitigation Measures

The potential risks and impacts to the community shall be managed appropriately during the lifetime of the Project through the following measures:

- All relevant health and safety regulations will be followed during the development and operation of the Project in order to minimize accidents that may have impacts on the community and to control potential Project related releases and/or emissions.
- A grievance management system will be in place that will enable the community to raise concerns during the lifetime of the Project.
- All employees will be trained on health and safety, and Emergency Preparedness and Response Plan to respond timely to the incidents.
- Necessary measures (covering materials, water suppression, etc.) will be taken to avoid and/or minimize dust emissions during the construction phase.
- An Air Quality Control Monitoring Plan will be prepared and implemented during the construction and operation phases of the Project.
- Construction activities will be planned in a way considering the nearby communities and noise generating activities are not planned to be undertaken during evening and night time.
- A Noise Control and Monitoring Plan will be prepared and implemented during the construction and operation phases of the Project.
- Drivers of trucks and vehicles will adhere to defined speed limits and will be warned against creating unnecessary noise by using horns during the construction phase.

- All vehicles and work machinery will be subject to periodic maintenance with the aim of reducing noise, dust and gas emissions from vehicles.
- Transportation impacts will be minimized as far as possible with the establishment of a Construction Traffic Management Plan.
- An IHC Traffic Management Plan will be prepared to manage the internal traffic in the IHC.
- A Security Plan will be developed to be implemented during the construction and operation phases of the Project. Security will be provided in a manner that does not jeopardize the community's safety or ADN PPP A.Ş.'s relationship with the community and that is consistent with national requirements.
- International best practice will be applied to hiring, training and mobilizing security staff. ADN PPP A.Ş. will ensure that security personnel have not been involved in past abuses and are adequately trained. Force will only be sanctioned in preventive or defensive circumstances in proportion to the threat and security will operate within the law. The grievance mechanism will allow communities to express concerns in accordance with requirements of IFC and EBRD standards.
- The structural elements and components of the Project will be designed and built according to national regulations and international best practice. All structures will be built taking into account the regulatory requirements to be implemented at 2nd degree earthquake zones. Regarding design of the buildings within the Project area, the Regulation on Buildings to be Constructed in Seismic Zones (Official Gazette date/no: 06.03.2007/26454) will be complied with.
- A Life and Fire Safety Master Plan will be prepared identifying major fire risks, applicable codes, standards and regulations, and mitigation measures. This plan will need to be approved by a third party acceptable to IFC and EBRD, prior to the construction of the facilities to ensure compliance with local and international standards
- All hazardous materials will be stored in designated areas having secondary containment and handled with care by authorized staff in order to prevent potential spills in accordance with the Hazardous Material Management Plan to be prepared. All relevant mitigation measures described in other chapters of the ESIA Report will be implemented.

15.0 LABOR AND WORKING CONDITIONS

15.1 Scope

This chapter will describe how labor and working conditions will be managed for the Project and the requirements of IFC PS2: Labor and Working Conditions and EBRD PR2: Labor and Working Conditions will be discussed. This chapter will address the following issues:

- Legal and Policy Context
- General Condition of Service
- Non-Discrimination
- Grievance Mechanism
- Child Labor and Forced Labor
- Health and Safety
- Supply Chains

The assessment is based on the review of the following standards and documents:

- IFC PS2: Labor and Working Conditions
- EBRD PR2: Labor and Working Conditions
- International Labor Organization (ILO) Fundamental Conventions
- Turkish Labor, Health and Safety Legislation
- IFC General EHS Guidelines
- IFC EHS Guidelines for Health Care Facilities
- EBRD Sub-sectoral Environmental and Social Guidelines: Health Services and Clinical Waste Disposal

It is important to note that there will be a joint management system between MoH and ADN PPP A.Ş. during the operation of the IHC. MoH will be responsible for providing doctors and the support health personnel, and the general management of the hospital will be undertaken by the administrative staff provided by the MoH. Staff other than the doctors and support health personnel will be provided by ADN PPP A.Ş. ADN PPP A.Ş. will be responsible for the management of services classified as obligatory services and optional services as described in Section 2.7.1 of *Chapter 2: Project Description*.

ADN PPP A.Ş. will be responsible for the labor and working conditions depicted in this chapter for their own construction workers during the construction phase and personnel providing support services during the operation phase.

15.2 Legal and Policy Context

15.2.1 IFC PS2 and EBRD PR2 Labor and Working Conditions

IFC PS2 and EBRD PR2 set out policies and standards of international good practice related to labor and working conditions. The objectives of the PS2 and PR2 are:

- to establish, maintain and improve the worker-management relationship,
- to promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labor and employment laws,

- to protect the workforce by addressing child labor and forced labor,
- to promote safe and healthy working conditions, and to protect and promote the health of workers.

The requirements of IFC PS2/EBRD PR2 are summarized in Table 15-1.

Table 15-1: Requirements under IFC PS2/EBRD PR2

PS2/PR2 Provisions	Summary of the Requirements
Working Conditions and Management of Working Relationship	
Human Resources (HR) Policy	Client to adopt a HR policy that is consistent with PS2/PR2. Under the policy, the client will inform employees of their rights. It will be clear and will be made available at start of employment.
Working Relationship	Working conditions and terms of employment will be clearly documented and communicated to employees and contracted workers.
Working Conditions and Terms of Employment	If the client is a party to a collective bargaining agreement, the terms of the agreement will be respected. Where not, working conditions and terms of employment will at least comply with national law. In addition, the client will comply with the ILO conventions on the abolition of child labor, elimination of forced labor, elimination of discrimination and freedom of association and collective bargaining.
Worker's Organizations	Where national law recognizes worker's rights to associate and bargain collectively, the client will comply with the national law and engage with worker's organizations and provide them with information needed for meaningful negotiation in a timely manner. Where the law is restrictive, the client will enable alternative means of expression, including a mechanism for grievances.
Non-Discrimination and Equal Opportunity	The employment relationship will be based on the principle of equal opportunity and fair treatment, and will not discriminate with respect to hiring, compensation, working conditions and terms of employment, access to training, promotion, termination of employment or retirement and discipline. The client will also comply with EU requirements on non-discrimination related to employment.
Retrenchment	The client will develop a plan to mitigate the adverse impacts of retrenchment in line with national law and good industry practice and based on the principles of non-discrimination and consultation.
Grievance Mechanism	The client will provide a grievance mechanism for workers, inform the workers about the mechanism at the time of hire and make it easily accessible to them. The mechanism should be transparent and well understood, and should address concerns promptly at an appropriate level of management. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.
Protecting the Workforce	
Child Labor	The client will not employ children in a manner that is exploitative, is likely to be hazardous, or to interfere with child's education, or to be harmful to child's health or development. The client will follow national laws as applicable, but children below the age of 18 will not be employed in dangerous work.
Forced Labor	The client will not employ forced labor, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.
Occupational Health and Safety (OHS)	
Health and Safety	The client will provide the workers with a safe and healthy work environment, taking into account inherent risks and hazards. Steps will be taken to prevent accidents, injury and disease arising from, associated with or occurring in the course of work by minimizing the causes of hazards as far as practicable. In line

PS2/PR2 Provisions	Summary of the Requirements
	with good international industry practice, the client will address identification of hazards; provision of preventative and protective measures; training of workers; documentation and reporting of accidents, diseases and incidents; and emergency prevention, preparedness and response arrangements. The client will also comply with the relevant EU OHS requirements and when such requirements do not exist, relevant IFC OHS guidelines. Moreover, the client will maintain an OHS management system in line with good international practice.
Non-Employee Workers and Supply Chain	
Non-Employee Workers	The client will use commercially reasonable efforts to apply the requirements of PS2/PR2 to non-employee workers directly contracted, except for provisions under HR Policy, Retrenchment and Supply Chain.
Supply Chain	The client will address child labor and forced labor in its supply chain consistent with the provision under Child Labor and Forced Labor.

15.2.2 ILO Fundamental Conventions

IFC PS2 and EBRD PR2 are in part guided by a number of ILO Conventions, and PS2 as well as PR2 require complying with four core labor standards of ILO including child labor, forced labor, non-discrimination and freedom of association and collective bargaining. Furthermore, ILO has identified eight conventions as "fundamental (or core)", covering subjects that are considered as fundamental principles and rights at work. These fundamental conventions are presented in Table 15-2, all of which are ratified by Turkey. ADN PPP A.Ş. will comply with the requirements of these conventions during the construction and operation phases of the Project.

Table 15-2: ILO Fundamental Conventions

Convention Name	Key Provisions
C29: Forced Labor (Ratification by Turkey: 1998)	- Forced or compulsory labor not permitted - Existing practices to be suppressed in the shortest possible time - Regulated by governments that are signatories to the convention
C 87: Freedom of Association and Protection of the Right to Organize (Ratification by Turkey: 1993)	- Workers and employers have the right to establish and join organizations of their choice, subject to the rules of the organization concerned - Regulated by governments that are signatories to the convention
C98: Right to Organize and Collective Bargaining (Ratification by Turkey: 1952)	- Workers to be protected against anti-union discrimination in the workplace - Worker's and employer's organizations to be protected from acts of interference - Regulated by governments that are signatories to the convention
C 100: Equal Remuneration (Ratification by Turkey: 1967)	- Men and women to receive equal remuneration for work of equal value, consistent with the provisions of the applicable remuneration methods - Regulated by governments that are signatories to the convention
C 105: Abolition of Forced Labor (Ratification by Turkey: 1961)	- Forced labor not to be used for political ends, for economic gain, as a form of discipline or punishment, or in the context of discrimination - Regulated by governments that are signatories to the convention
C111: Discrimination (Ratification by Turkey: 1967)	- Equal opportunity in respect of employment and opportunity to be pursued in a manner appropriate to national practice - Discrimination based on race, color, sex, religion, political opinion, nationality not permitted - Exclusion or preference in respect of the requirements of a specific job is not discrimination - Regulated by governments that are signatories to the convention
C138: Minimum Age (Ratification by Turkey: 1998)	- Child labor to be progressively abolished where it is still practiced - Signatories to determine a locally appropriate minimum age, not less than 15 years or 14 in specific circumstances - Regulated by governments that are signatories to the convention

Convention Name	Key Provisions
C182: Worst Forms of Child Labor (Ratification by Turkey: 2001)	• Elimination of child exploitation through slavery, prostitution, pornography, illicit services or work which is harmful to health, morals or safety • Regulated by governments that are signatories to the convention

15.2.3 Turkish Health and Safety Regulations

IFC PS2 and EBRD PR2 require complying with the national laws and regulations that are applicable to projects with regard to labor and working conditions and health and safety. An EHSS legislation review has been undertaken as part of the ESIA study (see Annex B) including review of the Turkish Labor Law and Occupational Health and Safety Legislation as listed below:

- Labor Law (Official Gazette-OG- Date/Number: 10.6.2003/25134)
- Occupational Health and Safety Law (OG Date/Number: 30.06.2012/28339)
- Regulation on the Minimum Wage (OG Date/Number: 01.08. 2004/25540)
- First Aid Regulation (OG Date/Number: 22.05.2002/24762)
- Regulation on Working Duration Related to Labor Law (OG Date/Number: 06.04.2004/25425)
- Regulation on Excess Work and Work in Excess Periods (OG Date/Number: 06.04.2004/25425)
- Regulation on Special Principles in Works Carried out by Employing Workers in Shifts (OG Date/Number: 07.04.2004/ 25426)
- Occupational Health and Safety Risk Assessment Regulation (OG Date/Number: 29.12.2012/28512)
- Regulation on the Provisions of Occupational Health and Safety Training of Employees (OG Date/Number: 15.05.2013/28648)
- Occupational Health and Safety Services Regulation (OG Date/Number: 29.12.2012/28512)
- Communiqué on Danger Class Lists Related to Occupational Health and Safety (OG Date/Number: 26.12.2012/28509)
- Regulation on Duties, Authority, Responsibilities and Trainings of Occupational Health and Safety Specialists (OG Date/Number: 29.12.2012/28512)
- Regulation on the Occupational Health and Safety Boards (OG Date/Number: 18.01.2013/28532)
- Regulation on the Health and Safety Measures to be taken in Workplace Buildings and Additions (OG Date/Number: 17.07.2013/28710)
- Regulation on Health and Safety at Construction Works (OG Date/Number: 05.10.2013/28786)
- Regulation on the Tasks, Authority, Responsibility and Education of On-Site Doctor and Other Health Personnel (OG Date/Number: 20.07.2013/28713)
- Regulation on Health and Safety Requirements in the Use of Work Equipment (OG Date/Number: 25.04.2013/28628)
- Regulation on Manual Handling (OG Date/Number: 24.07.2013/28717)
- Regulation on Fire Protection of Buildings (OG Date/Number: 19.12.2007/26735)
- Regulation on the Emergency Cases in Workplaces (OG Date/Number: 18.06.2013/28681)
- Regulation on the Use of Personal Protective Equipment in Workplaces (OG Date/Number: 02.07.2013/28695)

- Regulation on Safety and Health Signs (OG Date/Number: 11.09.2013/28762)
- Regulation on the Protection of the Workers against Risks Relevant to Noise (OG Date/Number: 28.07.2013/28721)
- Regulation on the Protection of the Workers against Vibration Risks (OG Date/Number: 22.08.2013/28743)
- Regulation on Occupational Health and Safety in Temporary or Fixed Term Employment (OG Date/Number: 23.08.2013/28744)
- Regulation on Suspension of Work in Workplaces (OG Date/Number: 30.03.2013/28603)
- Regulation on Health and Safety Measures in Works with Carcinogenic and Mutagenic Substances (OG Date/Number: 06.08.2013/28730)
- Regulation on Health and Safety Measures in Works with Chemical Substances (OG Date/Number: 12.08.2013/28733)
- Regulation on Protection of Workers from Dangers of Explosive Environments (OG Date/Number: 30.04.2013/28633)
- Regulation on the Prevention of Exposure Risks from Biological Agents (OG Date/Number: 15.06.2013/28678)
- Regulation on the Works in Which Workers shall Work Maximum Seven and Half Hours or Less in a Day in Terms of Health Rules (OG Date/Number: 16.07.2013/28709)
- Regulation on Radiation Safety (OG Date/Number: 24.03.2000/23999)
- Regulation on the Working Principles and Radiation Dosage Limits of the Personnel Working with Ionizing Radiation Resources in Health Services (OG Date/Number: 05.07.2012/28344)
- Regulation on Safe Transportation of Radioactive Substances (OG Date/Number: 08.07.2005/25869)

15.2.4 ADN PPP A.Ş. HR Policy

ADN PPP A.Ş. will develop an HR Policy as part of the Environmental and Social Management System (ESMS) which will be an Integrated Management System that will cover environmental, health and safety and social issues for the construction and operation phases.

ADN PPP A.Ş. will fulfill the requirements of IFC PS2 and EBRD PR2 by adopting and implementing an HR policy appropriate to its size and workforce during the construction and operation phases of the Project.

15.3 General Conditions

15.3.1 Employment Contract

IFC PS2 and EBRD PR 2 require documenting and communicating to all employees their working conditions and terms of employment, including their entitlement to wages and any benefits. According to Turkish Labor Law, the employer is required to have a written contract with the employees for employment with duration of one year or more. In cases when a written contract is not made, the employer is under obligation to provide the employee with a written document, within two months at the latest, showing the general and special conditions of work, the daily or weekly working time, the basic wage and any wage supplements, the time intervals for remuneration, the duration (if it is a fixed term contract) and conditions concerning the termination of the contract.

ADN PPP A.Ş. will have a written contract with all employees complying with the requirements of the Turkish Labor Law and therefore will fulfill the requirements of PS2 and PR2 with regard to employment contracts.

15.3.2 Working Hours

Regarding working hours and conditions, ADN PPP A.Ş. will comply with the Turkish laws and regulations. According to Regulation on Working Duration Related to Labor Law, the maximum working duration is 45 hours a week, and the daily working duration cannot exceed 11 hours in any case. According to Regulation on Excess Work and Work in Excess Periods, excess work is defined as “those works that exceed 45 hours a week”, and work in excess periods is defined as “those works that are lower than 45 hours a week according to a contract and when the work exceeds this working period set in the contract and becomes 45 hours a week”. Pursuant to article 4 of the subject regulation, the wage for each hour of the excess work is paid by increasing the hourly wage of normal working condition by 50%, and the wage for each hour of the work in excess periods is paid by increasing the hourly wage of normal working condition by 25%.

ADN PPP A.Ş. will ensure to communicate to all employees and workers the working durations including the conditions and wages related to excess works, as appropriate.

15.3.3 Non-Discrimination

ADN PPP A.Ş. will strictly prohibit discrimination against any employee or applicant for employment because of the individual’s race, color, religion, gender, sexual orientation, gender identity or expression, national origin, age, disability, veteran’s status or any other characteristic protected by law.

Turkish Labor Law forbids discrimination due to race, language, gender, political views and opinion and religion. In accordance with the equal treatment principle covered in article 5 of the Turkish Labor Law, employers should treat part time workers with the same rights as full time workers and indefinite period workers to definite period workers unless there are genuine reasons for not doing so. As ADN PPP A.Ş. will comply with the Turkish Labor Law and will base the employment relationships on the principle of equal opportunity and fair treatment, the Turkish standards will fulfill the requirements of PS2 and PR2 with regard to avoiding non-discrimination.

15.3.4 Grievance Mechanism

IFC PS2 and EBRD PR2 require providing a grievance mechanism for workers and their organizations, where they exist to raise reasonable workplace concerns. ADN PPP A.Ş. will develop an ESMS for the construction and operation phases where grievances of employees related to environment, health and safety issues are handled and the workers are informed about the grievance mechanism at the time of employment. The grievances can be raised anonymously and reviewed in one week intervals followed by initiation of corrective action within two days for grievances with high importance.

15.3.5 Child Labor and Forced Labor

Turkish Labor Law sets provisions related to child labor and forced labor. According to the Turkish Labor Law, it is forbidden to employ children under the age of fifteen. Children and young employees under the age of eighteen must not be employed on industrial work during the night. Young employees who have not reached the age of sixteen years, children and workers who have not received relevant occupational training for the work they are responsible for must not be employed on heavy and dangerous work. Forced labor is prohibited by the Turkish Labor Law. ADN PPP A.Ş. will comply with the provisions of Turkish Labor Law with regard to child labor and forced labor.

15.3.6 Non-Employee Workers and Supply Chains

In accordance with IFC PS2 and EBRD PR2, ADN PPP A.Ş. will use commercially reasonable efforts to apply the requirements of PS2 and PR2 to non-employee workers directly contracted by ADN PPP A.Ş., except for provisions of PS2 and PR2 under HR policy, retrenchment and supply chain. Contracts including the health, safety and environmental requirements will be signed with all sub-contractors. ADN PPP A.Ş. will also address child labor and forced labor in its supply chain consistent with the provisions of PS2/PR2 under child labor and forced labor, and as defined in section 15.3.5. The third party employers will be managed and monitored by procurement procedure that includes assessment of the third party performance.

15.4 Specific Conditions for Service

15.4.1 Accommodation during Construction

ADN PPP A.Ş. will manage workers' accommodation and provide basic services to workers in line with the provisions of IFC PS2 and EBRD PR2 and also follow the guidance note on worker's accommodation published by IFC and EBRD (Worker's Accommodation: Processes and Standards). During the construction phase, ADN PPP A.Ş. will provide appropriate facilities to those employees who will need onsite accommodation. Workers' accommodation arrangements will not restrict workers' freedom of movement or of association.

Accommodations will meet national legislation and international good practice. According to the Guidance Note by IFC and the EBRD, giving special attention to the following issues¹ with regard to housing is expected:

- Minimum space allocated per person (floor area; cubic volume; or size and number of rooms),
- Supply of safe water in the workers' dwelling in such quantities as to provide for all personal and household uses,
- Adequate sewage and garbage disposal systems,
- Appropriate protection against heat, cold, damp, noise, fire and disease-carrying animals, and in particular, insects,

¹ILO Workers' Housing Recommendation 115

- Adequate sanitary and washing facilities, ventilation, cooking and storage facilities and natural and artificial lighting,
- A minimum degree of privacy both between individual persons within the household and for the members of the household against undue disturbance by external factors,
- Necessary provisions for any health, fire safety or other hazards or disturbances and local facilities as well as the provision of first aid and medical facilities,
- Workers freedom of movement to and from the employer-provided accommodation shall not be unduly restricted.

15.4.2 Health and Safety

Occupational health and safety considerations during the construction of the IHC are common to those of most civil construction facilities. The health and safety hazards during the IHC operation may affect healthcare providers, cleaning and maintenance personnel and workers involved in waste management handling, treatment and disposal. Healthcare facility specific hazards have been highlighted to include: exposure to infections and diseases, exposure to hazardous materials/waste, exposure to radiation and fire safety. The potential impacts are discussed in Section 15.5.

IFC PS2 and EBRD PR2 requires providing the workers with a safe and healthy work environment, taking into account inherent risks and hazards specific to the work. ADN PPP A.Ş will develop an ESMS covering OHSAS 18001:2007 requirements for the management of health and safety issues. The management system will ensure that all applicable health and safety legislation is met during the construction phase and operation phase. The mitigation measures discussed in Section 15.6 will be part of the ESMS procedures and related instructions for the construction and operation phases.

15.5 Impacts

Construction Phase

The construction activities will pose certain health and safety risks for the employees involved. These risks will include physical hazards (i.e. use of machinery and vehicles, working with moving machinery and vehicles, working at heights), chemical hazards (i.e. direct contact with fuels or chemicals, contaminated soil), dust emissions with excavation and noise emissions (vehicular traffic and machinery operation).

The impacts associated with these activities are expected to be of minor significance considering that health and safety management system will be implemented during the construction phase which will ensure identification of intrinsic risks associated with the activities, regular training of the workers, provision of appropriate personal protective equipment and presence of emergency response plans.

The implementation of ESMS during construction phase of the Project will minimize the impacts to the extent possible and ensure safe working conditions for the workers.

Operation Phase

The operation activities will pose specific health and safety risks for the employees involved in the IHC. These potential risks are summarized as follows:

- Biological risks from exposure to general infections, blood-borne pathogens and other potential infectious materials during care and treatment, as well as during collection, handling, treatment and disposal of healthcare wastes,
- Chemical risks from exposure to drugs used in the treatment of cancer, hazardous materials and waste including specific toxic chemical and gases used in sterilization of medical equipment, formaldehyde, mercury (exposure from broken thermometers), solvents, and photographic chemicals,
- Physical risks such as ionizing radiation from equipment emitting X-rays and gamma rays (e.g. CT scanners), radiotherapy machines and equipment for nuclear medicine activities,
- Ergonomic risks, for example, patient handling
- Psychosocial risks including violence and shift work.

Healthcare facilities may be under fire risks due to the storage, handling, and presence of chemicals, pressurized gases, boards, plastics and other flammable substances.

Spread of infectious diseases represents a major risk during IHC operational phase. Infectious diseases can be due to improper waste management practices (especially medical waste) and through air conditioning systems and poor sterilization, primarily during operations and medical treatment.

15.6 Mitigation Measures

The following mitigation measures will be applied to manage labor and working conditions during construction and operation phases of the Project including the health and safety of the employees:

- An ESMS that considers OHSAS 18001:2007 requirements will be developed for both construction phase and operation phase.
- An HR policy for ADN PPP A.Ş. will be developed.
- Workers will have contracts in place prior to commencement setting out working conditions, terms of employment and EHS responsibilities.
- All applicable national health and safety legislation and international regulations will be followed.
- All the health and safety risks of each activity during construction and operation will be identified followed by identification of the appropriate mitigation measures/personal protective equipment. These issues will be detailed in an Occupational Health and Safety Management Plan that will be separately prepared for both phases of the Project.
- A grievance mechanism will be developed for employees and included in the ESMS. Employees will be informed about this mechanism at the time of hiring. Grievance mechanism will be extended to non-employee workers in future.

- Subcontractors will also be required to follow the requirements of IFC PS2 and EBRD PR2. Contracts to be signed with subcontractors will include EHS requirements. A Subcontractor Management and Monitoring Plan will be prepared and implemented.
- All workers (including subcontractors) will be trained on health and safety, and emergency preparedness and response plan to respond timely to the incidents.
- All workers will be insured under Social Security Institution.
- All accidents and incidents will be recorded. The efficiency of health and safety practices will be monitored through internal and external audits and corrective actions will be taken if required.

Of specific to construction phase, the following mitigation measures will also apply:

- Workers' accommodation will be managed in line with the provisions of IFC PS2 and EBRD PR2 provisions and the guidance note on worker's accommodation published by IFC and EBRD (Worker's Accommodation: Processes and Standards), and a relevant procedure will be set out in the ESMS. A Construction Camp Management Plan will be developed by ADN PPP A.Ş.
- Dust emissions will be minimized to the extent possible with the implementation of mitigation measures mentioned in *Chapter 9: Air Quality*.
- Workers (including subcontractors) will be provided safety briefings every day before the work starts and provided with necessary personal protective equipment.
- Work permits will be required for high risk activities such as working at heights, operation of heavy equipment and similar.

Of specific to operation phase, the risk and mitigation measures will ensure that the following items are considered at a minimum:

- Development of a comprehensive plan to control radiation exposure
- Formulation of an Exposure Control Plan for blood-borne pathogens. In addition, staff members will be informed on infection control policies.
- Minimization of risks from hazardous material and hazardous wastes by appropriately following the Hazardous Material Management Plan, Waste Management Plan and Health Care Waste Management System (HWMS). These plans will be developed, implemented and monitored.
- Immunization for staff members, provision of necessary personal protection equipment for personnel involved in waste management, provision of necessary hand washing facilities.
- A Radioactive Substance Management Plan will be developed and implemented.

In addition, fire safety measures will be taken by performing the following steps at a minimum:

- The IHC will be designed, constructed, and operated in full compliance with the Regulation on the Protection of Buildings from Fire (OG Date/Number: 19.12.2007/26735).
- When local standards are not sufficiently detailed and are incomplete, internationally accepted life and fire standards (NFPA standards, IBC Codes and EN standards) will be

applied. For this reason, mapping of Turkish requirements for life and fire safety will be conducted by ADN PPP A.Ş. in order to identify the insufficient areas and incorporate them into the design based on the international standards. ADN PPP A.Ş. will demonstrate that the buildings as well as life and fire safety systems and equipment will have been designed and installed appropriately at the facilities.

- A Life and Fire Safety Master Plan will be prepared identifying major fire risks, applicable codes, standards and regulations, and mitigation measures. This plan will need to be approved prior to the construction of the facilities to ensure compliance with local and international standards.
- Regulation on Protection of Buildings from Fire brings forward detailed requirements for the design and operation of the facilities taking into account fire prevention issues (i.e. fuel load and control of combustibles), means of egress, detection of alarm systems, compartmentalization, fire suppression and control as are required by IFC EHS Guidelines for Health Care Facilities.

15.7 Residual Impacts

If the ESMS is implemented properly during construction phase and operation phase which will cover the implementation of all mitigation measures mentioned above and ensure compliance with Turkish regulatory requirements, the residual impact is considered to be insignificant to of minor significance.

16.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT

This chapter describes the arrangements by how environmental, occupational and community health and safety, social and labor related (*altogether described as “environmental and social”*) risks and impacts will be managed during the construction and operation phases of the Project. A management system is proposed to be used in order to manage these risks and also to meet applicable Turkish laws and regulations and EU directives as well as the Lenders’ Requirements.

ADN PPP A.Ş. will establish an integrated management system (*referred to here as the Environmental and Social Management System - ESMS*) for the construction and operation phases of the Project as it will be the main construction work contractor and the product and service provider of the Adana IHC. The ESMS will enable to (i) manage the above mentioned risks and impacts, (ii) implement, monitor and review identified mitigation measures, (iii) provide continuous control of the processes and (iv) improve environmental and social performance.

The ESMS will be established and implemented separately for the construction and operation phases. The ESMS will be established in line with the following international good practice and guidelines:

- ISO 9001:2008 - Quality Management System;
- ISO 14001:2004 - Environmental Management System;
- OHSAS 18001:2007 - Occupational Health and Safety Management System;
- IFC PS1 - Assessment and Management of Environmental and Social Risks;
- EBRD PR1 - Environmental and Social Appraisal and Management.

The following issues/documents will be taken into account during the establishment of the ESMS:

- Compliance with relevant Turkish laws and regulations and EU directives
- IFC PSs
- EBRD PRs
- IFC EHS General Guidelines
- IFC EHS Guidelines for Health Care Facilities
- EBRD Sub-sectoral Environmental and Social Guidelines: Health Services and Clinical Waste Disposal
- Environmental and Social Management Plan -ESMP- prepared within the scope of the ESIA study

The ESMS will integrate planning, implementation, control and review of the processes in terms of environmental and social impacts. The scope of the ESMS will be clearly defined in an “*ESMS Manual*” to be developed. This chapter has been prepared to identify and describe the outline structure of the ESMS and the relevant documentation. The scope will cover the following issues:

- 16.1:** Environmental, Health and Safety and Social -EHSS- Policy
- 16.2:** Planning of the ESMS
- 16.3:** Implementation of the ESMS
- 16.4:** Control of the ESMS (including monitoring and audit)
- 16.5:** Stakeholder Engagement
- 16.6:** Grievance Process

In addition to the ESMS, a Health Care Waste Management System will be established and implemented as per IFC requirements.

16.1 Environmental, Health and Safety and Social Policy

The senior management (or the Project Board) of ADN PPP A.Ş. will officially define a written “*EHSS Policy*”. The Policy will be relevant and compatible to the activities and environmental and social issues of the Project in order to provide a framework for the determination and review of environmental and social targets and objectives. In addition, a Project specific *HR Policy* will be developed to set values and principles including active and competent participation of all employees in management and decision taking processes, and equal employment opportunity to all employees.

EHSS Policy and HR Policy will be developed both for construction and operation phases of the Project. These policies will encompass the following:

- Comply with environmental protection requirements and be in line with the EHS Legislation,
- Occupational health and safety, human resources management and satisfaction of employees,
- Lender’s requirements
- Satisfaction of stakeholders (including patients),
- Commitment to continuous development and improvement of service quality

The Policy will be provided to employees, subcontractors and suppliers as an attachment of the contracts and will also be disclosed to the public on the Project website.

16.2 ESMS Planning

16.2.1 Environmental, Health and Safety and Social Aspect/Risk Assessment

The identification of the environmental, health and safety and social aspects, significant risks and impacts of the Project is considered to be the principle stage of the planning of an effective ESMS. Significant impacts of the Project have been identified within the scope of the ESIA study and an ESMP has been developed for the Project in order to manage these significant impacts as set out in Annex C (and as explained in more detail in Section 16.3.4). ADN PPP A.Ş. will determine the aspects and significant risks and impacts for specific processes, activities and/or services that could interact with the environmental and social elements based on the results of the ESIA study and the ESMP. For this purpose, ADN PPP A.Ş. will establish an “*EHSS Aspects and Risk Assessment Procedure*”. This procedure will define the methodology to be followed with respect to the assessment of the activities during construction and operation phases of the Project.

The EHSS Aspects/Risk Assessment study will define the (i) mitigation measures and required actions for the identified risks and impacts of the Project, (ii) source of the action (e.g. applicable legislation, Project ESIA commitments, Lender’s requirements) and (iii) deadlines and responsible party for each program. The Aspect/Risk Assessment study will be performed considering but not limited to the following:

- Legal and other requirements (e.g. Lender's requirements)
- Type, scale and location of the Project
- Environmental and social baseline data
- Resource and energy use
- Waste generation
- Frequency, duration, possibility of the aspect/impact
- Opinion of relevant internal and external parties
- Affected party (e.g. patients, community, environment)
- Regular and irregular situations and emergency situations

16.2.2 Legal and Other Requirements

The applicable legislation for the Project will be identified and followed by a "Legal and Other Requirements Follow-up List" in line with a "Legal and Other Requirements Determination and Compliance Procedure". A detailed "EHSS Legislation Review" has been prepared as part of the ESIA study (presented in Annex B) which can be used as a basis. This will provide an understanding of the legal (i.e. permits) requirements and ensure that employees are aware of the legal liabilities of their works and the Project operations. The list will also involve the other requirements (such as Lender's requirements) apart from the legal requirements. The list will be updated in case of any amendments in the legislation/other requirements or any change in the Project. Updates of this document will be reflected to the Project especially by means of the Environmental and Social Aspects and Risk Assessment, and accordingly additional plans and procedures as needed.

16.2.3 Targets, Objectives and Programs

EHSS objectives and targets will be set for the Project to comply with legal requirements and obligations for continuous improvement of the environmental and social quality targets and objectives of the Project. Targets and objectives will cover issues such as efficient use of raw materials, auxiliary materials/matters, natural resources/energy consumption and reduction, improvement awareness of employees. Targets and objectives will be specific, measurable and feasible and supported by the programs. Deadlines and responsible party for each program established to achieve desired results will be assigned. Environmental and social targets and programs will be documented and monitored.

16.3 Implementation of the ESMS

16.3.1 Responsibilities, Resources and Training

The overall responsibility for the establishment, implementation, maintenance and effectiveness of ESMS will lie with the Project Board of ADN PPP A.Ş. For this purpose, necessary human and financial resources and technical infrastructure will be provided by the Project Board for all phases of the Project.

Prior to start of the construction, the Board will establish an organizational structure for the implementation of the ESMS and relevant personnel, especially those who have critical importance in the implementation and management of the ESMS (i.e. management representatives) will be appointed. Key environmental and social roles, responsibilities and authorities as well as qualifications will be clearly defined and announced to the relevant responsible personnel and to

the rest of the employees working within the Project. For this purpose, an “*Environmental and Social Task Qualification Table*” will be developed by ADN PPP A.Ş.

Personnel with direct responsibility for the Project’s environmental and social performance such as health and safety specialist, environmental officer, emergency team members will be adequately qualified, trained and experienced to perform their work. Competencies of these employees will be met with national legal requirements and Lenders’ expectations. External experts and/or consultancy services, if legally or technically necessary, will also be obtained during the Project phases. Determination and providing of the training needs, informing and increasing the awareness of the employees, subcontractors and suppliers regarding the ESMS Policy; significant environmental and social risks and impacts; and procedures will be defined in the “*Training and Improvement Management Process Procedure*” to be prepared.

ADN PPP A.Ş. will appoint an ESMS Manager having overall responsibility for the establishment, implementation and maintenance of the ESMS.

As described in Section 2.7.1 of *Chapter 2: Project Description*, the management of the IHC will be shared between MoH and ADN PPP A.Ş. during the operation phase. MoH will appoint administrative staff who will be responsible for the tasks excluding those that are under the responsibility of ADN PPP A.Ş. which include obligatory and optional services as described in Section 2.7.1 of *Chapter 2: Project Description*. Due to the fact that there will be a shared management, it is expected that there should be cooperation between MoH and ADN PPP A.Ş. for some specific areas during the development and implementation of the ESMS which are not clear at this stage. It is expected that necessary discussions and engagement will be made with MoH by ADN PPP A.Ş. prior to the start of developing the operation phase ESMS in order to clarify these issues.

16.3.2 Communication

ADN PPP A.Ş. will develop procedures to establish and maintain an effective and strong internal and external communication within the scope of the Project. Internal communication will be provided via means such as boards, website of the Project and meetings. Grievances, requests and suggestions coming from all parties (employees, patients, community and others) will be taken, recorded, evaluated and solved/responded in line with a “*Grievance and Request Management Process Procedure*”. A Stakeholder Engagement Plan -SEP- has been developed for the Project that covers engagement activities for the duration of the ESIA study. Engagement activities for the duration of construction and operation phases are also briefly outlined in the SEP. Communication methods/tools defined in the SEP will be considered in the establishment of this procedure and updated as necessary as the Project proceeds.

16.3.3 Documentation and Document Control

Documentation structure of the ESMS will include the following;

ESMS Manual: An official document that details how the ESMS is operated. The ESMS manual will include the ESMS policy, description of ESMS control, roles, responsibilities and relationships, plans, procedures, systems and similar.

EHSS Policy: Consists of all the commitments which are formally expressed by the Senior Management for the construction and operation phases of the Project and which help to determine the framework of the objectives and targets.

Procedures: Documents outlining the main activities and phases, defined procedures, authorities and responsibilities concerning the ESMS that is to be established separately during the construction and operation of the Project.

Plans: Documents supporting the procedures and describing the studies in detail.

Other Supporting Documentation: Forms, lists and other documents used within the scope of the ESMS.

External Documentation: Laws, regulations and standards which define the service conditions and are used mandatorily.

Controlled Copy: Documents in current use.

Uncontrolled Copy: Documents not requiring follow-up.

A “Document and Data Control Procedure” will be established within the scope of construction and operation phase ESMS to control and approve any document before it is issued, to determine writing format and numeration system to be used; to determine approval system; to provide controlled distribution, review and update of the documents; to provide relevant and updated documents in the relevant points; to abolish invalid documents and to manage external documents.

16.3.4 Operational control

An *ESMP* has been developed for the Project (covering construction and operation phases) in order to manage the adverse impacts on the environment. The ESMP is prepared based on the international standards and national laws and regulations. The ESMP of the Project is presented in Annex C of this report. The ESMP includes description of the mitigation measures to avoid, minimize or compensate the adverse impacts during the construction and operation phases of the project; responsible parties for the implementation of the mitigation measures; the timing of implementation; monitoring and audit requirements. The ESMP focuses on the avoidance of impacts, and where this is not possible, presents technically and financially feasible and cost-effective mitigation measures to minimize possible impacts to acceptable levels. The ESMP is based on the results of the ESIA study and is a framework document that specifies the necessary work to be conducted for the Project such as preparation of detailed management plans for each topic (e.g. air quality control and monitoring, noise control and monitoring, traffic management). The ESMP will be kept up to date with any required additional mitigation throughout the Project and to reflect the requirements of new and/or amended laws and regulations.

A Waste Management Plan has also been established as part of the ESIA and presented in Annex H. Waste Management Plan will be updated based on the final design and site layout plan. In addition to the updated Waste Management Plan, the following plans are described in the ESMP and will be developed to achieve EHSS objectives for the construction and operation phases:

For construction phase:

- Air Quality Control and Monitoring Plan
- Noise Control and Monitoring Plan
- Hazardous Material Management Plan
- Emergency Preparedness and Response Plan
- Soil Sampling Plan
- Construction Camp Management Plan
- Construction Traffic Management Plan
- Human Resources Management Plan
- Occupational Health and Safety Management Plan
- Community Health and Safety Management Plan
- Security Plan
- Archaeological Chance Find Management Plan
- Subcontractor Management and Monitoring Plan

For operation phase:

- Air Quality Control and Monitoring Plan
- Hazardous Material Management Plan
- Emergency Preparedness and Response Plan
- IHC Traffic Management Plan
- Community Health and Safety Management Plan
- Occupational Health and Safety Management Plan
- Exposure Control Plan for blood-borne pathogens
- Radiation Exposure Control Plan
- Radioactive Substance Management Plan
- Life and Fire Safety Master Plan
- Security Plan
- Human Resources Management Plan
- Subcontractor Management and Monitoring Plan

These plans will be supported with operational procedures and related instructions as necessary as part of the ESMS. The ESMS procedures and plans will be periodically (or when necessary) reviewed and revised. Additional procedures and plans will be developed as the Project progresses, as necessary.

16.3.5 Environmental and Social Emergency Preparedness and Response

An “Emergency Preparedness and Response Procedure” will be developed for emergency cases that consist of incidents such as accidents, explosions, fires, gas leakages, hazardous chemical and liquid waste spills, disease outbreaks and similar that occur unexpectedly due to equipment/infrastructure failures, employee errors, natural disasters (flooding, landslides, earthquakes, storms), sabotage and similar. Emergency cases are incidents that cause the activities to cease and also cause serious damages on environment, occupational health and assets.

The following needs to be detailed in the procedure:

- Emergency Response Team (Title, Responsibilities and key features)
- Emergency Response Plans, Emergency Drills, Internal Trainings (The drill scenarios should be conducted for different emergency cases)
- Maintenance and Control of Emergency Response Equipment (Fire Emergency Equipment, Pollution Prevention Materials, First Aid Cabinet, Material Safety Data Sheets, Personal Protective Equipment, Warning and Guiding Signs etc.)
- Measures to be taken in case of Emergencies/Natural Disasters (Communication in case of Emergency, Liquid Chemicals/Hazardous Liquid Wastes Spills, Gas Leakage (O₂, Natural Gas, LPG, LPG Forklift, etc.) and Explosion, Flash/Fire, Earthquakes)

16.4 ESMS Control

16.4.1 Monitoring, Measurement and Review

For an effective environmental and social management, the ESMS should be continuously monitored and periodically reviewed.

ADN PPP A.Ş. will monitor:

- the compliance of the ESMS with the environmental and social provisions of the legal and other requirements as well as the commitments given in the ESMP;
- overall implementation of the ESMP and other plans and procedures; and
- improvements achieved as the Project goes forward.

Periodical internal audits, independent parties' audits, regular checks, site inspections and measurements, impact monitoring, implementation of the processes in accordance with the ESMS and regulations, regular audits of the overall implementation of the ESMP and site inspections will be used for this purpose. Realization of environmental targets and objectives, environmental and social performance, equipment calibrations, air emissions, energy, fuel and natural source consumption, noise, waste amounts, environmental and social complaints and similar issues will be monitored, measured and evaluated. Conformance with legal and other requirements will be periodically evaluated and recorded.

Internal audits will be conducted in line with an *"Internal Audit Process Procedure"* to be developed within the scope of the ESMS. The *"Legal and Other Requirements Determination and Compliance Procedure"* will be used to evaluate conformance with the legal and other requirements. Other relevant and required procedures for the monitoring and measurement processes will be established for the Project as needed.

16.4.2 Non-conformities and Corrective, Preventive and Improving Actions

Non-conformities, weaknesses, deficiencies, deviations and improvement opportunities will be identified by means of audits, checks and measurements and grievances; the non-conformities will be analyzed in order to identify their root cause and appropriate corrective/preventive/improving actions will be determined, initiated and tracked through to completion. Required amendments will be reflected to the management programs, procedures and plans including ESMP. A *"Management of Non-conformities and Corrective and Preventive Actions Procedure"* will be developed to manage this process.

16.4.3 Data Control

Any information and data relevant to the ESMS will be recorded in line with a “*Document and Data Control Procedure*” to be developed for the Project. This procedure will set procedures and principles related to the establishment, prevention, maintenance and disposal of the ESMS records.

16.4.4 Management Review

Management reviews will be conducted (at least once a year) to maintain effectiveness of the ESMS and to determine the modification necessities and improvement opportunities in line with a “*Management Review Procedure*”. Internal and external audit results, conformance of the Project with legal and other requirements, external notifications including grievances, ESMS performance (e.g. achievement level to targets and objectives), corrective and preventive actions situations, decisions/actions coming from previous meetings, improvement recommendations will be taken as the inputs for the management reviews. Based on the results generated from the reviews, senior management will take the necessary and appropriate actions to ensure the policy is met, procedures and plans are implemented and are effective.

16.5 Stakeholder Engagement

Stakeholder engagement has started during the ESIA study. The consultation activities will also continue during the construction and operation phases of the Project and will aim to maintain constructive relationships both with the local communities and other stakeholders. In brief, the following activities will be undertaken during the construction and operation phases of the Project:

Construction Phase

- Project information will be disclosed from the project website which will be updated as deemed necessary.
- Ongoing meetings, as deemed necessary with national and local authorities will continue during construction phase related to permitting and other issues.
- Ongoing meetings, as deemed necessary with the local residents and facilities will continue.
- The stakeholder list will be updated regularly and any new stakeholder identified will be included in the list.
- Any activities likely to cause particular disturbance (such as noisy activities etc.) to the nearby neighborhoods will be announced through handouts to be distributed to local people via headmen offices. This information will also be provided in the Project website.
- All comments and grievances will be managed in accordance with the Grievance Management Procedure.
- The security staff at the construction site will be informed about the Grievance Mechanism and in case a local person wants to submit a comment or grievance, the security person will be able to convey this person to the responsible staff.

Operation Phase

- The Project website will be updated to include information on operation activities and any changes in environmental policy, plans and procedures that are followed.
- Ongoing meetings, as deemed necessary will be conducted with the national and local authorities to inform them of any changes in project activities and related to permitting.
- Ongoing meetings with MoH will be conducted as necessary.
- Ongoing meetings, as deemed necessary with the local residents and facilities will continue.
- The stakeholder list will be updated regularly and any new stakeholder identified will be included in the list.
- All comments and grievances will be managed in accordance with the Grievance Management Procedure.
- The security staff at the hospital will be informed about the Grievance Mechanism and in case a local person wants to submit a comment or grievance, the security person will be able to convey this person to the responsible staff.

16.6 Grievance Management

A Grievance Management Procedure will be established in order to ensure that all comments, suggestions and objections received from the Project stakeholders especially from nearby surrounding communities and facilities are dealt with appropriately and in a timely manner. It is important to note that there will also be a separate grievance management procedure for workers/employees during construction and operation phases, and for patients during the operation phase.

Local communities will be informed about the grievance management system during the consultation and disclosure activities. All grievances will be recorded, responded and resolved in a defined timeframe. Comments and grievances can be sent to ADN PPP A.Ş. via mail, e-mail, and fax during the construction and operation stages as well as through the Project website and telephone.

The procedure to handle grievances is described below:

1. All grievances submitted by the stakeholders in verbal and written will be considered. Verbal grievances will be written on grievance forms by the responsible person as defined below.
2. All grievances will be reflected in a grievance log to ensure that each grievance is assigned an individual number and that consistent tracking and corrective actions are carried out. The grievance log will contain:
 - Date of submission of the grievance
 - Reference number
 - Contact details of the complainant
 - Content of the grievance
 - Identification of parties responsible for the resolution
 - Dates when the investigation was initiated and completed
 - Findings of the investigation
 - Proposed corrective action
 - Date of response sent to the complainant (unless it is anonymous)

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- Statement of satisfaction of the complainant
 - Date of closing out the grievance
 - Any outstanding actions for non-closed grievances
3. The grievance will be evaluated by the relevant staff and management to identify what actions need to be taken, and an appropriate response will be developed. The complaint action form (as presented in SEP) will be filled accordingly. .
 4. The complainant will be informed about the proposed corrective action in writing and the date of response to the complainant will be recorded in the grievance log,
 5. The complainant will be contacted through telephone or face-to-face meeting, if needed to confirm that the proposed corrective action taken is satisfactory, and the complainant's response will be recorded in the grievance log,
 6. The grievance will be closed out and the close out date will be recorded, if the complainant is satisfied with the action taken. If not, further assessment is needed and reevaluation of the grievance is required.
 7. It is envisaged that the grievances will be resolved within one month after receipt. If this is not possible, the complainant will be informed about the progress on a regular basis.
 8. Any grievances related to subcontractors' activities will be managed in line with the mechanism described here.

In addition to grievances, comments will be reviewed once a week to identify if they require a response. In case the comment requires a response, an appropriate response will be developed by the Project team in a month after the submission date of the comment. Comments will be reflected to a comment log that will include information on the date of the comment submission, details of the person submitting the comment, issue of comment, response required or not, and date of response.

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