MARMARA OTOYOL İNŞAATI
ADİ ORTAKLIĞI TİCARİ İŞLETMESİ

KMO ANADOLU
OTOYOL İŞLETME A.Ş.

NORTH MARMARA MOTORWAY PROJECT

(ASIAN PART: KURTKOY-AKYAZI SECTION)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

FINAL ESIA REPORT

encon

ENCON ENVIRONMENTAL CONSULTANCY CO.

MARCH 2018

NORTH MARMARA MOTORWAY PROJECT

(ASIAN PART: KURTKOY-AKYAZI SECTION)

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LIST OF ABBREVIATIONS

AA-EQS	Annual Average Environmental Quality Standard
AASHTO	American Association of State Highway and Transportation Officials
Anadolu OIAS	KMO Anadolu Otoyol Isletme A.S.
AoI	Area of Influence
Avrupa OYIAS	Avrupa Otoyolu Yatirim ve Isletme A.S.
BCE	Before Common Era
BOD	Biological Oxygen Demand
BOT	Build, Operate and Transfer
c.	Century
CE	Common Era
CHC	Central Hunting Commission
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLRTAP	Convention on Long Range Transboundary Air Pollution
COD	Chemical Oxygen Demand
CORINE	Coordination of Information on the Environment
DSI	State Hydraulic Works
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EFTA	European Free Trade Association
EHS	Environmental, Health and Safety
EN	Endangered
EPA	US Environmental Protection Agency
EPs	Equator Principles
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESR	Ecosystem Services Review
EU	European Union
EUNIS	European Nature Information System
EUROSTAT	European Statistical System
FPS	Free Passage System
GDRS	General Directorate for Rural Services
GHG	Greenhouse gases
GIS	Geographical Information Systems
GPS	Global Positioning System
IAIA	International Association for Impact Assessment
IAPCR	Industrial Air Pollution Control Regulation
IBAS	Important Bird Area

LIST OF ABBREVIATIONS (CONTINUED)

ICOMOS	International Council on Monuments and Sites
IESC	Independent Environmental and Social Consultant
IFC	International Finance Corporation
ILO	International Labor Organization
IPA	Important Plant Area
ISKI	Istanbul Water and Sewerage Administration
ITS	Intelligent Traffic System
IUCN	International Union for Conservation of Nature
IZAYDAS	Izmit Waste and Residue Treatment Incineration and Utilization Corp.
KBA	Key Biodiversity Area
KGM	General Directorate of Highways
KM	Kilometre
KVKBKM	Directorate of Regional Conservation Board for Conservation of Cultural Assets
M	Metre
MAX-EQS	Maximum Environmental Quality Standards
MFWA	Ministry of Forestry and Water Affairs
MoEU	Ministry of Environment and Urbanization
MOJV	Marmara Otoyolu Joint Venture
MoTMAC	Turkish Ministry of Transport, Maritime Affairs and Communications
MPN	Most Probable Number
MSDS	Materials Safety Data Sheets
NATM	New Austrian Tunneling Method
NMM	North Marmara Motorway
OUV	Outstanding Universal Value
PCU	Passenger Car Unit
POPs	Persistent Organic Pollutant
PPD	Personal Protective Devices
PPE	Personal Protective Equipment
PSs	Performance Standards
RAMEN	Regulation on the Assessment and Management of Environmental Noise
Ramsar Convention	Convention on Wetlands of International Importance, especially as Waterfowl Habitat
RT	Republic of Turkey
SEP	Stakeholder Engagement Plan
SPV	Special Purpose Entities
TBMM	Grand National Assembly
TEM	Trans European Motorway
TKN	Total Kjeldahl Nitrogen
TRACECA	Europe, Caucasus and Asia Transport Corridor
TSS	Total Suspended Solids
TUIK	Turkish Statistical Institute

LIST OF ABBREVIATIONS (CONTINUED)

TURKSTAT	Turkish Statistical Institute
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
VECs	Valued Ecosystem Components
VU	Vulnerable
WBG	World Bank Group
WHO	World Health Organization
WHS	World Heritage Sites
WWTPs	Wastewater Treatment Plants

CHAPTER 1

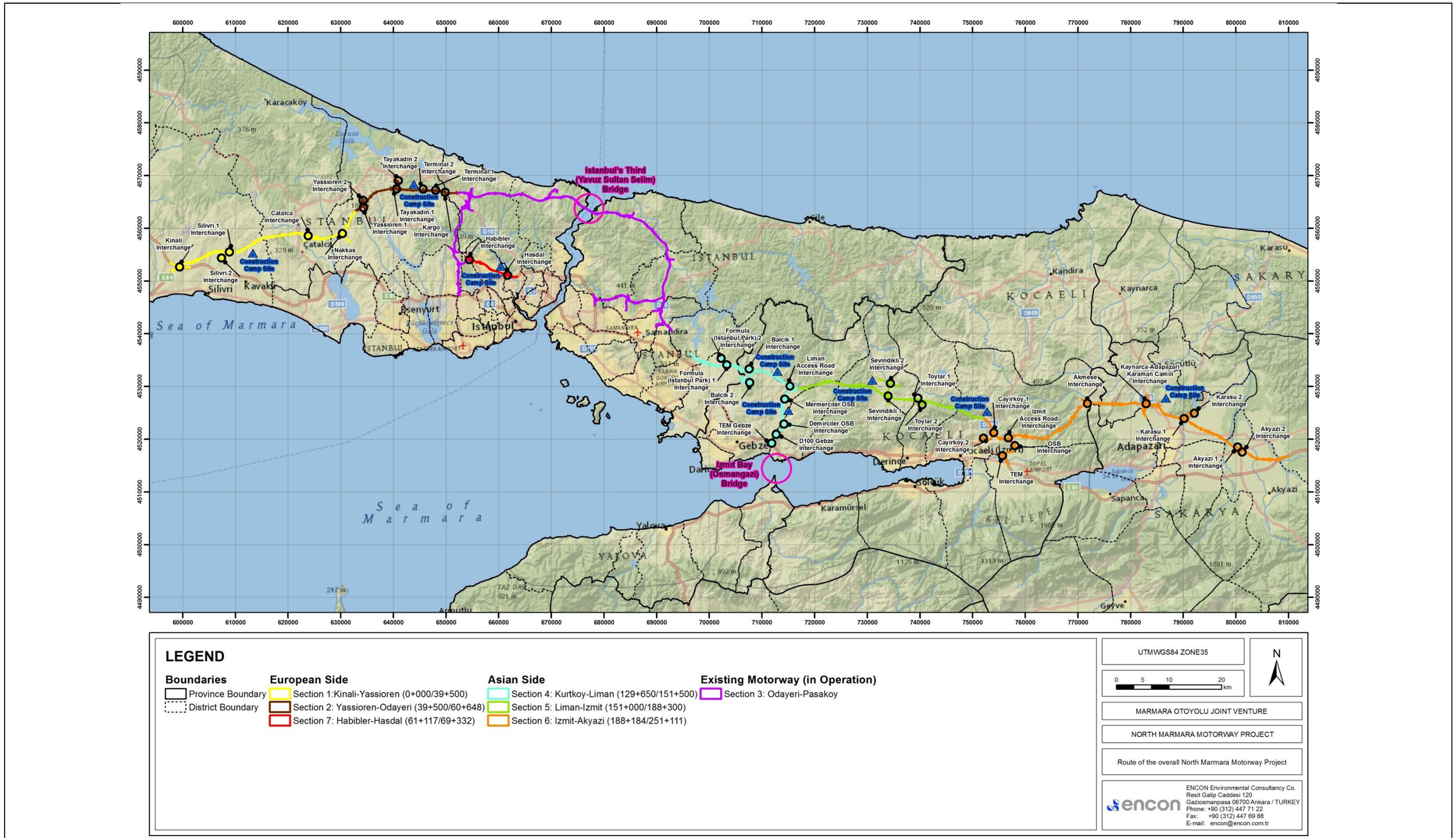
INTRODUCTION

CHAPTER 1. INTRODUCTION

In accordance with the Law on Implementation of Some of the Investments and Services in the Framework of Build, Operate and Transfer Model (Law No: 3996), the Turkish Ministry of Transport, Maritime Affairs and Communications (MoTMAC), General Directorate of Highways ("KGM" or "the Administration"), has tendered for contracts in May 2016 for the overall North Marmara Motorway Project (including European and Asian sections), which starts at Kinali toll plaza near Alipasa neighborhood in Silivri district of Istanbul province, crosses the city of Kocaeli and ends at Akyazi Trans European Motorway (TEM) toll plaza in Akyazi district of Sakarya province, where the sea crossing is provided by the existing Yavuz Sultan Selim (Istanbul's Third Bosphorus) Bridge and its associated motorways that are operational since August 2016. As a result of this tender, KGM has commissioned two different special purpose vehicles (SPV) for the implementation of the European and Asian sections of the North Marmara Motorway Project under the related Build, Operate and Transfer (BOT) contracts. In this regard, Avrupa Otoyolu Yatirim ve Isletme A.S. (Avrupa OYIAS) has been awarded with a BOT Contract for the implementation of the European part (European sections: Kinali-Yassioren, Yassioren-Odayeri and Habibler-Hasdal sections) of the Project and KMO Anadolu Otoyol Isletme A.S. (Anadolu OIAS) has been awarded with a BOT Contract for the implementation of the Asian part (Asian sections: Kurtkoy-Liman; Liman-Izmit and Izmit-Akyazi sections) of the Project. These two entities together form the Marmara Otoyolu Joint Venture (MOJV) and referred as Project Sponsors in the scope of the Environmental and Social Impact Assessment (ESIA) studies.

This ESIA Report has been prepared by ENCON Environmental Consultancy Co. ("the Independent Environmental and Social Consultant (IESC)" or "ENCON") for the Asian part (Asian sections: Kurtkoy-Liman; Liman-Izmit; and Izmit-Akyazi) of the North Marmara Motorway Project ("the Asian part of the Project"). The European part of the Project is subject to a separate ESIA Report.

The Motorway will be a dual carriageway of 4 lanes (2 x 4) in each direction. According to the current design (as of end of March 2016), the total length of the North Marmara Motorway, covering both the European and Asian sections, will be 274,4 km including the main carriageway and the access roads. Total length of the Asian sections (including the main carriageway and the access roads) of the Project will be 186,9 km. Summary of the key information regarding the European and Asian sections of the overall North Marmara Motorway Project is provided in Table 1.1. Figure 1.1 presents a map showing the entire route including both the European and Asian sections.



LEGEND

Boundaries
- Province Boundary
- District Boundary

European Side
- Section 1:Kinali-Yassioren (0+000/39+500)
- Section 2: Yassioren-Odayeri (39+500/60+648)
- Section 7: Habibler-Hasdal (61+117/69+332)

Asian Side
- Section 4: Kurtkoy-Liman (129+650/151+500)
- Section 5: Liman-Izmit (151+000/188+300)
- Section 6: Izmit-Akyazi (188+184/251+111)

Existing Motorway (in Operation)
- Section 3: Odayeri-Pasakoy

UTMWGS84 ZONE35

N

0 5 10 20 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Route of the overall North Marmara Motorway Project

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Figure 1.1. Route of the Overall North Marmara Motorway Project

Table 1.1. Summary of the Key Project Information

Project Sections	Section Description	Length of Motorway (km)*			Name of the Special Purpose Entity (SPV)	Contractors
		Main Road	Access Road	Total		
Asian sections	Kurtkoy-Liman	121,6	65,3	186,9	KMO Anadolu Otoyol Isletme A.S. (Anadolu OIAS)	Limak Ins. San. ve Tic. A.S.
	Liman-Izmit					Cengiz Insaat San. ve Tic. A.S.
	Izmit-Akyazi					Kolin Insaat, Turizm San ve Tic. A.S.
European sections	Kinali-Odayeri	68,8	18,7	87,5	Avrupa Otoyolu Yatirim ve Isletme A.S. (Avrupa OYIAS)	KRP Joint Venture (Kalyon RSY PAK)
Total		**190,4**	**84,0**	**274,4**	**Marmara Otoyolu Joint Venture (MOJV)**	

**According to the current design as of end of March 2017.*

1.1. Aim of the ESIA Report

Expenditure on new development of roads is likely to be a major component of national budgeting. Due to high cost of construction and budget constraints, financing new motorway projects by national budget is difficult. Thus, in the recent years, build-transfer-operate (BOT) models, based on the project experience of the private sector and support of financial institutions, has been one of the most effective mechanisms in Turkey for realizing large-scale motorway projects without causing public burden (*KGM, June 2011*).

The North Marmara Motorway is a project that has been tendered out in the framework of BOT model. As the winning bidder, the companies forming MOJV seeks finance from financial institutions/potential lenders, who would require international environmental and social standards and guidelines to be adopted in the implementation of the Project. In consideration of Equator Principles, World Bank policies and IFC's Sustainability Framework, the Project is evaluated to be likely to include activities and components that are to be effectively managed to avoid or minimize significant environmental and social impacts. In this respect, the North Marmara Motorway Project would be classified as a Category A Project, for which the borrower is responsible for preparing an Environmental Impact Assessment (EIA) Report/full-scale ESIA. Similarly the EU's EIA Directive and the Turkish EIA Regulation, which has been harmonized with EU's EIA Directive also define the motorway construction projects as Annex I activities, for which an EIA is required. Thus, to meet the environmental and social requirements of the potential lenders, who would require international environmental and social standards and guidelines to be adopted in the implementation of the Projects that are to be financed by them, a full-scale ESIA process has been started for the Project in November 2016.

According to internationally accepted and applied impact assessment procedures, the ESIA process started with the initial screening and scoping phases. Findings of the screening and scoping studies were documented in the Scoping Report dated December 2016. The primary aim of the Scoping Report has been the identification of the the environmental and social issues and impacts that are likely to be important and delineation of the scope of the ESIA Report to be prepared.

Following the scoping phase, other key processes including examination of alternatives; stakeholder identification (focusing on those directly affected) and engagement; gathering of environmental and social baseline data by means of desk-based and field studies; impact identification, prediction, and analysis; generation of mitigation or management measures and actions; evaluation of significance of impacts and residual impacts; and documentation of the assessment process, were conducted in accordance with the requirements of the relevant Turkish laws and regulations, Equator Principles and IFC's Sustainability Framework and the findings of the entire process have been compiled in this ESIA Report, which has been prepared for the Asian sections of the overall North Marmara Motorway Project. The ESIA Report has been structured as follows:

- Chapter 1 Introduction
- Chapter 2 Institutional and Legal Framework
- Chapter 3 Project Description
- Chapter 4 ESIA Methodology
- Chapter 5 Land Use and Property
- Chapter 6 Topography, Soils and Geology
- Chapter 7 Use of Resources and Wastes
- Chapter 8 Water Resources
- Chapter 9 Ecology and Biodiversity
- Chapter 10 Air Quality and Climate Change
- Chapter 11 Noise and Vibration
- Chapter 12 Protected Areas, Landscape and Visual Environment
- Chapter 13 Archaeological and Immovable Cultural Heritage
- Chapter 14 Socio-economic Environment
- Chapter 15 Community Health and Safety
- Chapter 16 Labor and Working Conditions
- Chapter 17 Cumulative Impact Assessment
- Chapter 18 Analysis of Alternatives
- Chapter 19 Public Consultation and Stakeholder Engagement Activities
- Chapter 20 Environmental and Social Management System

1.2. Need for and Aim of the Project

Effective transportation infrastructure is a key to the development of countries. Today, transportation has become one of the basic needs of the mankind and a prominent driving force for the socio-economic development. In this respect, road transportation provides the most flexible transportation means as far as the topography, amount of the load to be transported and the time is concerned. Road transportation is usually preferred as it enables non-stop and fast transportation and thus most of the time is the most economic alternative when compared to other transportation systems.

Road transportation has become prominent in the 20th century following the Second World War. Once the 1970s energy crisis had been overcome, road transportation has risen and become the primary means of transportation in 2000s in many developed and developing countries. Currently, with continuing technological advancements, demand for transportation and number of vehicle ownership increases resulting in an upward trend in the preference for road transportation (*KGM, August 2010*).

The share of road transportation within the transportation sector in Turkey shows gradual increase. Road transportation meets the demand for intercity transport of passengers and goods to a larger extent when compared to other transportation sectors in the country. Table 1.2 presents the data on transportation of freight and passengers according to transportation types. As can be seen, road transportation has been by far the foremost type of transportation for freight and passengers.

Table 1.2. Transportation of Freight and Passengers According to Transportation Type*

Years	Roads/Motorways				Maritime				Railways			
	Freight		Passenger		Freight		Passenger		Freight		Passenger	
	Tonne/ km	%	Pass-km	%	Tonne/ km	%	Pass-km	%	Tonne/ km	%	Pass-km	%
2001	151.421	87,0	168.211	95,2	15.001	8,6	57	0,0	7.561	4,3	5.568	3,2
2002	150.912	89,4	163.327	95,4	10.627	6,3	39	0,0	7.224	4,3	5.204	3,0
2003	152.163	89,1	164.311	95,0	10.001	5,9	41	0,0	8.669	5,1	5.878	3,4
2004	156.853	90,4	174.312	94,8	7.277	4,2	1.150	0,6	9.417	5,4	5.237	2,8
2005	166.831	91,5	182.152	94,7	6.439	3,5	1.241	0,6	9.152	5,0	5.036	2,6
2006	177.399	91,4	187.593	96,6	7.084	3,6	1.393	0,7	9.676	5,0	5.277	2,7
2007	181.330	90,3	209.115	96,7	9.573	4,8	1.561	0,7	9.921	4,9	5.553	2,6
2008	181.935	89,3	206.098	96,9	11.114	5,5	1.570	0,7	10.739	5,3	5.097	2,4
2009	176.455	89,0	212.464	96,8	11.397	5,8	1.643	0,7	10.326	5,2	5.374	2,4
2010	190.365	88,8	226.913	97,0	12.570	5,9	1.570	0,7	11.462	5,3	5.491	2,3
2011	203.072	88,0	242.265	90,5	15.959	6,9	1.570	0,6	11.677	5,1	5.882	2,2
2012	216.123	88,7	258.874	91,0	15.768	6,5	1.417	0,5	11.670	4,8	4.598	1,6
2013	224.048	88,7	268.178	90,5	17.312	6,9	1.667	0,6	11.177	4,4	3020	1,0
2014	234.492	89,5	276.073	89,8	15.572	5,9	1.806	0,6	11.992	4,6	3458	1,1

**Airline transportation statistics are not included in the database of TurkStat; it does not have a considerable part in freight transportation but passenger-kilometers for airline transportation are more than passenger-kilometers for maritime and railways transportation.*

***Source: TurkStat, 2015; KGM, November 2015.*

Road motor vehicle ownership is an indicator directly related with the per capita income in a country. Both the population and the vehicle ownership increase in Turkey. As of 2014 (*TurkStat, 2015*), population of the country was 76,9 millions and the stock of registered vehicles was 18,8 millions, while the gross domestic product per capita was 22.753 TL with current prices (10.404 USD). Growth of country's population and stock of registered vehicles and status of gross domestic product per capita in years is presented in Table 1.3. In 2015, population and stock of registered vehicles have continued to increase in Turkey and it is anticipated that this growth will continue in the upcoming years as the saturation level is far from being reached (*KGM, August 2010*). The graph given in Figure 1.2 provides a comparison of population and number of road motor vehicles in use.

Table 1.3. Growth of Population and Vehicle Ownership and Status of Gross Domestic Product Per Capita in Years.

Years	Mid-year Population (Thousand)	Stock of Registered Vehicles	Vehicle-km (Million)	Gross Domestic Product Per Capita		
				With Current Prices (TL)	With Current Prices (USD)	With Constant Prices (1998, TL)
2000	64.269	8.320.449	56.151	2.593	4.129	1.127
2001	65.166	8.521.956	52.631	3.686	3.019	1.048
2002	66.003	8.655.170	51.664	5.310	3.492	1.099
2003	66.795	8.903.843	52.349	6.809	4.565	1.143
2004	67.599	10.236.357	57.767	8.270	5.775	1.235
2005	68.435	11.145.826	61.129	9.482	7.036	1.322
2006	69.295	12.227.393	64.577	10.944	7.597	1.396
2007	70.158	13.022.945	69.609	12.018	9.247	1.443
2008	71.052	13.765.395	69.771	13.378	10.444	1.434
2009	72.039	14.316.700	72.432	13.223	8.561	1.347
2010	73.142	15.095.603	80.124	15.023	10.003	1.448
2011	74.224	16.089.528	85.495	17.484	10.428	1.552
2012	75.176	17.033.413	93.989	18.846	10.459	1.565
2013	76.055	17.939.447	99.431	20.607	10.822	1.611
2014	76.903	18.828.721	102.988	22.753	10.404	1.639

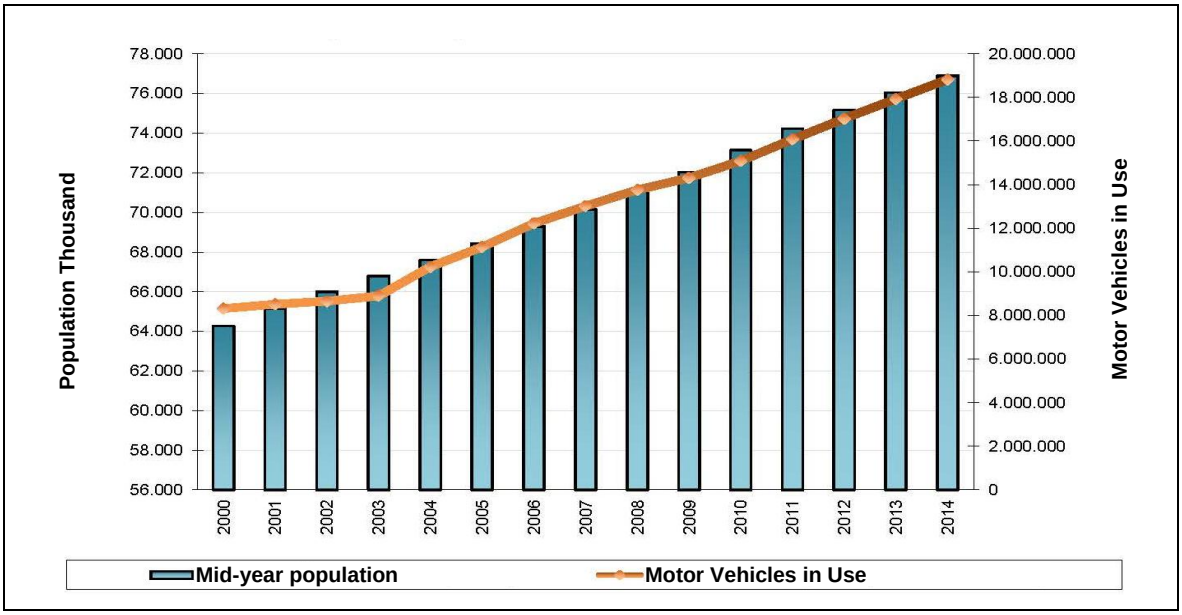


Figure 1.2. Comparison of Population and Number of Road Motor Vehicles in Use

Playing a key role in economic development and enhancement of welfare, road transportation is not only an important economic activity on its own but it also paves ground for interaction between different sectors. The fact that time gains primary importance in the globalizing world raises the importance of road transportation as it provides the ability to compete and establish flexible relations (*KGM, August 2010*).

Turkey serves as a bridge for regional and intercontinental trade links as it is located on the main transportation corridors. Being aware of its geographic importance, the government of Turkey spends great effort to establish uninterrupted transportation connections between Europe, Asia and Africa. The system of highways network in the country is significant to provide national development, unity and general development in the region (*http://www.kgm.gov.tr*).

Marmara Region of Turkey has a particular role in this transportation system as the city of Istanbul located in this region bridges Asia and Europe continents. Its geographical position makes Marmara the most important hub for industry and logistics as well as the most crowded region in the country. In the current situation, as a result of the rapid population growth, which brings together increased number of vehicle ownership, traffic problems (i.e. chronic congestion, frequent traffic jams) occur in the peak hours of the traffic. Being the largest metropolitan in the country in terms of population and industrialization and the most important center for cultural, social and touristic attractions, Istanbul is the most prominent as far as the traffic problems are concerned. In addition to inner city traffic, roads providing access to Asian and European sides of Istanbul are also affected by those traffic problems. The existing traffic load in Istanbul is mainly caused by the daily inner city traffic and also by the regional traffic flow coming to Istanbul from Sakarya, Izmit and Tekirdag regions and by the transit traffic crossing the city.

The transportation network in Istanbul and its surroundings runs mainly in the east-west direction, consisting of the D-100 State Road and Trans European Motorway (TEM or E-80) as can be seen in Figure 1.3. In the city, 1st Ring Road (O-1) and 2nd Ring Road (O-2) ensure the continuity of these roads and provide the crossing of Istanbul Bosphorus. In this respect, D-100 State Road crosses the Istanbul Bosphorus by Bogazici (15 Temmuz Sehitler) Bridge located on the 1st Ring Road (O-1) and TEM (E-80) crosses the Bosphorus by Fatih Sultan Mehmet (FSM) Bridge located on the 2nd Ring Road (O-2).

D-100 State Road is mostly composed of 2x3 lanes and partly 2x2 lanes. The existing traffic load on this road is over its capacity leading to long tailbacks during the morning and evening hours. Similarly, the inner city artery of D-100, the 1st Ring Road (O-1) experiences overloaded traffic and congestion that causes substantial increase in fuel consumption and loss of workforce.

2nd Ring Road (O-2) part of TEM (E-80) is a 2x4 lanes motorway, while the remaining parts consist of roads with 2x3 and 2x2 lanes. The daily traffic load and the percentage of heavy vehicles on the 2nd Ring Road (O-2) is considerably high. In the current situation, all sections of TEM are overloaded with traffic and the capacity of this road has turned out to be insufficient. Especially during extreme weather conditions and/or at the time of accidents, this overloaded capacity reduces even further resulting in interruptions in the traffic flow and adverse effects on the inner city traffic (*KGM, August 2010*).

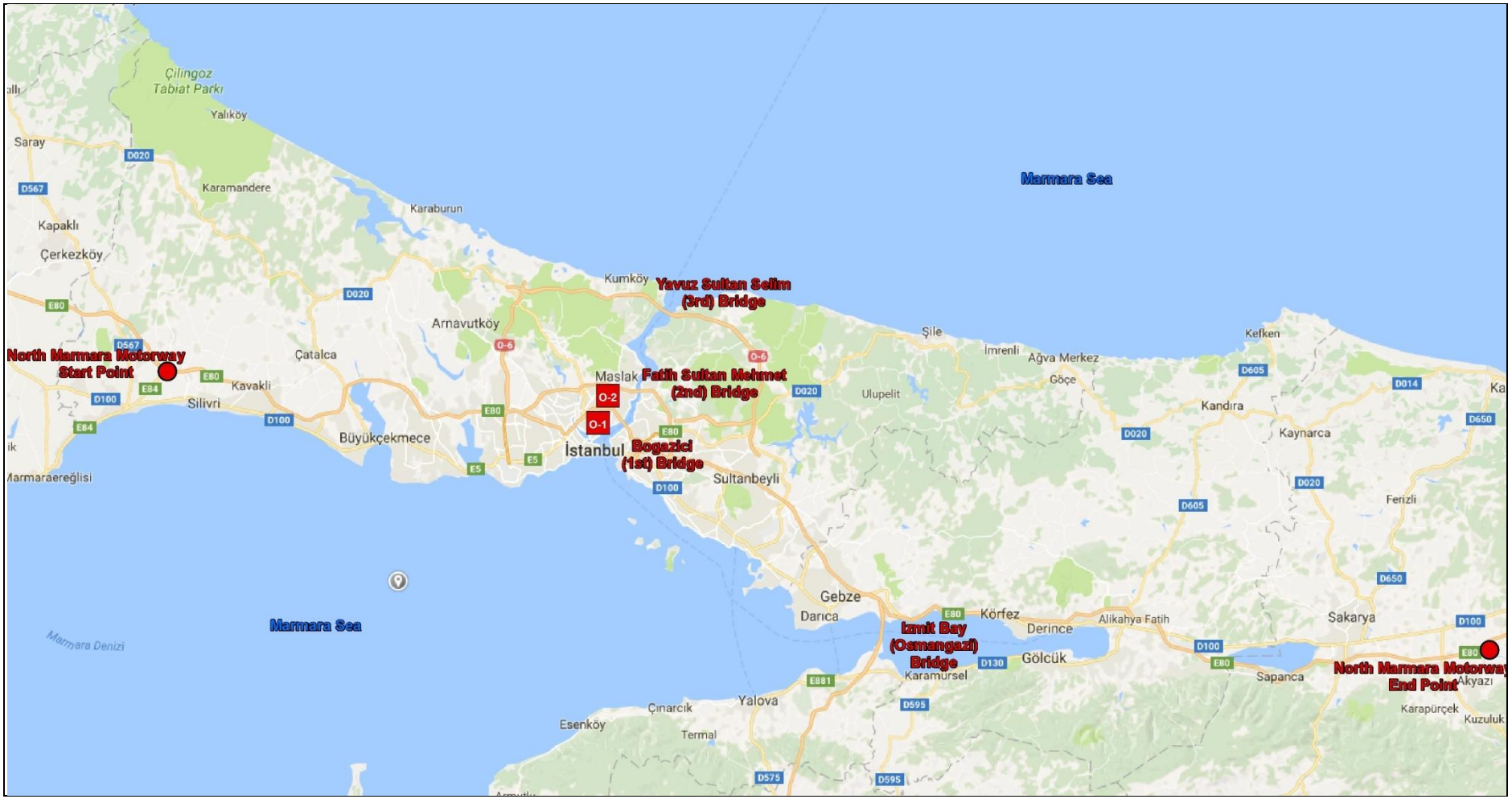


Figure 1.3. Transportation Network in the Region

In addition, Gebze and Izmit sections of TEM (E-80) and D-100 State Road falling into the jurisdiction of Kocaeli Metropolitan Municipality operate over their capacity as well. Accidents frequently occur and complaints are repeatedly received in these sections as this section of the D-100 State Road passes through the settlements.

According to Turkish Statistical Institute's (Turkstat) database of 2015, %18,6 of the total population of Turkey lives in Istanbul, which makes it by far the most crowded city in the country with a population exceeding 14,6 millions. Kocaeli, with its population of about 1,8 millions, is also one of the 10 most crowded cities in the country. When Sakarya province's population of 950.000 is considered together with the population of Istanbul and Kocaeli, it is seen that more than %22 of country's population lives on the cities located on the North Marmara Motorway route. As far as the population growth is concerned, Istanbul ranks the first and Kocaeli ranks the third in the entire country. The population projections for 2023 for the city of Istanbul, Kocaeli and Sakarya are given in Table 1.4. Istanbul is anticipated to remain as the most crowded city of the country with a population of around 15,2 million, while Kocaeli is anticipated to be within the 10 mostly populated cities of the country with a population of exceeding 2 million.

Table 1.4. Population Projection for Istanbul, Kocaeli and Sakarya Provinces

Provinces	2015 Population[(1)]	2023 Projected Population[(2)]
Istanbul	14.657.434	15.188.562
Kocaeli	1.780.055	2.116.643
Sakarya	953.181	1.011.504

Source: [(1)]Tursktat, 2016; [(2)]Karakaya, M. Turkstat and Turkyilmaz, S. Hacettepe University, 2008.

In parallel to population density, an important part of the stock of registered vehicles according to the statistical region units (Istanbul is located in TR1 Istanbul region; Kocaeli and Sakarya, together with Bursa, Eskisehir, Bilecik, Duzce, Bolu and Yalova provinces, are located in TR4 East Marmara Region) is registered in the Marmara Region. In this respect, around 27% (corresponds to nearly 5,5 million vehicles) of all road motor vehicles registered in Turkey in 2015 (corresponds to nearly 20 million vehicles; *Turkstat, 2016*) are registered in the region (TR1 and TR4) where the Project will be implemented. As the population is anticipated to continue its growth in the upcoming years, the vehicle ownership rates in Marmara Region would also grow substantially leading to exaggeration of the existing traffic problems. The North Marmara Motorway is a Project planned in Istanbul, Kocaeli and Sakarya provinces of the Marmara Region, aiming to alleviate all these problems and strengthen the region's capacity to serve its existing roles in industry and logistics as well as social, cultural and touristic aspects and future transport demands in the most efficient way possible.

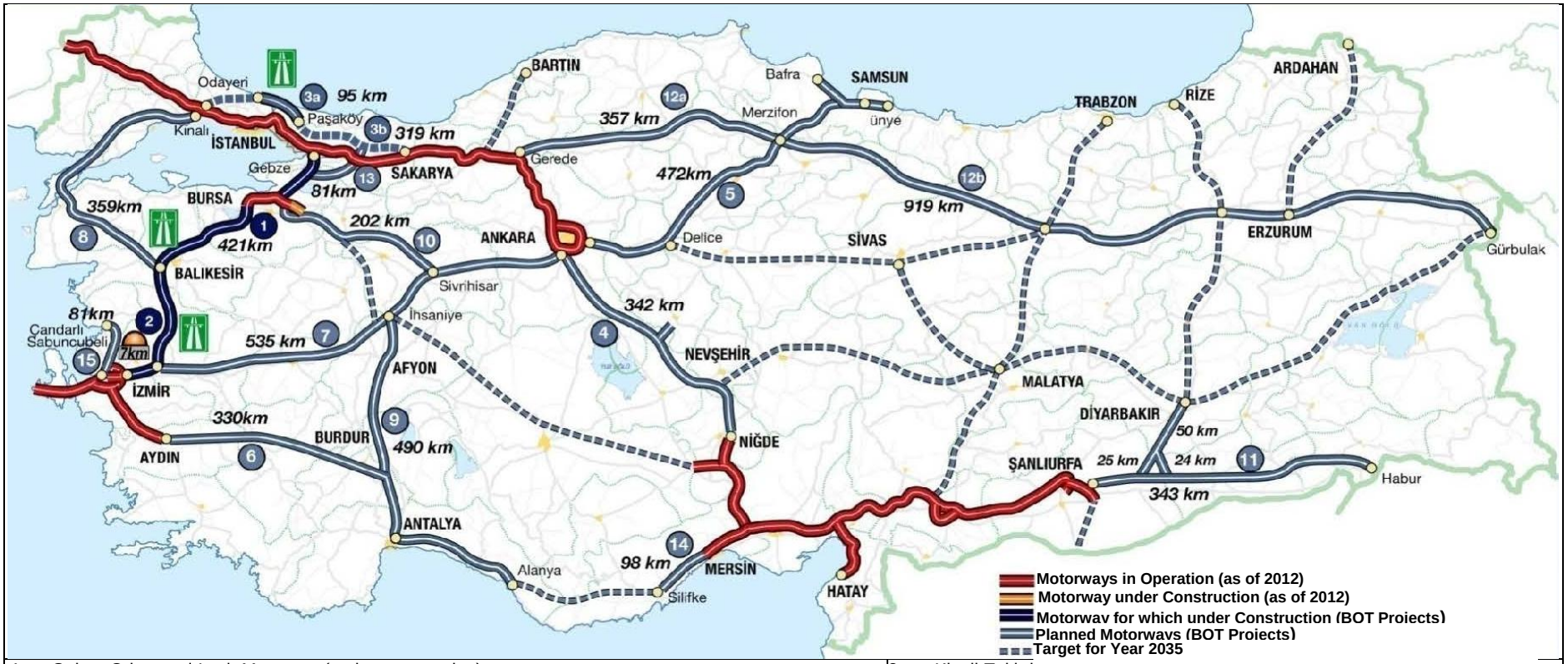
To contribute alleviation of these ever-increasing problems, motorway projects, with access controlled multi-lanes and non-stop tolling systems, have been developed by the KGM since 1970s with the aim of preventing time loss and providing fast transportation (*http://www.kgm.gov.tr*). Construction of motorways (multi-lane access-controlled highways) with high physical and geometric standards has accelerated in Turkey since 1980s. As of November 2016, total length of the Motorways with toll systems and their access roads is 2.489 km (*http://www.kgm.gov.tr/*). The North Marmara Motorway is a Project planned by KGM in this context and it will be integrated to KGM's other operational and/or planned transportation systems (i.e. highways, bridges, tunnels) in the South Marmara and Western Anatolia regions.

The Asian part of the Motorway subject to this ESIA (Sections 4, 5 and 6), as well as the European part (Section 1, 2, and 7) that is subject to a separate ESIA Report, are integral parts of the overall Project, without which the North Marmara Motorway (including Istanbul's Third Bridge) would not be viable. Section 3 of the Motorway, which includes the Istanbul's Third Bosphorus Bridge and the associated motorways, has been taken into operation in August 2016. The associated motorway section of the Third Bosphorus Bridge, has been constructed between Odayeri in Eyup district and Pasakoy in Sancaktepe district. In the current situation, with the absence of European and Asian sections, Third Bosphorus Bridge and Section 3 of the Motorway cannot effectively serve their planning and construction purposes. Once the European and Asian sections are completed, integrity of the overall Project will be achieved and the North Marmara Motorway will provide a transit corridor (i.e. for freight transportation) that bypasses the busy city centers and enable connection of the roads between Akyazi district of Sakarya province and the Thrace Region.

In this regard, the primary aim of the overall North Marmara Motorway Project is to expand and improve the regional transportation network to meet the demand of national economic growth and ensure provision of comfortable transportation services by means of balancing the intense traffic stress that prevail on the existing road transportation infrastructure of North Marmara Region. Additionally, the North Marmara Motorway aims to build capacity that would be necessary for meeting the anticipated traffic loads in the future with an infrastructure having sufficient physical and geometric standards. This is planned to be achieved by separating the local traffic caused by the urbanization and industrialization growing near the main transportation lines located in the east-west direction in the North Marmara Region from the intercity and international traffic to the extent possible. As a result of this effort, it is anticipated that the quality of transportation services would be increased and traffic-induced energy consumption, air and noise emissions, losses of time, work force and money and the number of accidents that are caused by insufficient geometric road standards risking the road safety would be minimized. With a focus on the city of Istanbul, the North Marmara Motorway is anticipated to alleviate the local transit load and provide an alternative high-standard, intermittent, reliable, safe and comfortable route for transit passage that does not enter the inner city traffic of Istanbul. Such that, almost all of the heavy vehicles entering the country through the Kapikule Customs Gate at the Bulgarian border of Turkey in Edirne province and heading to Marmara, Anatolia and Black Sea regions will use the North Marmara Motorway to transit Istanbul and pass the Bosphorus via the Third Bridge.

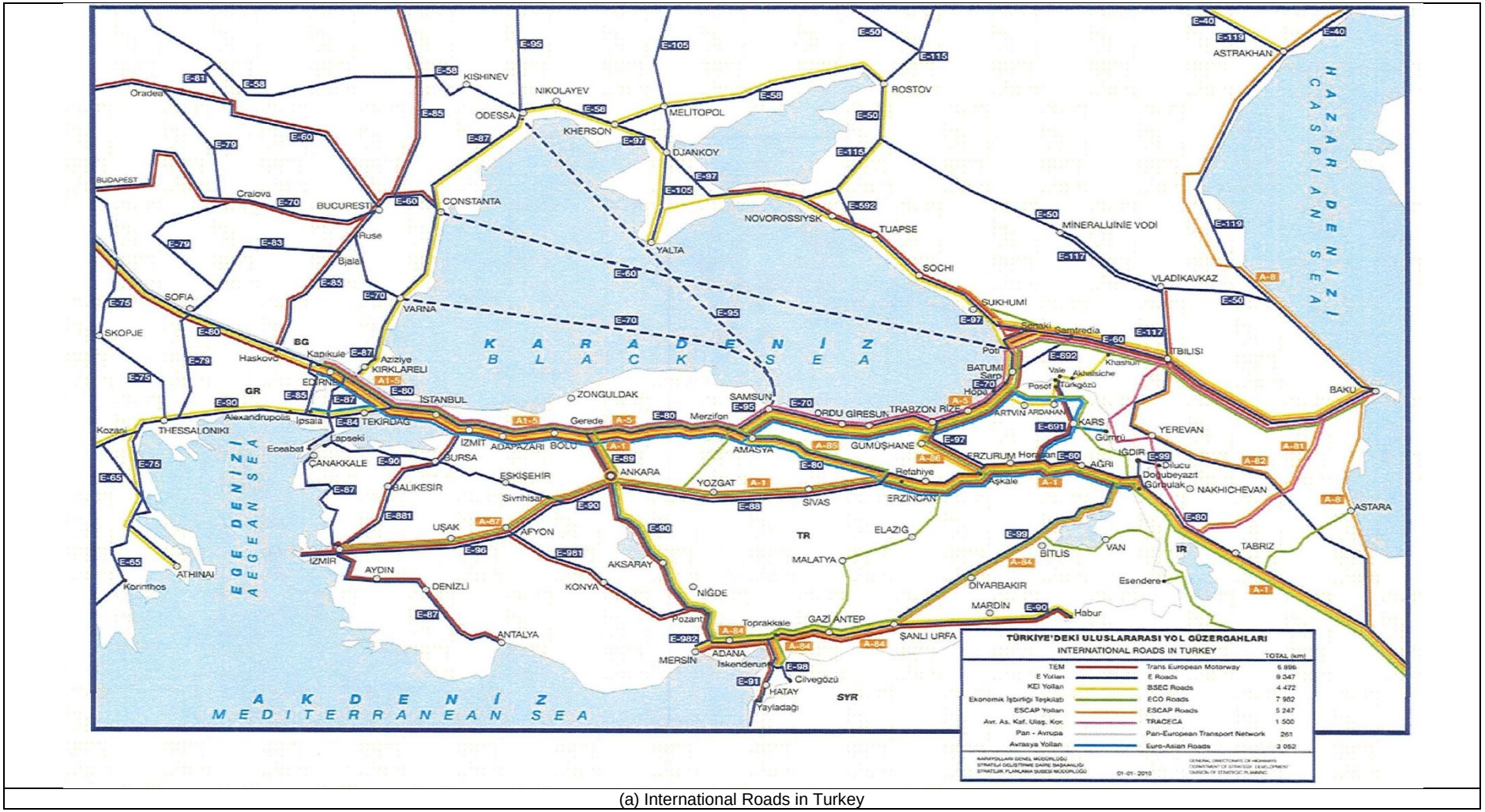
In addition, the North Marmara Motorway is one of the 17 keystone projects of KGM's Target Transportation Network for 2023 (100th Anniversary of the Republic) vision covering all the geographical regions of the country as demonstrated in Figure 1.4. Connection between two most industrialized and widely populated regions, namely Marmara and Aegean, will be provided by the connections to be made between the North Marmara Motorway, Gebze-Orhangazi-Izmir Motorway and Kinali-Tekirdag-Canakkale-Balikesir Motorway projects. Thus, North Marmara Motorway Project is a major component that will ensure integrity of the 2023 Transportation Network target of the country and enhance the position of Turkey within the international arteries consisting of European Road (E-Roads) Network, Asian Road Network (A-Roads), Trans-Euorpean North-South (TEM) Motorway, TRACECA (Europe, Caucasus and Asia Transport Corridor), Eurasia Transport Connection and Black Sea Economic Cooperation roads. International roads and European Roads (E-Roads) in Turkey are shown on the maps given in Figure 1.5.

Last but not least, Motorway projects are known to be investments with high added-value. Thus, besides the benefits to be provided to the transportation networks and their users, North Marmara Motorway Project is anticipated to create social and economic benefits, which would include creation of employment opportunities, local and regional development, increased access to employment, markets and education, health and cultural/tourism facilities and contribution to national budget through collection of taxes and to national security. On the other hand, to maximize those benefits and ensure environmental and social acceptance of the Project, effective management of the potential environmental and social impacts of the Project, as described in this ESIA Report, will be a must.



1. Gebze-Orhangazi-Izmir Motorway (under construction)	8. Kinali-Tekird
2. Sabuncubeli Tunnel (under construction)	9. Afyonkarahisar-Antalya-Alanya Motorway
3/a. North Marmara Motorway (Odayeri-Pasakoy section and the 3rd Bosphorus Bridge) (in operation)	10. Sivrihisar-Bursa Motorway
3/b. North Marmara Motorway (under construction)	11. Sanliurfa-Habur Motorway (including Diyarbakir connection)
4. Ankara-Nigde Motorway	12/a. Gerede-Merzifon-Gurbulak Motorway (Gerede-Merzifon section)
5. Ankara-Kirikkale-Delice-Samsun Motorway	12/b. Gerede-Merzifon-Gurbulak Motorway (Merzifon-Gurbulak section)
6. Aydin-Denizli-Burdur Motorway	13. Yalova-Izmit Motorway
7. Ankara-Izmir Motorway	14. Mersin-Silifke (Tasucu) Motorway
	15. Cigli-Aliaga-Candarli Motorway

Figure 1.4. Build-Operate-Transfer Projects in Road Sector (*Source: Ministry of Transport, Maritime Affairs and Communications, March 2013*)



(a) International Roads in Turkey

(b) European Roads in Turkey

Figure 1.5. International Roads (a) and European Roads (b) in Turkey (*Source: August 2010*)

1.3. Background to the Project

The North Marmara Motorway was initially developed as an integral project consisting of the Istanbul's Third Bosphorus (Yavuz Sultan Selim) Bridge and the motorway sections between Kinali Toll Plaza located near Alipasa neighborhood of Silivri district in Istanbul province and Akyazi Toll Plaza located near Bedilkadirbey neighborhood of Akyazi district in Sakarya province. The overall Project (including the Istanbul's Third Bosphorus Bridge) was put in the public investment program in 1991 with the number 1991E040150. Following the start of Pre-feasibility Studies in 2006, an application was made to the Undersecretariat of the State Planning Organization of that time (currently serves under the Ministry of Development) in July 2009 with a request for High Planning Council Decision that would authorize KGM for the implementation of the Project in accordance with the Law on the Implementation of Some of the Investments and Services in the Framework of BOT Model (Law No: 3996).

Accordingly, a consolidated Feasibility Study has been prepared by KGM and its consultants for the overall Project including the Third Bosphorus Bridge. A revised Feasibility Report, reflecting the changes made on the route, has been issued by the KGM (Strategic Planning Division under the Strategy Development Department of KGM) in August 2010. This Feasibility Study defined the Asian sections of the Motorway as Section 4: Pasakoy-Gebze (Mollafenari), Section 5: Gebze (Mollafenari)-Izmit (Durhasan) and Section 6: Izmit (Durhasan)-Akyazi and has consisted of the following main chapters:

- Description of the BOT Model
- General Information on the Project
- Traffic Projections
- Capacity Analyses and Determination of Operation Speeds
- Technical Information on the Project
- Expropriation, Construction and Operation-Maintenance Costs
- Economic Analyses
- Financial Analyses

Traffic Projections Study Report was initially prepared by KGM's expert and competent independent consultants in 2008 and revised in 2009 to reflect the changes in the route as a part of the revised Feasibility Report. In the scope of the Traffic Projections Study, historic traffic loads on the existing roads, their distribution and annual differences for the period between 1996 and 2009 were reviewed for light and heavy vehicles. Based on this review, traffic projections have been performed for both the existing roads (state roads, ring roads, etc.) and the North Marmara Motorway (including the Third Bosphorus Bridge and its associated motorway) up until year 2038 on a yearly basis in consideration of the estimated load that will shift from the existing roads to the planned Motorway.

The initial tender for the entire North Marmara Motorway Project (Kinali-Akyazi) was announced in 2011. Later, due to the conditions of that time, it has been decided to tender out Section 3 of the Motorway, which includes the Motorway section between Odayeri and Pasakoy and the Third Bosphorus Bridge, separately. The tender for Section 3 was accordingly finalized in 2012 and the Third Bosphorus Bridge including the associated Motorway section (Odayeri-Pasakoy) has been put in service in August 2016.

Following the feasibility stage, further revisions have been made on the remaining sections of the route at the tendering stage and the Asian sections of the Project were revised as Section 4: Kurtkoy-Liman, Section 5: Liman-Izmit and Section 6: Izmit-Akyazi. The tender for the Asian sections of the Project was made in May 2016 in accordance with the Law on Implementation of Some of the Investments and Services in the Framework of BOT Model (Law No: 3996) and the BOT Contract was signed between the winning bidder, namely KMO Anadolu Otoyol Isletme A.S. (referred as Project Sponsors), and the Administration, namely KGM, in July 2016.

In accordance with the terms of the BOT Contract, the Motorway will be a dual carriageway having 4 lanes in each direction (4 x 2). In the Asian side, Motorway (Section 4) will connect to the existing associated highway (Section 3) of the Istanbul's Third Bridge in Kurtkoy, a location close to the end of Section 3 in Pasakoy. In the European side, Motorway (Section 2) starts in Kurtkoy, a location close to the end of Section 3 in Pasakoy. In the European side, Motorway (Section 2) will connect to the existing associated highway (Section 3) of the Istanbul's Third Bridge in Odayeri. Following the signing of BOT Contract, KMO Anadolu OIAS has continued route and Project optimization and design works in cooperation with KGM and other related state authorities. According to current design, the lengths of the main and access roads in six sections that form the European and Asian part of the North Marmara Motorway Project are summarized in Table 1.5. Information on the Asian sections of the Motorway, which are subject of this ESIA Report, is provided in the upper part of the Table. Figure 1.1, given in the beginning of this Chapter, has presented a map showing the entire route including both the European and Asian sections, while Figure 1.6 focuses on the Asian sections of the Project.

Table 1.5. Information on the Sections of North Marmara Motorway (as of end of March 2017)

Section Number	Section Name	Start and End Locations of the Section		Length of the Section (km)		
		Start Location (km)	End Location (km)	Main Road (Motorway)	Access Road	Total
Asian Side						
Section 4	Kurtkoy-Liman	129+650	151+500	21,9	21,7	43,6
Section 5	Liman-Izmit	151+000	188+300	36,8	20,2	57,0
Section 6	Izmit-Akyazi	188+184	251+111	62,9	23,4	86,3
Asia Total				**121,6**	**65,3**	**186,9**
European Side						
Section 1	Kinali-Yassioren	0+000	39+500	39,5	9,4	48,9
Section 2	Yassioren-Odayeri	39+500	60+648	21,1	5,6	26,7
Section 7	Habibler-Hasdal	61+117	69+332	8,2	3,7	11,9
Europe Total				**68,8**	**18,7**	**87,5**
Total (Asia and Europe)				**190,4**	**84,0**	**274,4**

**Minor differences in the decimals may be caused by the rounding of numbers.*

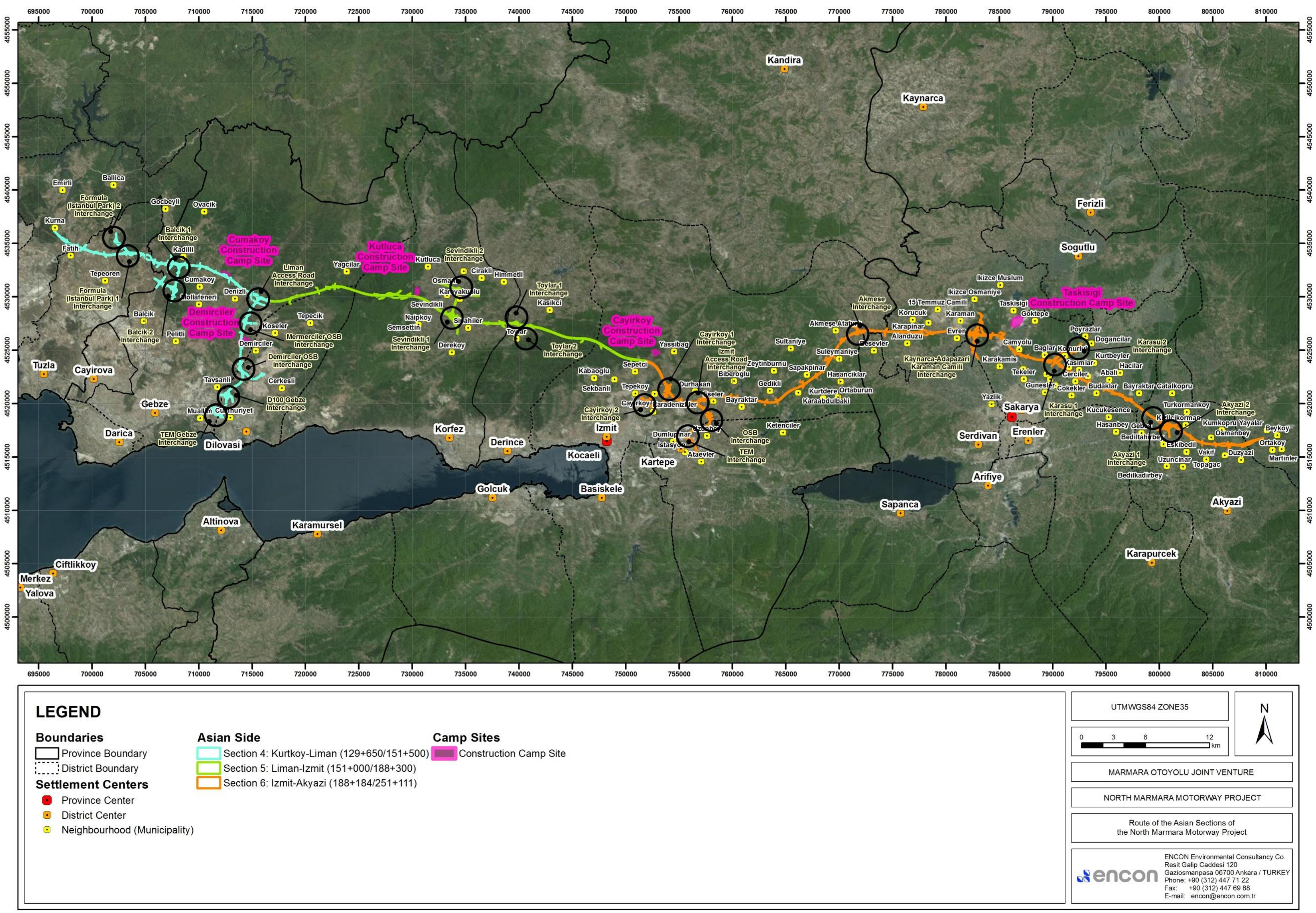


Figure 1.6. Route of the Asian Sections of the North Marmara Motorway Project

1.4. Uncertainty and Data Limitations

The ESIA Report prepared for the North Marmara Motorway is based on the information given in Chapter 3 ("Project Description"). The design of the Project has progressed in parallel to the ESIA studies. Route selection has reached an advanced level within the ESIA process however design and/or optimization of certain Project components (e.g. storage sites, etc.) are still going on. The assessments done in the scope of this ESIA Report are based on the most current design. The expropriation plans have been mostly completed for the current route and land use permits have been obtained for certain parts of the Project area. On the other hand, it should be noted that detailed engineering studies have not been finalized yet and Project optimization (e.g. change in the number, characteristic and locations of the engineering structures) may continue in the next phases of the construction. Other major uncertainties and/or data limitations that affected the assessments done in the scope of this ESIA Report are summarized below. Specific assumptions done for each subject are described in the relevant chapters of the ESIA.

- Site surveys have been conducted for all relevant environmental and social subjects (i.e. water, soil, air, background noise, flora and fauna, landscape, social) to collect/gather up-to-date/valid baseline information characterizing the existing conditions.
- However, it should be noted that the land preparation and construction works have already started in certain sections of the Motorway. Thus the baseline conditions along the Motorway corridor are subject to progressive change.
- Expropriation plans for most of the route have been made available in the scope of the ESIA but certain parts of the expropriation plans could not be reviewed as the approval process by the KGM have not been finalized at the time of the assessments. It should be noted that according to Article 13 of the BOT Contract and in accordance with the relevant provisions of the Expropriation Law (Law No: 2942), expropriation works for the North Marmara Motorway Project are not under the control and authority of the Project Sponsors and will be conducted by the KGM (government) as the related administrative authority. Currently, expropriation works have started and being conducted by the KGM.
- Geological-geotechnical survey reports have not been available for the entire route thus assessments specific to the Project area could be done only for the sections for which the surveys reports have been available at the time of the assessment.
- Locations and capacities of the storage sites have not been selected for all sections. Thus, such components could not been included in the related assessments (e.g. air quality modeling), whenever their location is not certain.
- Due to the time restrictions, baseline surveys could be conducted at the most convenient time within the ESIA period. Additional survey requirements for the characterization of baseline have been identified in the relevant impact assessment chapters.
- Traffic projections have been obtained from the Revised Feasibility Report issued by KGM in 2010 for the overall North Marmara Motorway Project including the Third Bosphorus Bridge. It has been assumed in the assessments done in the scope of this ESIA that the information contained in the Revised Feasibility Report is applicable to the current design.

CHAPTER 2

INSTITUTIONAL AND LEGAL FRAMEWORK

CHAPTER 2. INSTITUTIONAL AND LEGAL FRAMEWORK

This Chapter describes the institutional framework in Turkey and identifies the national legislation (i.e. environmental, cultural, health and safety, etc.) international agreements and protocols and international environmental and social standards including the Equator Principles (EPs) and International Finance Corporation's (IFC) Policy (2012) and related Performance Standards (PSs) on Environmental and Social Sustainability that would be applicable to the North Marmara Motorway Project.

2.1. Institutional Framework

Administrative structure in Turkey is governed by central and local administrations. The central administration is organized so that the land mass of the country is divided into provinces and the provinces into further smaller divisions (i.e. districts, municipalities, villages/neighborhoods) according to geographic and economic conditions, and the need for public services. For the purpose of meeting collective local needs, the populations of provinces, municipalities, and villages/neighborhoods are administered by units of local government established by law (*Toksoz, F., 2006*). A general depiction of the institutional framework in Turkey with relevance to the North Marmara Motorway Project is shown in Figure 2.1.

Ministries are the units of central administration. Local branches of ministries are composed of provincial organizations attached to governors and district organizations attached to the district governors (*Hacettepe University, Department of Political Science and Public Administration, April, 2015*). At the local level, municipality mayors and the headmen of the villages/neighborhoods (muhtar) are the representatives of the administrative structure.

2.1.1. Central Administrations

Central administration is the core of the administrative structure. Each Ministry, being a unit of central administration, is headquartered in Ankara, with units at the provinces serving as their field organizations (*Toksoz, F., 2006*).

Ministry of Transport, Maritime Affairs and Communications (MoTMAC) is the key central administration in the scope of the North Marmara Motorway Project. Under the Ministry, General Directorate of Highways is the authority responsible from the implementation of the Project.

In Turkey, the Ministry of Environment and Urbanization (MoEU) is the responsible organization for the implementation of policies adopted for the protection and conservation of the environment and for sustainable development and management of natural resources. Thus, the MoEU will be the authority with which the MoTMAC (through the GD of KGM) and the Project Sponsors will collaborate regarding the assessment and management of environmental aspects of the North Marmara Motorway Project.

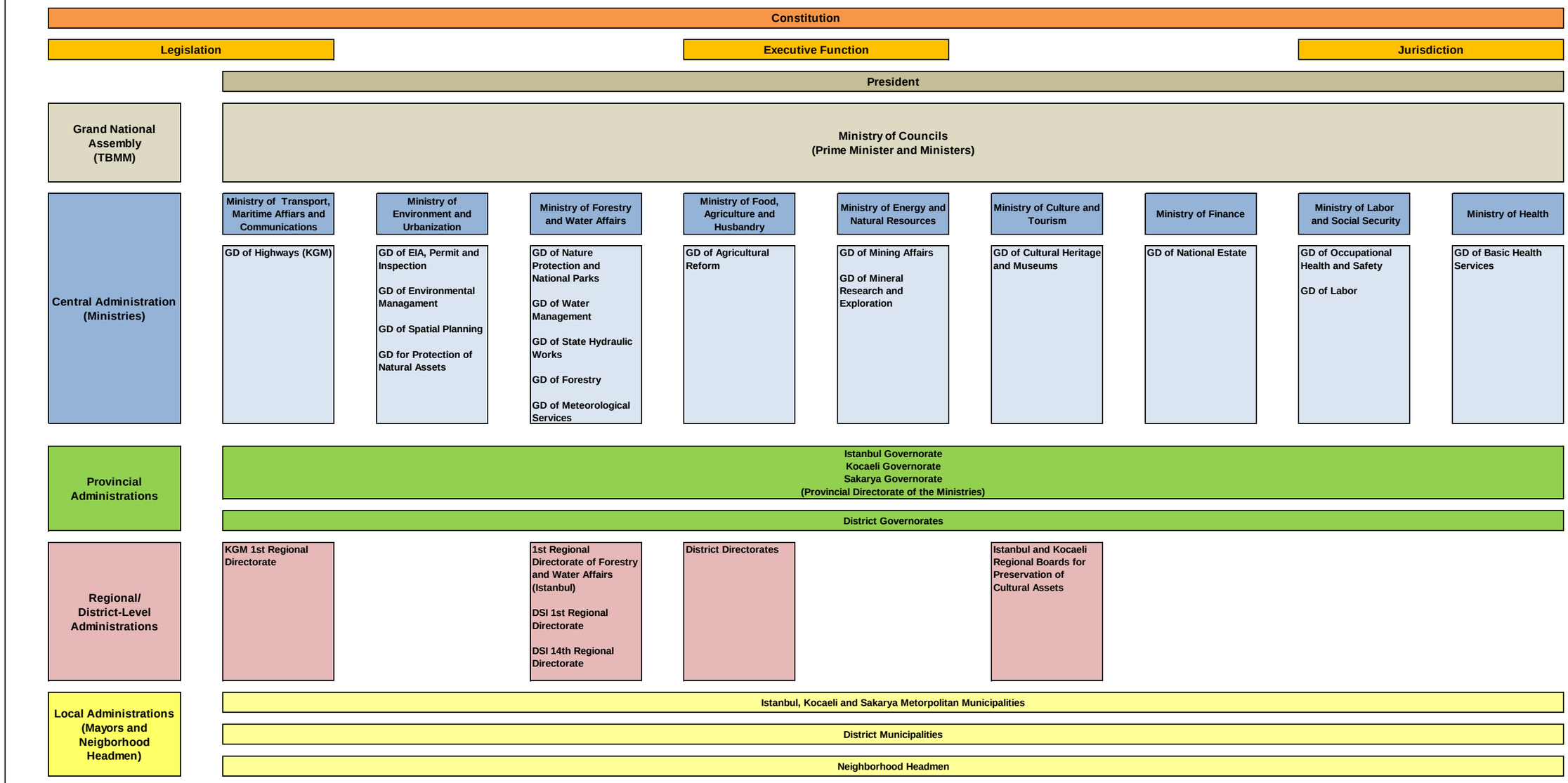


Figure 2.1. Institutional Framework in Turkey (in consideration of the Project)

The Ministry of Environment was first established as an Under-secretariat of the Prime Minister's office in 1987 and was promoted to the rank of Ministry of Environment in August 1991 by the Establishment Law No. 443. Then, the Ministry of Environment and Forestry was established in 2003 through a merger of the previously separate Ministry of Environment and the Ministry of Forestry. Recently, the environment part of the former Ministry of Environment and Forestry was separated and merged with the Ministry of Public Works and Settlement to form the Ministry of Environment and Urbanization (MoEU).

The MoEU has an overall coordinating role for the development and implementation of environmental policies in Turkey, including the approximation process for the EU environmental Acquis. The MoEU is composed of the 8 different general directorates. The general directorates, which are relevant to or may have an interest in the North Marmara Motorway Project, are listed below:

- Ministry of Environment and Urbanization
  - Directorate General of Environmental Management
  - Directorate General of EIA, Permit and Inspection
  - Directorate General of Spatial Planning
  - Directorate General for Protection of Natural Assets

Main environmental responsibilities of the MoEU are summarized below:

- To prepare the legislation on environment, public works, and housing development and monitor and audit the related implementations;
- To identify the principles and policies on environmental protection, rehabilitation of environment and prevention of environmental pollution, develop standards, criteria and programs in this context; outline the principles for implementing and monitoring these standards and criteria; undertake the works related to climate change;
- Assess the impacts of all facilities/activities that pollute the environment due to their activities resulting in solid, liquid or gaseous waste disposal/discharge into receiving environments; monitor, audit and issue the permits of such facilities/activities;
- Perform the measurements/analyses and monitoring studies concerning receiving environments;
- Establish the plans and policies regarding the global climate change and measures to be taken against its effects.

For the management of environmental issues, MoEU collaborates with other ministries, government agencies and relevant stakeholders. Ministries (through related General Directorates), which would be relevant to or may have an interest in the North Marmara Motorway Project, are listed below:

- Ministry of Transport, Maritime Affairs and Communications (MoTMAC)
  - General Directorate of Highways (KGM)

- Ministry of Forestry and Water Affairs
  - General Directorate of Nature Protection and National Parks
  - General Directorate of Water Management
  - General Directorate of State Hydraulic Works
  - General Directorate of Forestry
  - General Directorate of Meteorological Services

- Ministry of Food, Agriculture and Husbandry
  - General Directorate of Agricultural Reform

- Ministry of Culture and Tourism
  - General Directorate of Cultural Heritage and Museums

- Ministry of Energy and Natural Resources
  - General Directorate of Mining Affairs
  - General Directorate of Mineral Research and Exploration

- Ministry of Finance
  - General Directorate of National Estate

- Ministry of Labor and Social Security
  - General Directorate of Occupational Health and Safety
  - General Directorate of Labor

- Ministry of Health
  - General Directorate of Basic Health Services

2.1.2. Provincial, Regional and District Level Administrations

Provincial, regional and district level administrations are the field organizations of the Ministries. Under the MoTMAC, GD of KGM, Istanbul 1st Regional Directorate is the related local authority. The provinces of Kocaeli and Sakarya also fall in the jurisdiction of the 1st Regional Directorate of KGM. The area of jurisdiction of KGM 1st Regional Directorate is presented in Figure 2.2.

The MoEU, Ministry of Food, Agriculture and Husbandry, Ministry of Culture and Tourism and Ministry of Health have provincial directorates in each province under the related Governorate. Provincial directorates under the Istanbul, Kocaeli and Sakarya Governorates are the local governmental authorities related with the North Marmara Motorway Project.

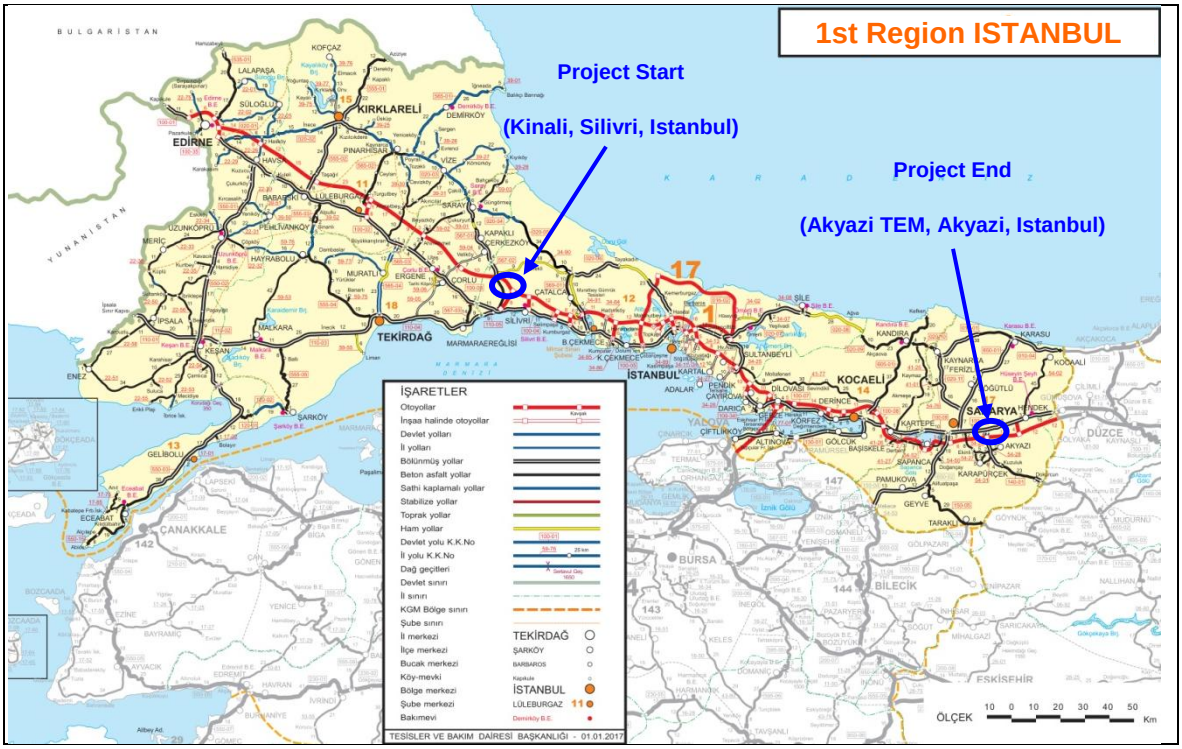


Figure 2.2. Jurisdiction Area of KGM's 1st Regional Directorate

In addition, the Project is located within the jurisdiction of the 1st Regional Directorate of the Ministry of Forestry and Water Affairs. The Motorway also passes through the jurisdiction areas of the 1st (Kocaeli province excluding Gebze district), 3rd (Sakarya province) and 14th (Istanbul province and Gebze district of Kocaeli) State Hydraulic Works (DSI) under the same Ministry.

Regarding the cultural heritage, Istanbul (for Istanbul province) and Kocaeli (for Kocaeli and Sakarya provinces) Regional Directorates of the Conservation of Cultural Assets under the Ministry of Culture and Tourism will be the responsible authority along the Motorway route.

2.1.3. Local Administrations

Local Administration, which functions under the administrative tutelage of the central administration, is divided into three main administrative tiers. These are the special provincial administrations, municipalities, and village/neighborhood administrations (*Toksoz, F., 2006*). Since all the three provinces (Istanbul, Kocaeli and Sakarya) are metropolitan municipalities, no special provincial administration is present. Istanbul Metropolitan Municipality, Kocaeli Metropolitan Municipality and Sakarya Metropolitan Municipality, related district municipalities and the neighborhood headmen are the local administrations relevant to the North Marmara Motorway Project.

2.2. Applicable Turkish Environmental and Social Legislation

Turkish Environmental Law (Law No: 2872), which came into force in 1983, handles environmental issues on a very broad scope. Under the Environmental Law, environmental regulations have been developed in line with national and international initiative and standards, and some of them have been revised recently to be harmonized with the European Union (EU) Directives in the scope of pre-accession efforts of Turkey.

Complementary to the Environmental Law and its regulations, the laws listed below also govern the protection and conservation of the environment, prevention and control of pollution, implementation of measures for the prevention of pollution, health and safety and labor issues:

- Electricity Market Law (Law No: 6446)
- Energy Efficiency Law (Law No: 5627)
- Expropriation Law (Law No: 2942)
- Forestry Law (Law No:6831)
- Groundwater Law (Law No: 167)
- Labor Law (Law No:4857)
- Law on the Conservation of Cultural and Natural Assets (Law No:2863)
- Law on Improvement of Olive Cultivation and Budding of Wild Species (No:3573)
- Law on Soil Protection and Land Use (Law No:5403)
- Mining Law (Law No:3213)
- Municipality Law (Law No: 5393)
- National Parks Law (Law No: 2873)
- Pasture Law (Law No:4342)
- Public Health Law (Law No: 1593)
- Resettlement Law (Law No: 5543)
- Traffic Law (Law No:2918)

The primary environmental laws, regulations, by-laws and communiqués and other complementary regulations applicable to the infrastructure projects are listed below in Table 2.1. Project Sponsors will comply with the requirements of relevant national legislations and codes of practice, and fulfill all other legal requirements.

Table 2.1. National Environmental Legislation Applicable to the Project

Subject	Name of the Legislation
Land Use and Soils	
Agricultural lands	Law on Soil Protection and Land Use
	Implementation Regulation on Soil Protection and Land Use
	By-law on Protection and Use of Agricultural Lands and Land Consolidation
	Law on Improvement of Olive Cultivation and Budding of Wild Species
	Regulation on the Improvement of Olive Cultivation and Budding of Wild Species
Forest lands	Forestry Law
	Implementation Regulation of 16th Article of the Forestry Law
	Implementation Regulation of 17/3rd and 18th Articles of the Forestry Law
Pasture lands	Pasture Law
	Pastures Regulation
Soils	Regulation on the Control of Soil Pollution and Lands Contaminated by Point Sources
	Regulation on the Extraction, Operation and Control of Sand, Gravel and Similar Materials
Rehabilitation	Regulation Concerning the Rehabilitation of the Lands Disturbed by Mining Activities
Socio-economics	
Land Acquisition	Expropriation Law
	Regulation on the Exchange of Treasury Lands in the scope of Expropriation for Motorway Construction Purposes
Resettlement	Resettlement Law
	Resettlement Implementation Regulation
Water and Wastewater	
Water and Wastewater Management	Water Pollution Control Regulation
	Urban Wastewater Treatment Regulation
	Regulation on Pit Opening Where Sewer System Construction is not Applicable
	Surface Water Quality Regulation
	Regulation on the Control of Pollution Caused by Dangerous Substances in and around the Water Bodies
	Regulation Concerning Water Intended for Human Consumption
	Regulation Concerning Protection of Groundwaters against Pollution and Deterioration
	Regulation Concerning Monitoring of Surface and Groundwater Resources
	Ordinance on Groundwater Resources
Air	
Air Quality	Regulation on the Control of the Air Pollution Sourced by the Industry
	Regulation on the Assessment and Management of Air Quality
	Regulation Concerning Follow up of Greenhouse Gas Emissions
	Regulation on the Control of Exhaust Gas
	Regulation on the Control of Air Pollution Sourced by Heating
	Regulation on the Reduction of Ozone Depleting Substances
	Regulation on the Monitoring of Greenhouse Gas Emissions
Odor	Regulation on Control of Emissions Causing Odor
Noise	
Environmental Noise	Regulation on the Assessment and Management of Environmental Noise
	Regulation on Environmental Noise Emission Caused by Equipments Used Outdoors
Wastes	
Waste Management	Regulation on Waste Management
	Regulation on the Control of Packaging Wastes
	Hazardous Wastes Control Regulation
	Regulation on the Control of Medical Wastes
	Regulation on the Control of Waste Oils
	Regulation on the Control of Waste Batteries and Accumulators
	Regulation on the Control of Waste Tires
	Regulation on the Control of Waste Vegetable Oils
	Regulation on the Control of Excavation Soil, Construction and Demolition Wastes
	Regulation on Mining Wastes
Landfills	Regulation on the Landfill of Wastes
	Circular on the Preparation of Implementation Project for Landfills
	Circular on Landfill of Mining Wastes and Technical Arrangement of Other Landfills
Nature and Cultural Heritage	
Protection	Law on the Conservation of Cultural and Natural Heritage
	Regulation on Procedures and Principles Concerning the Protection of Game and Wild Animals and their Habitats and Combat with their Pests
Wetlands	Regulation on the Protection of Wetlands

Subject	Name of the Legislation
Environmental Permits and Licenses	
General	Environmental Impact Assessment (EIA) Regulation
	Regulation on Environmental Permit and Licenses
	Environmental Auditing Regulation
	Regulation Concerning Environmental Officers, Environmental Management Unit and Environmental Consulting Firms
	Regulation for Starting Up and Opening a Workplace
	Communiqué on Certificate of Competency
Health and Safety	
Occupational Health and Safety	Labor Law
	Regulation on Occupational Health and Safety
	Regulation on Occupational Health and Safety at Mining Worksite
	Regulation on Methods and Essential for Work Health and Safety Training for Works
	Regulation on Health and Safety Signs
	Regulation Concerning the Use of Personal Protection Equipments at Workplaces
	Regulation on Health and Safety Measures to be taken at Works Involving Chemicals
	Regulation on Protecting Workers from Hazards of Explosive Environments
	Regulation Concerning Health and Safety Measures Associated While Working with Asbestos
	First Aid Regulation
	Regulation Concerning the Protection of Workers from Risks Associated with Vibration
	Regulation Concerning the Protection of Workers from Risks Associated with Noise
	Communiqué on Hazard Classes List related to Occupational Health and Safety
	Regulation on Prevention and Mitigation of Impacts of Large-Scale Industrial Accidents
Dangerous Substances	Regulation on the Transportation of Dangerous Materials on Motorways
	Regulation Concerning the Classification, Packaging and Labeling of Dangerous Substances
	Regulation on the Control of Polychlorinated Biphenyl and Polychlorinated Terphenyls
Structural Safety	Regulation on Structures to be Built in Disaster Zones
	Regulation on Structures to be Built in Earthquake Zones
	Regulation on the Protection of Buildings from Fire
Others	
General	Regulation Concerning the Increase of Efficiency in the Usage of Energy Resources
	Regulation on the Implementation of the Law Concerning Private Security Services

2.2.1. EIA Process under Turkish EIA Regulation

Under Article 10, Environmental Law sets out the general scope of the Environmental Impact Assessment (EIA) procedure in Turkey, indicating that institutions, agencies and establishments that lead to environmental problems as a result of their planned activities are obliged to prepare environmental impact assessment report or Project Information File. Based on this legal framework, the EIA Regulation was put into force for the first time after being published in the Official Gazette numbered 21489 and dated on February 7, 1993. Since then there had been several amendments in the first regulation and new EIA regulations were published in 2008 and 2013 repealing the former regulations in force. The latest EIA Regulation (2014 EIA Regulation) has been published in the Official Gazette dated 25.11.2014 and numbered 29186, which repealed the 2013 EIA Regulation.

Under its annexes, the EIA Regulation categorizes investments as projects subject to full EIA (Annex-1) and projects subject to screening-elimination criteria (Annex-2). This categorization is done based on the type of activity and/or plant capacity. If the planned investment is defined as an activity under Annex-1 of the EIA Regulation, a full EIA Report is required. For Annex-2 activities, first a Project Information File is prepared in accordance with a limited format specified in the Annex-4 of the EIA Regulation and the MoEU (“Ministry”) evaluates the need for a full EIA process for the project.

The categorization for motorway projects under Turkish EIA regulation is done according to the type or length of the road (km) as follows:

- Full EIA process is required for the following Annex-1 activities;
  - Highways and state motorways (Article 8-c)
  - Construction of express roads having four and more lanes (Article 8-ç)
  - Rehabilitation or expansion of the existing express roads having two or less lanes in a way that they are upgraded to have four or more lanes, extension of the motorway section that will be reconstructed or expanded in a way that it has a non-stop length of 10 km or more (Article 8-d)
- Limited EIA process is required to be conducted for the following Annex-2 activities;
  - Ring roads having a length of 20 km and more (Article 31-i)
  - Provincial roads (excluding the neighborhood and village roads; Article 31-j)
  - Change of the route of the motorway projects listed in Annex-1 and Annex-2 (of the EIA Regulation) in a way that they have a length of 20 km and more (Article 31-k)
  - Expansion of the existing provincial roads having two or less lanes for at least 20 km in a way that they are upgraded to have four or more lanes (Article 31-l)

According to the EIA Regulation in force (2014 EIA Regulation); projects, for which it is documented that they have started production or been put in operation before the first publishing date of EIA Regulation that is 07/02/1993, are out of the scope of the EIA Regulation (Temporary Article 2). Additionally, projects (including the structures and facilities that are required for the implementation of those projects), which are taken to the public investment program before 23/06/1997 and has started production or operation before 29/05/2013 are also out of the scope of the EIA Regulation (Temporary Article 3).

The North Marmara (including the Istanbul's Third Bosphorus Bridge) Motorway Project was put in the public investment program in 1991 with the number 1991E040150 and evaluated by the MoEU with its official letter dated 31/07/2009 (EIA Exemption Letter; see Annex-1.1) in the scope of Temporary Article 3 of the then-current EIA Regulation (2008 EIA Regulation). Temporary Article 3 ("Out of Scope Projects") of the 2008 Regulation specifies that "*As per the projects whose application projects have been approved or for which required approval, permit, license or expropriation decision has been taken or have been included in the investment program or whose local zoning plans have been approved before the Environmental Impact Assessment Regulation, which was published in the Official Gazette numbered 21489 and dated 07/02/1993 or those with documented proof of production initiation and/or operation stage inception before this date the provisions of this Regulation shall not apply, without prejudice to the provisions regarding permits envisaged by the Environment Law and other relevant regulations*".

KGM declared in its official letter (dated 22/08/2014) addressed to the MoEU that "*The Kinali-Odayeri (including the access roads) and Kurtkoy-Akyazi (including the access roads) sections, which are planned under second phase of the North Marmara (including the Third Bosphorus Bridge) Motorway Project, are integral components of the North Marmara (including the Third Bosphorus Bridge) Motorway Project and listed under the same Project heading, have the same location and located on the same route with the North Marmara (including the Third Bosphorus Bridge) Motorway Project numbered DPT 1991E040150".*

In the official letter of the MoEU dated 05/09/2014, it is stated that "*The provisions specified in the official letter of the Ministry dated 31/07/2009*[1] *are applicable to the Kinali-Odayeri (including the access roads) and Kurtkoy-Akyazi (including the access roads) section projects, which are planned under second phase of the North Marmara (including the Third Bosphorus Bridge) Motorway Project, on condition that the location of the projects, Project heading, scope and route are not changed*".

Accordingly, since the North Marmara Motorway (including the Third Bosphorus Bridge) Project was put in the public investment program before 07/02/1993 and the Kinali-Odayeri (inc. the access roads) and Kurtkoy-Akyazi (inc. the access roads) section have been approved as the integral components of the North Marmara Motorway (including the Third Bosphorus Bridge) Project, the EIA exemption decision issued for the North Marmara (inc. the Third Bosphorus Bridge) Motorway Project with the official letter of the MoEU dated 31/07/2009 was evaluated by the MoEU to be applicable to the North Marmara Motorway Project as well, which includes the construction, operation and transfer of the Kinali-Odayeri (inc. the access roads) and Kurtkoy-Akyazi (inc. the access roads) sections. Thus, no full or limited EIA report has been required for the Project. On the other hand, the ESIA Report to be prepared for the Project will aim to cover the relevant methodological requirements of the Turkish EIA Regulation.

2.2.2. Expropriation Process under Turkish Expropriation Law

As it is known, expropriation is the most widely used method for land acquisition. Article 46 of the Turkish Constitution explains that state and legal public entities, in cases of public benefit, are entitled to entirely or partially expropriate immovable properties in private possession, on condition that the real value of those immovable properties are paid in advance and in cash; and to establish easement (servitude) on these immovable properties in compliance with the procedures and principles set by expropriation law.

There are a large number of laws and regulations relevant to the implementation of land acquisition. Those can cited as follows; Expropriation Law (Law No: 2942), Resettlement Law (Law No: 5543), Code of Civil Law (Law No: 4721), Cadastre Law (Law No: 3402), Forest Law (Law No: 6831), Environment Law (Law No: 2872), Municipalities Law (Law No: 5393), Pasture Law (Law No: 4342) and Village Law (Law No: 442) and several implementation regulations pertaining to the above-mentioned laws. Expropriation implementation activities based on Turkish laws and regulations can be summarized in line with the following stages:

[1] MoEU's EIA Exemption Letter issued for the North Marmara Motorway (inc. Third Bosphorus Bridge) Project.

- Project approval (public benefit decision)
- Preparation of expropriation plans
- Identification of property owners and address investigation
- Expropriation decision
- Establishment of a “Valuation Commission” and the Valuation Process
- Establishment of a “Negotiation Commission” and purchasing process

Before describing the process under the Turkish Expropriation Law, it should be underlined that according to Article 13 of the BOT Contract and in accordance with the relevant provisions of the Expropriation Law, expropriation works for the North Marmara Motorway Project will be conducted by the KGM as the related administrative authority/responsible agency. Project Sponsors does not have any responsibility or authority regarding the execution of expropriation works but they are liable to provide up to 500 million TL for the expropriation costs in each section. The costs exceeding this amount will be provided by the KGM. The costs related with the procurement of services for the valuation works and others will be separately covered by the Project Sponsors.

The process under Turkish Expropriation Law starts with the approval of relevant ministry/authority of the expropriation works on behalf the public interest. This decision is made public at the office of village/neighborhood head for 15 days and then it is regarded as “cutoff date”. After the approval of the Project, expropriation plans are prepared. The actual size and boundaries of the immovable assets and resources are determined by land surveys and a scaled (usually with a scale of 1/5.000) expropriation map is prepared. Expropriation maps shall demonstrate the boundaries, surface area and kind of immovable assets and resources to be expropriated. Mainly title deeds, taxes and state registers and/or external researches are used for identification of the owners.

Stage by stage (in accordance with the expropriation priority) the project responsible agency takes the “expropriation decision” for designated areas and informs/requests to the Land Titling and Cadastre Directorate to put an “expropriation note” on the register of the relevant property. The responsible agency establishes a Valuation Commission of at least three experts to determine the values of assets and resources. Valuation commission determines the unit and ceiling values of assets and resources to be expropriated. Then, responsible agency establishes a negotiation commission within its own entity to reconcile with property owners on the value. Each negotiation commission comprises of at least three members. The commission sends an official invitation letter to each property owner without declaring the value for the asset that was previously estimated by valuation commission.

Article 27 of the Expropriation Law, states that; for the expropriation of immovable properties in situations for which Minister of Councils takes decision regarding the need or urgency for national defense in the scope of the implementation of the Law on National Defense Obligations (Law No: 3634) or during emergencies foreseen by special laws, the immovable property subject to expropriation may be seized by the related administration on condition that the procedures other than valuation shall be completed afterwards. In this process, following the request of the related administration, compensation amount for the immovable property shall be appraised by the court within 7 days through the experts assigned as per Article 10 and 15 of the Expropriation Law. Seizure shall only be made following the invitation to be done in accordance with Article 10 and the amount is deposited to the bank specified in the announcement.

In the scope of the North Marmara Motorway Project, for the parcels, for which agreements cannot be settled through the negotiations and expropriation cannot be carried out through the purchasing process, urgent expropriation will be applied in accordance with Article 27 of the Expropriation Law. In this context, initially an Urgent Expropriation Decision has been taken by the Council of Ministers on 11/10/2016 for the urgent expropriation of the immovable assets by the KGM in the scope of the North Marmara Motorway (including Third Bosphorus Bridge) Project. This Decision has been abolished with the publishing of a current Decision (Decision no: 2017/10039; Decision Date: 20/3/2017) in the Official Gazette dated 22/04/2017 and numbered 30046 (see Annex-1.2). The parcels listed in the current Decision will be subject to urgent expropriation, if required.

2.2.3. Resettlement Process under Turkish Resettlement Law

In Turkey, resettlement activities of the government are regulated by Resettlement Law (No: 5543). The Resettlement Law deals with the families applying to related governmental agencies in the project region and requesting government assisted resettlement. Law also covers the procedure of resettlement of immigrant families coming from other countries, as well as that of nomadic families.

Resettlement assistance of the government is provided to entitled families while expropriation compensation payments are paid to all individuals holding immovable properties in the project area. Three types of resettlement can be applied according to the choices and requests of affected families. Entitlement criteria related with resettlement whose lands will be expropriated are defined in Resettlement Implementation Regulation. According to the Regulation, owners requesting the resettlement must be residing at the project affected area, and they must earn annually less than 18 times monthly minimum official wages, and they should be seen as a family and must not be a civil servant.

Agricultural Resettlement: Agricultural resettlement is implemented through providing a family with the following; agricultural land at the amount of envisaged in special resettlement project, house, management building, animal for income generation, agricultural devices and tools, workbench and credits one or more.

Non-agricultural Resettlement: This type of resettlement is implemented through providing a family with the following: building plot at the amount provisioned in special resettlement project, house, devices, tools, workbench and loans one or more.

Physical Settlement: This type of resettlement is implemented through providing construction credit support to a family within the amount of loan determined by the Ministry (MoEU) with the aim of re-building (moving) of villages because of unsuitability of a village center or consolidating of villages because of dispersed settlement or villages which are fragmented as a result of disasters; after selling land (house plot) from village development areas to people in need.

Article 12 of Resettlement Law refers to the resettlement of persons whose immovable properties are expropriated and specifies eligibility criteria for government assisted resettlement as follows:

(1) Due to the construction of a dam, an area adjacent to the dam, an area under protection, airport, highway, railway, plant and other facilities related to national economy and defense will be erected by public institutions and organizations; and due to the implementation of special laws and in order to protect historical and natural valuables;

a) The families who have to leave their locations/places as a result of partial or full expropriation of their immobile properties,

b) The families who do not own any immovable property, but who reside in the expropriation area at least for three years before the beginning of the calendar year, in which the resettlement planning studies were commenced, will be resettled to the locations/places indicated by the MoEU according to the provisions of this Law, provided that they request.

(2) However, the families who own immovable properties to be expropriated but left their places before the commencement date of resettlement planning studies shall not be resettled. Within the last three years as of this date, the families who sold their immobile properties without any compulsory situation and did not purchase immovable property with the equal or higher value shall not be resettled even if they did not leave their places. The compulsory situations mentioned above shall be determined by the regulations.

(3) Among the families residing in the expropriation area, those who are affected from the expropriation implemented by the public institutions and organizations, can be resettled by the Ministry to a location indicated within their village boundaries upon their written application if they do not want to be resettled by the government in any other place, provided that the suggestion of relevant Governorate and the approval of the Ministry of Interior are obtained.

(4) Among the families included in the scope of the this article, and requested to be resettled by the Government; the families who do not apply within the ninety day following the ending date of the announcement of resettlement, and the families who do not commit to deposit the amount determined by the MoEU from their expropriation compensation they received or will receive, or their full expropriation compensation and additional increase awarded by court in the case that the amount of expropriation compensation is lower than the amount (determined by the Ministry) into the account of the Central Account Unit of the Ministry, shall not be resettled.

Article 9 of Resettlement Law explains the resettlement assistance (which is similar to World Bank Standards) as follows:

(1) The immigrants, nomads, the persons whose places/grounds are expropriated and persons who are decided to be relocated by the reason of the national security shall be resettled in cities, towns and villages by means of providing the following through debiting/repayment according to the provisions of this Law, and pursuant to the plan and the project (specific) prepared by the MoEU;

a) At first, house and its' house- plot (for building),
b) For craftsmen, artisans and tradesmen: work place and its' building plot and operation credit to enable them providing for their livelihood,
c) For farmers, land, necessary agricultural inputs, agricultural structures or plot of structure, and in kind and in cash operation and equipment credits as envisaged in agricultural resettlement project (specific),
d) In case of the request of the right holder families (entitled to resettlement), resettlement credits can be given to the families collectively or individually, if the house, work place and agricultural land are found by themselves and their suggestions are approved by MoEU.

(2) Annual operation and equipment credits provisioned in agricultural resettlement projects (specific) shall not be paid to the families who did not request the mentioned credits within two years following the transfer of their agricultural lands.

(3) For immigrants accepted to enter the country according to this Law, as of the date they pass (enter) the border gates with their used goods which are exempt of customs; and for the people whose grounds(immovable properties) are expropriated and for those who are resettled due to national security and for the nomads, as of time when they are transferred to their resettlement areas; they shall be provided the support of medical help, accommodation, food, fuel and the support of clothing (for once only) for persons in need, and gratuitous assistances for temporary re-settlement for those whose immovable properties are expropriated; these supports shall be provided according to the time, amount and the conditions specified in the regulations of the Law.

(4) Transportation (moving) of those (families) mentioned above to the resettlement areas (sites) shall be provided free of charge by the government according to the "Transportation (moving) Project" to be prepared (specifically) by the Ministry.

From the international standards point of view of, another important point is the allocation of expenditure regarding land acquisition and resettlement under a single/same budget item. Article 33 of the Resettlement Law states that the resettlement allowance will be allocated in the budget of the institution responsible for expropriation.

It should be noted that in the selection of the North Marmara Motorway route, physical displacement has been avoided to the extent the highway design criteria allowed. In the scope of the land acquisition process to be conducted for the potentially limited number of parcels on which buildings/structures located within the expropriation corridor according to the current design, it is essential that the related authorities to aim the conduct acquisition process based on negotiated settlements to be established in accordance with the Expropriation Law thus the affected families do not apply to government and request government assisted resettlement.

2.2.4. Cultural Heritage Management under Law on the Conservation of Cultural and Natural Assets

According to the Law on the Conservation of Cultural and Natural Assets (Law no: 2863), all cultural and natural properties requiring protection are considered as state property. As stated in the same law, the Ministry of Culture and Tourism and its local branches (Boards for Preservation of Cultural Assets, Museums) are the main national government institutions who have the authority of conducting the works of identification and registration of cultural assets and defining the conditions of conservation. In this respect, Kocaeli and Istanbul Regional Boards for Preservation of Cultural Assets are the sole competent authority within the scope of the North Marmara Motorway Project.

Due to intensity of cultural assets, there are more than one Preservation Boards in Istanbul. The Project area within Istanbul province is under the responsibility of Preservation Boards numbered I and V. The Project area within Kocaeli and Sakarya province is under the responsibility of Kocaeli Regional Board. The project is bound legally to follow the decision taken and shall be taken by the preservation board. Information on the relevant regional boards for the preservation of cultural assets is provided in Table 2.2.

Istanbul Archaeological Museums, Sakarya Museum and Kocaeli Museum will be responsible for officially supervising actions such as official monitoring and/or further activities (trial pits, salvage excavation, re-routing and remote sensing surveys) in line with the decisions taken by the relevant Regional Boards for Preservation of Cultural Assets. They will also prepare the conclusion reports about actions to be taken and submit to Preservation Board for re-evaluation of the sites. Information on the museum directorates is presented in Table 2.3.

North Marmara Motorway Project Management is responsible for conservation of immovable cultural assets in case of discovery, and implementation of plans minimizing the negative impacts of the construction activities over these assets and keeping relevant government institutions informed. In this respect, the Project management is obliged to prepare a plan which comprises of the construction activities and their impacts on the archaeological and immovable cultural assets located within the boundaries of the project construction and its impact area and to propose methods for eliminating or minimizing the negative impacts of construction activities over the concerned sites for the opinion of the directorate of Preservation Board.

Table 2.2. Relevant Regional Boards for Preservation of Cultural Assets

Regional Board for Conservation of Cultural Assets	District of Responsibility	Related Sections of the Motorway	Address	Phone	Fax
Istanbul Regional Board for Conservation for Cultural Assets No 1	Arnavutköy, Avcılar, Bağcılar, Bahçelievler, Bakırköy, Başakşehir, Bayrampaşa, Beylükdüzü, Büyükçekmece, Çatalca, Esenler, Esenyurt, Eyüp, Gaziosmanpaşa, Güngören, Kağıthane, Küçükçekmece, Silivri, Sultangazi	Section 1 Section 2 Section 7	Hobyar Mah. Büyük Postane Cad. No:72 Kat:2 Sirkeci-FATİH/İSTANBUL	(0212) 528 24 78	(0212) 512 26 36
İstanbul Regional Board for Conservation of Cultural Assets No 5	Adalar, Ataşehir, Çekmeköy, Kadıköy, Kartal, Maltepe, Pendik, Sancaktepe, Sultanbeyli, Tuzla, Ümraniye	Section 4 (from KM 139+650 to KM 139+528)	Hobyar Mah. Büyük Postane Cad. No:72 Kat:4 Sirkeci-FATİH/İSTANBUL	(0212) 512 09 20 (0212) 528 31 13	(0212) 528 31 13
Kocaeli Regional Board for Conservation of Cultural Assets	Düzce, Kocaeli, Sakarya, Yalova	Section 5 Section 6 Section 4 (from KM 139+528 to KM 154+800)	Kozluk Mah. İstasyon Cad. TCDD Eski Gar Binası Kat:2 İzmit/KOCAELİ	(0262) 323 29 26 (0262) 321 67 33	(0262) 323 29 36

Table 2.3. Relevant Museum Directorates

Museums	Provinces of Responsibility	Address	Phone	Fax
Istanbul Archaeological Museums Directorate	Istanbul	Istanbul Arkeoloji Müzeleri Alemdar Cad. Osman Hamdi Bey Yokuşu Sk, 34122, Gülhane / Fatih, İSTANBUL	(0212) 520 77 40	(0212) 527 43 00
Kocaeli Museum Directorate	Kocaeli	Arkeoloji ve Etnografya Müzesi Müdürlüğü, Eski Gar Binası, Demiryolu Caddesi Kemalpaşa KOCAELİ	(0262) 312 22 74	(0262) 325 53 54
Sakarya Museum Directorate	Sakarya	Semerciler Mah. Sait Faik Sok. No:36 SAKARYA	(0264) 277 36 68	(0264) 274 25 15

2.2.5. Project-specific Legal Arrangements

Prime Ministry Circular

In addition to the national environmental and social laws and regulation, a Prime Ministry Circular (Circular no: 2016/20) specific to the North Marmara Motorway Project (including Third Bosphorus Bridge) has been promulgated in the Official Gazette dated 24/08/2016 and numbered 29811 (see Annex-1.3). The Circular defines the measures that are to be taken to ensure that the North Marmara Motorway Project including the Kinali-Odayeri and Kurtkoy-Akyazi sections is completed within the specified duration under 16 different articles. In this respect, the Circular covers the issues/works related with expropriation, zoning plans, relocation of existing infrastructures, use of quarries and material borrow sites, allocation of treasury and forest lands and chance finds management. The Circular, under Article 11, states that the North Marmara Motorway Project shall have precedence over other projects with which it is in interaction or it may interact.

With regard to expropriation, the Prime Ministry Circular (numbered 2016/20) describes the following specific measures to allow the Project's expropriation works to be completed within the specified duration.

- Timely release of allowance required for the expropriation works to be conducted in the scope of the Project ensuring that the annual allowances are available within the first three months of the year;
- To finalize the court cases opened in the scope of Article 10 of the Expropriation Law regarding the valuation and registration in a short duration, related governmental authorities and institutions shall take the necessary measures; the information and documents to be requested by the KGM and courts for the valuation of the immovable properties subject to expropriation shall be provided by the related governmental authorities and institutions with due care within the shortest possible time;
- For the finalization of the expropriation works properly and urgently, related branches of the General Directorate of Land Registry and Cadastre shall immediately conduct all the works related to delivery of information and documents necessary for the preparation of expropriation plans, control of the plans at the office and on the field and land registration and registration/deletion of the immovable properties for which expropriation works are completed in accordance with the Expropriation Law.

Urgent Expropriation Decision

An Urgent Expropriation Decision was initially taken by the Council of Ministers on 11/10/2016 for the urgent expropriation of the immovable assets by the KGM in the scope of the North Marmara Motorway (including Third Bosphorus Bridge) Project (see Annex-1.2). This Decision has been abolished with the publishing of a current Decision (Decision no: 2017/10039; Decision Date: 20/3/2017) in the Official Gazette dated 22/04/2017 and numbered 30046 (see Annex-1.2). The parcels listed in the current Decision will be subject to urgent expropriation, if required. Thus, parcels listed in the former urgent expropriation decision dated 2016 have been revised in the current decision dated 2017 to reflect the actual parcels to be expropriated according the final route approved by the KGM.

2.2.6. Environmental Permitting and Licensing Requirements

The North Marmara Motorway Project has been exempted from the requirements of the Turkish EIA Regulation with the EIA Exemption Letter provided by the MoEU (see Annex-1.1) thus no "EIA Positive Certificate" is required for the Project. Main environmental permits and/or licenses that would be required for the Project are listed in Table 2.4.

Table 2.4. Main Environmental Permits and/or Licenses that would be Required

Project Phase	Permit/License/Approval/Agreement	Status of Permitting (Completed (C)/On-going (ONG)/ Not Started (NS))		
		Section 4	Section 5	Section 6
Land Preparation and Construction				
Land Use	Forestry permit	ONG	ONG	ONG
	Permit for the use of pasturelands	ONG	ONG	ONG
	Permit for the use of agricultural lands for non-agricultural purposes	ONG	ONG	ONG
	Land use agreements with state authorities	ONG	ONG	ONG
Construction and Camp Sites	Crossing permits/approvals for railroads, rivers, roads, canals, power supply lines, natural gas pipelines, etc.	ONG	ONG	ONG
	Utility permits for the temporary connection to existing utilities	ONG	ONG	ONG
	Fuel storage permit	NA	C	NS
	Permits for service roads	C	C	C
	Provisional operation certificate/environmental permit for the operation of concrete plants	NS	NS	C
	Provisional operation certificate/environmental permit for the operation of asphalt plants	ONG	NS	NS
Water/Wastewater Management	Groundwater utilization permit	ONG	ONG	NS
	Provisional operation certificate/environmental permit for the operation of package wastewater treatment plants	ONG	ONG	ONG
	Wastewater treatment plant identity	ONG	NS	ONG
Waste Management	Permit for temporary waste storage areas	NS	NS	NS
	Waste management plan approval	NS	NS	NS
	Agreements with licensed waste management/disposal companies	ONG	ONG	ONG
Quarry Operation	Raw material production/quarry operation license	NS	C	ONG
	Permission to use long vehicles	NS	NS	NS
Blasting and Explosives Management	Blasting permit	C	C	
	Permit for storage of explosives	ONG	ONG	ONG
Others	Private security permit	ONG	ONG	ONG
	Work permit for foreign personnel	NA	NA	NA
	Residence permit for foreign personnel	NA	NA	NA
Operation				
Water/Wastewater Management	Provisional operation certificate/environmental permit for the operation of package wastewater treatment plants at the service areas or connection quality control certificate and/or wastewater channel connection document	Not Applicable at this stage.		
Others	Certificate for starting up and operating of a workplace			
	Private security permit			

2.3. Relevant International Agreements, Conventions and Protocols

Turkish national policy on protection of environment, cultural heritage and conservation of biological resources has been constituted on the base of relevant international agreements that Turkey has signed or ratified. Relevant environmental international agreements, conventions and protocols that have been ratified by Turkey are listed in Table 2.5.

Table 2.5. International Agreements, Conventions and Protocols that have been Ratified by Turkey

Name of the Legislation	Date of Convention/ Agreement/ Protocol Signature	Date of Ratification by Turkey
Air Quality and Climate Change		
Convention on Long Range Transboundary Air Pollution (CLRTAP)	13.11.1979	18.04.1983
Vienna Convention for the Protection of the Ozone Layer	22.03.1985	20.09.1991
Montreal Protocol on Substances Depleting the Ozone Layer (1990)	16.09.1987	19.12.1991
UN Framework Convention on Climate Change (UNFCCC)	26.06.1992	24.05.2004
Kyoto Protocol (1997)	11.12.1997	26.08.2009
United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (1990)	14.11.1994	31.03.1998
Biodiversity, Natural and Cultural Heritage		
Convention on the Protection of the World Cultural and Natural Heritage (1983)	23.11.1972	16.03.1983
Bern Convention on Protection of Europe's Wild Life and Living Environment (1984)	19.09.1979	02.05.1984
UN Convention on Biological Diversity (Rio Convention) (1996)	05.06.1992	24.10.2003
Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (RAMSAR) (1994)	02.02.1971	13.09.1994
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1996)	03.03.1973	22.12.1996
Mediterranean Sea Protocol Concerning Specially Protected Areas and Biodiversity (1988)	23.03.1986	29.09.1986
Convention for the Protection of the Architectural Heritage of Europe (1985)	1985	11.10.1989
European Convention on the Protection of the Archaeological Heritage (1969)	06.05.1969	-
European Cultural Convention (1954)	19.12.1954	10.10.1957
Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property	14.11.1970	21.04.1981
Conservation of Intangible Cultural Heritage Convention	17.10.2003	27.03.2006
European Landscape Convention (Florence Convention) (2001)	20.10.2000	13.10.2003
Environmental Pollution		
The Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) (1981)	16.02.1976	12.06.1976
The International Convention on the Established of an International Fund for Compensation for Oil Pollution Damage (FUND 1992)	1992	17.08.2002
International Convention on Civil Liability for Oil Pollution Damage (1992)	1992	27.07.2001
Convention for the Protection of the Black Sea Against Pollution (Bucharest) (1994) and its protocols including the Protocol for the Protection of Biological and Landscape Diversity in the Black Sea (2004)	21.04.1992	1994
Convention on The Prevention Of Marine Pollution By From Ships (Marpol) (73/78)	02.11.1983	24.06.1990
Hazardous Substances and Waste Management		
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	22.05.1989	07.02.1994
Stockholm Convention on Persistent Organic Pollutant (POPs)	22.05.2001	12.01.2010
Others		
International Labor Organisation (ILO) Conventions (Basic Conventions, 8 out of 8 signed) (Technical Conventions 48 out of 177 signed) (Administrative Conventions 3 out of 4 signed)	http://www.ilo.org/	http://www.ilo.org/ankara/conventions-ratified-by-turkey/lang--tr/index.htm

2.4. Applicable International Environment and Social Standards and Guidelines

International financial institutions follow certain policies and procedures regarding assessment and management of environmental and social impacts of the projects to be financed. The relevant environmental and social requirements of these institutions are mainly based on World Bank Group (WBG) Safeguard Policies. For the private sector financing, WBG/International Finance Corporation's (IFC) Environmental Health and Safety Guidelines and Performance Standards on Environmental and Social Sustainability have become the one of the most important international requirements. These standards have also been adopted by the major international private banks through the so called Equator Principles (EPs). These principles aim to ensure that projects to be financed by these banks are developed in a socially and environmentally sound manner.

The ESIA Report to be prepared for the North Marmara Motorway Project will be in accordance with the Equator Principles (III) and IFC's Performance Standards on Environmental and Social Sustainability and general as well as sector-specific Environmental, Health and Safety Guidelines. Key points of each international principle, standard and guideline is provided in the following sections. It should be noted that when Turkish (host country) regulations differ from the levels and measures presented in the EHS Guidelines, the Project will aim to achieve whichever is more stringent.

2.4.1. Equator Principles III

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The EPs apply globally to all industry sectors.

Most of the large private international banks (so called Equator Principles Financial Institutions-EPFIs) have officially adopted these principles (based on EPs III that have been effective from June 2013), summarized below, to ensure that the projects financed or advised by them are developed in a manner that is socially responsible and reflect sound environmental management practices.

Principle 1: Review and Categorization

When a Project is proposed for financing, the EPFI will, as part of its internal environmental and social review and due diligence, categorize it based on the magnitude of its potential environmental and social risks and impacts. Such screening is based on the environmental and social categorization process of IFC (Category A, B or C). Using categorization, the EPFI's environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts.

Principle 2: Environmental and Social Assessment

For all Category A and Category B Projects, the EPFI will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project. The Assessment Documentation should propose measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project.

Principle 3: Applicable Environmental and Social Standards

The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan

For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System. Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards.

Principle 5: Stakeholder Engagement

For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.

Principle 6: Grievance Mechanism

For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the Environmental and Social Management System, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user.

Principle 7: Independent Review

For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the Environmental and Social Management System, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

An important strength of the Equator Principles is the incorporation of covenants linked to compliance. For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects.

Principle 9: Independent Monitoring and Reporting

To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan, the EPFI will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFI.

Principle 10: Reporting and Transparency

For all Category A and, as appropriate, Category B Projects, the client will ensure that, at a minimum, a summary of the ESIA is accessible and available online; and the client will publicly report GHG emission levels during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

2.4.2. IFC's Standards and Guidelines

2.4.2.1. Performance Standards on Environmental and Social Sustainability

IFC published its current Policy on Environmental and Social Sustainability in 2012. Within the framework of this Policy, it applies a comprehensive set of Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in the member countries eligible for financing. The Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets.

The following eight Performance Standards establish the requirements that the client has to meet throughout the life of an investment supported by IFC or other relevant financial institution using these Standards:

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

In brief, the objectives of Performance Standard 1 are;

- To identify and evaluate environmental and social risks and impacts of the project,
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and where residual impacts remain, compensate/offset risks and impacts to workers, Affected Communities, and the environment,
- To promote improved environmental and social performance of clients through the effective use of management systems,
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately,
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Performance Standards 2 through 8 describe potential environmental and social risks and impacts that require particular attention. Where environmental or social risks and impacts are identified, the client is required to manage them through its Environmental and Social Management System (ESMS) consistent with Performance Standard 1, which is applicable to all projects that may have environmental and social risks and impacts. Applicability of IFC's Performance Requirements/Standards is summarized in Table 2.6.

Table 2.6. Applicability of IFC's Performance Standards

IFC	Performance Standards (2012)	Applicability (Yes/No)
PS 1	Assessment and Management of Environmental and Social Risks and Impacts	Yes
PS 2	Labor and Working Conditions	Yes
PS 3	Resource Efficiency and Pollution Prevention	Yes
PS 4	Community Health, Safety and Security	Yes
PS 5	Land Acquisition and Involuntary Resettlement	Yes
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes
PS 7	Indigenous Peoples	No
PS 8	Cultural Heritage	Yes

2.4.2.2. General Environmental, Health, and Safety (EHS) Guidelines

In addition to the Performance Standards, IFC publishes health and safety guidelines that provide examples of general and subject-specific Good International Industry Practices (GIIP). In this respect, IFC published General EHS Guidelines in April 2007. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. The document provides guidance for effective management of environmental, occupational health and safety, and community health and safety aspects of the projects including their construction and decommissioning phases. Besides the General EHS Guidelines, IFC has published sector-specific guidelines for a variety of industries including the Toll Roads and Construction Materials Extraction, as described below. Relevant aspects of the Environmental, Health, and Safety (EHS) Guidelines would be applicable to the North Marmara Motorway Project and will be considered in the scope of the ESIA Report.

2.4.2.3. Environmental, Health, and Safety (EHS) Guidelines for Toll Roads

The EHS Guidelines for Toll Roads, published in April 2007, include information relevant to construction, operation and maintenance of large, sealed road projects including associated bridges and overpasses.

2.4.2.4. Environmental, Health, and Safety (EHS) Guidelines for Construction Materials Extraction

The EHS Guidelines for Construction Materials Extraction, published in April 2007, includes information relevant to construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite, as well as to the extraction of dimension stone. It addresses stand-alone projects and extraction activities supporting construction, civil works, and cement projects.

2.4.3. Project Categorization

According to World Bank policies, projects to be invested in are classified as Category A, B or C based on environmental and social criteria. Based on World Bank Operational Policy 4.01 (Environmental Assessment), definition of these project categories may be briefly given as follows:

- Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral Environmental Assessment).

- Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas (including wetlands, forests, grasslands, and other natural habitats) are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of Environmental Assessment for a Category B is narrower than that of Category A. The findings and results of Category B Environmental Assessment are described in a project documentation such as Project Appraisal Document or Project Information Document.

- Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further Environmental Assessment action is required for a Category C project.

IFC, in its Guidance Note 1 on the Assessment and Management of Environmental and Social Risks and Impacts, states that "For certain projects, and particularly for greenfield investments and projects (including, but not limited to, major expansion or transformation-conversion activities) involving specifically identified physical elements, aspects and facilities that are likely to generate potentially significant adverse environmental and social risks and impacts, the client should conduct a comprehensive full-scale ESIA". Accordingly, North Marmara Motorway Project would be categorized as "A" based on World Bank and IFC's criteria and thus a comprehensive full-scale ESIA Report would be required for the Project.

To provide further evaluation in the scope of national and international categorization criteria in consideration of existing indicative lists of Category A project, the screening criteria defined in the European Union's (EU) EIA Directive and Turkish EIA Regulation is also considered as described below.

According to the EU's EIA Directive, all projects listed in Annex I of the Directive, are considered as having significant effects on the environment and require an EIA (*http://ec.europa.eu*). "Construction of motorways and express roads" and "Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes" are listed under Article 7 of the EIA Directive's Annex I list. Thus, the North Marmara Motorway would be categorized as an Annex I activity according to the EU's EIA Directive.

As Turkey gained a candidate country status in EU access process in 1999, the Turkish EIA Regulation has been harmonized with the EU's EIA Directive with several revisions and amendments made on the regulation since then. In parallel to the categorization approach of EU's EIA Directive, the Turkish EIA Regulation requires an EIA Report to be prepared for the activities listed under Annex-1 of the EIA Regulation. As mentioned in Section 2.2.1, "Highways and state motorways (Article 8-c)" and "Construction of express roads having four and more lanes (Article 8-ç)" are listed as Annex-1 activities thus, same with the categorization under EU's EIA Directive, North Marmara Motorway would be an Annex-1 activity according to the Turkish EIA Regulation (see Section 2.2.1 for the EIA exemption criteria) as well.

In consideration of the all the categorization approach and criteria of the IFC, EU's EIA Directive and Turkish EIA Regulation, the North Marmara Motorway, which is likely to include activities and components that are to be effectively managed to avoid or minimize significant environmental and social impacts, would be identified as a "Category A" project by potential lenders and thus an EIA/ESIA Report would be required for the Project.

2.5. Project Standards

Project Sponsors are committed to comply with the requirements of applicable national legislation as well as Equator Principles (EPs) and IFC's environmental and social performance standards and general/sector specific environmental, health and safety guidelines. When the measures, standards and levels/limit values specified in national legislation differ from the ones specified by IFC or EPs, the Project will aim to meet whichever is more stringent. Specific measures, standards, levels and/or limit values applicable to each environmental or social subject are defined in the relevant individual ESIA chapter of this report.

CHAPTER 3

PROJECT DESCRIPTION

CHAPTER 3. PROJECT DESCRIPTION

The North Marmara Motorway was initially planned as an integrated Project starting at Kinali interchange in Silivri, Istanbul and ending at the Akyazi TEM interchange in Akyazi, Sakarya, which crosses the sea by a Third Bosphorus Bridge. Once the location of the Third Bosphorus Bridge has been selected between Garipce (Sariyer, Istanbul) and Poyraz (Beykoz, Istanbul) neighborhoods, feasibility studies were conducted by the General Directorate of Highway (KGM) by dividing the entire Motorway route between Kinali and Akyazi into seven different sections. Later in the process, the authorities decided to separate the Third Bosphorus Bridge and its associated Motorway section from the Project and tender it out individually due to emerging conditions. Accordingly, Section 3 of the Project, which included the Third Bosphorus Bridge and its associated Motorway section between Odayeri and Pasakoy, has been separately constructed and taken into operation in August 2016.

Following the feasibility stage and tendering of Section 3 (including the Third Bosphorus Bridge), the European and Asian sections of the Project have been revised, keeping the ultimate starting (Kinali) and ending (Akyazi) points of the feasibility route the same and ensuring connection to Section 3 of the Motorway at Odayeri (European sections) and Pasakoy (Asian sections) locations as originally planned. Consequently, the European and Asian sections of the Project were tendered out in May 2016. In this tender, the European sections included Section 1: Kinali-Yassioren, Section 2: Yassioren-Odayeri and Section 7: Habibler-Hasdal; and the Asian sections included Section 4: Kurtkoy-Liman, Section 5: Liman-Izmit, and Section 6: Izmit-Akyazi. This ESIA Report has been prepared for the Asian sections (Section 4, 5 and 6) of the North Marmara Motorway Project, where the European sections (Section 1, 2 and 7) are subject of a separate ESIA study conducted in parallel to this study.

The Asian part of the North Marmara Motorway Project will have components distributed in three sections between Kurnakoy neighborhood in Pendik district of Istanbul, which is located in the southeast of Pasakoy interchange (the ending point of Section 3) and Akyazi TEM interchange in Akyazi district of Sakarya. According to the current route design (as of March 2017), total length of the Motorway's Asian sections, including the main carriageway and the access roads, is 186,9 km, as detailed in Table 3.1.

Table 3.1. Route Design (as of March 2017) for Asian Sections

Section Number	Section Name	Start and End Locations of the Section		Length of the Section (km)		
		Start Location (km)	End Location (km)	Main Road (Motorway)	Access Road	Total
Section 4	Kurtkoy-Liman	129+650	151+500	21,9	21,7	43,6
Section 5	Liman-Izmit	151+000	188+300	36,8	20,2	57,0
Section 6	Izmit-Akyazi	188+184	251+111	62,9	23,4	86,3
Asia Total				**121,6**	**65,3**	**186,9**

In accordance with the terms of the BOT Contract signed between the KGM and the Project Sponsors, the Project includes financing, planning/design, building/construction, operation, full range of maintenance and repair works during the operation period and transfer of the Motorway to the KGM at the end of the Contract Duration free from any debt or commitment and in a well-maintained, operating, in-service condition, without any charge. The rights of the Project Sponsors to operate, maintain and repair the Motorway will expire at the end of the Contract Duration.

According to the BOT Contract, Contract Duration covers both the construction and operation phases. Contract Duration for the Asian sections has been specified as 6 years 9 months 12 days and the total investment cost for these sections has been estimated as 4.487.000.000 TL including the expropriation costs up to 500 Million TL and excluding the value added tax (VAT). Maximum construction period is 3 years after the effective (signing) date of the contract. If the construction period exceeds 3 years, the delay time (the time after 3 years) will be deducted from the operation period. If the construction of the Motorway is completed before the end of foreseen construction period (3 years), the remaining time will be added to operation period.

3.1. Project Design Criteria

Motorways are access-controlled highways that have two or more traffic lanes in each direction and provide uninterrupted flow, on which opposing traffic is separated by a median and collection of tolls are performed at designated points. North Marmara Motorway has been designed in accordance with the KGM's technical specifications for motorways. The design criteria specified by the KGM for the North Marmara Motorway is listed in Table 3.2.

Table 3.2. Motorway Design Criteria

Project Component	Unit	Motorway (Main Carriageway)	Access Roads
Project speed	km/hour	120	100
Width of the traffic lane	m	3,75	3,50
Number of traffic lanes	-	2x4	2x2
Shoulder width (emergency lane)	m	3	3
Side width for guardrails (at fill)	m	1	1
Central reserve width	m	5	3
Shoulder width for central reserve	m	1	1
Normal standard side slope/minimum superelevation	%	2,5	2,5
Maximum superelevation	%	6,0	6,0
Minimum radius for horizontal curve	m	1.000	600
Radius for horizontal curve (min. superelevation=2,5%)	m	3.000	2.000
Radius for horizontal curve with no superelevation requirement	m	5.000	4.500
Minimum vertical clearance for bridges	m	5	5

Source: KGM, August 2010.

A typical cross-section for the North Marmara Motorway's main carriageway is provided in Figure 3.1. As can be seen from this cross-section, the Motorway will be a dual carriageway having 4 lanes in each direction (4 x 2). Each of the 8 lanes will have a width of 3,75 meters (3,75 m x 8). The central reserve will be 5 meters (2,5 m x 2) plus 2 meters of lined shoulder (1 m in each side of the reserve). At the outer side of the traffic lanes in each direction, there will be 3 meters of lined shoulders that will serve as emergency strips. Thus, the total width of the main carriageway (consisting of traffic lanes, central reserve and the lined shoulder for both direction) will be 43 meters (21,5 m x 2). There will be also ditches as required in both sides of the main carriageway. The design speed for the passenger cars on the main carriageway (including viaducts, tunnels, bridges, etc.) will be 120 km/hour. Additional drawings for Motorway's main carriage way, access roads, excavation and fill zones, interchanges, etc. are provided in Annex-2.

Access roads will have a different design when compared to main carriageway. Access roads will be composed of 2 lanes in each direction (2 x 2). Each of the four lanes will have a width of 3,5 meters (3,5 x 4). The central reserve in access roads will be 3 meters (1,5 m x 2) plus 2 meters of lined shoulder (1 m in each side of the reserve). At the outer side of the traffic lanes in each direction, there will be 3 meters of lined shoulders that will serve as emergency strips. Thus, the total width of the access roads' carriageways (consisting of traffic lanes, central reserve and the lined shoulder for both direction) will be 25 meters (12,5 m x 2). The design speed for the passenger cars on the main carriageway will be 100 km/hour. Typical cross-section for Motorway's access roads is presented in Figure 3.2. There will be also ditches as required in both sides of the main carriageway (see Annex-2). Design speed at the interchange arms will vary between 50 and 80 km/hour depending on the radius of the horizontal curve. Minimum relative slope will be %0,4, while maximum slope will vary between %0,50 and %0,65. Additional design criteria are listed below:

- For all types of topographical models, side slope for standard coating shall be 2,5% and superelevation will not exceed 6%.
- Vertical clearance shall be minimum 5 meters for all roads passing over or under the Motorway.
- Acceleration lanes for the vehicles approaching the Motorway shall have a width of 3,75 meters and sufficient length to ensure safety.
- Embankment (fill) slopes (s) shall be determined based on the height (h) of the embankment as follows:
  - For h<1,5 m ; s=4:1;
  - For 1,5 m<h<3 m ; s=3:1;
  - For 3 m<h<5 m ; s=2:1;
  - For h>5 m ; s shall be determined according to the geological-geotechnical report
- Cutting slopes shall be determined base on the results of drilling and geotechnical studies.
- Minimum bench width shall be 5 meters on the embankments and cuttings. Additionally, side slope shall be 5% towards the direction of the slope.
- Horizontal (i.e. shoulder lines, traffic lines, parking lines, etc.) and vertical signing (i.e. traffic signs, plates, etc.) of the Motorway will be in accordance with KGM's technical specifications (i.e. dimensions, color, material, reflectivity features, numbering, information figures, location of signs, etc.).

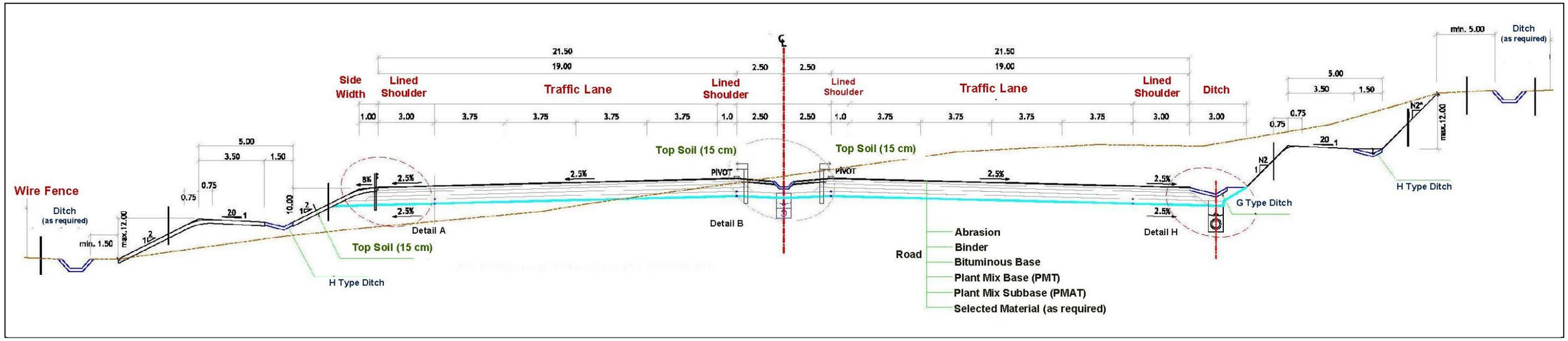


Figure 3.1. Typical Cross-section for the Motorway's Main Carriageway (with side slope)

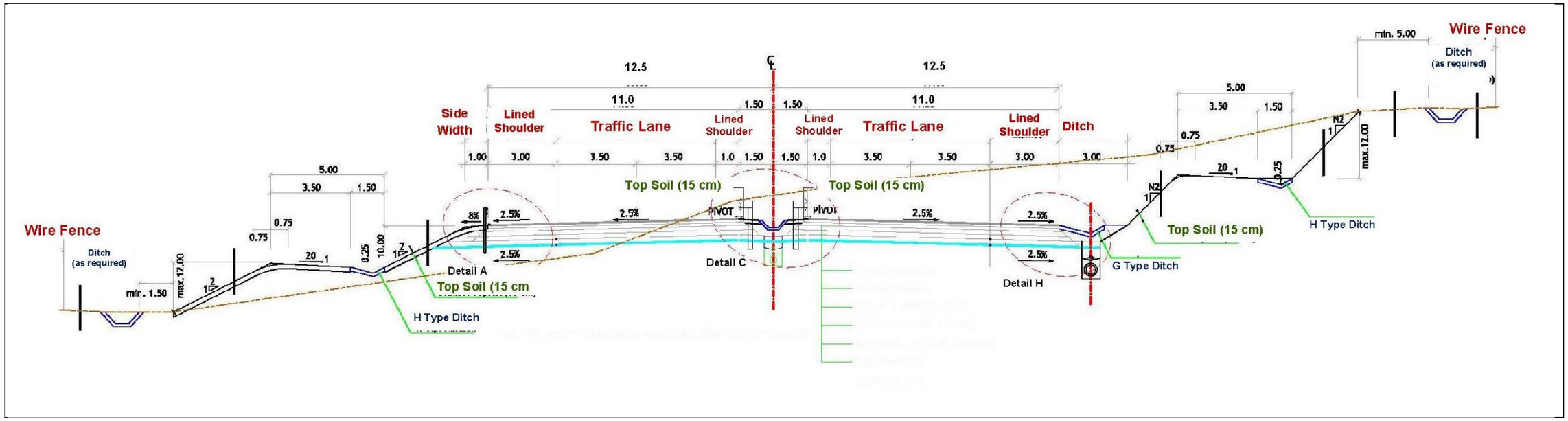


Figure 3.2. Typical Cross-section for the Motorway's Access Roads

3.2. Description of Activities and Project Components

The main activities to be conducted before the commissioning of the North Marmara Motorway will include the land acquisition, land preparation and construction stages. In this scope, before the start of construction works, the lands on which the Motorway and its components will be located, will be acquired in line with the applicable Turkish laws and regulations. In the scope of the North Marmara Motorway Project, KGM is the authority responsible from the implementation of expropriation works in accordance with the national Expropriation Law. For the forestry lands, treasury lands and other state-owned lands, necessary permits, land use permits and/or easement rights will be obtained by KGM from the related authorities in the scope of applicable legislation.

The works on a new route consist of three main steps. The first step, substructure works, start with earthworks that involve activities such as top soil stripping, poor soil excavations, and cut-fill operations. Following the earthworks, construction of engineering structures including bridges, underpasses, overpasses, retaining walls, culverts, concrete pipes, viaducts and tunnels, are performed. For the construction of tunnels, blasting operations will be conducted as necessary by taking the necessary permits. As the next step, pavement works, including the formation of subbase, base, asphalt layer and concrete or parquet paving for special situations, are conducted (*http://www.kgm.gov.tr*). Following the completion of substructure and pavement works, finishing operations that involve the placement of horizontal and vertical traffic signs and installation of guardrails and fences are conducted. Once the park and service areas, maintenance/operation centers and toll collection systems are prepared, the Motorway become ready for the tests and commissioning. This standard procedure will be followed in the construction of the North Marmara Motorway.

Construction of service roads to provide access to Camp Sites is not generally required for Asian sections as there are alternative access road options that do not pass through nearby settlements. When the Project has to cross existing infrastructure (e.g. sewage, electricity, water supply, telecommunication, natural gas, etc. lines), they will be relocated in the scope of the construction works so that no permanent interruption would occur on the services provided to local users. Similarly, some of the existing roads may need to be temporarily closed and the users of the affected roads will be directed to the service roads to ensure local transportation services are not interrupted.

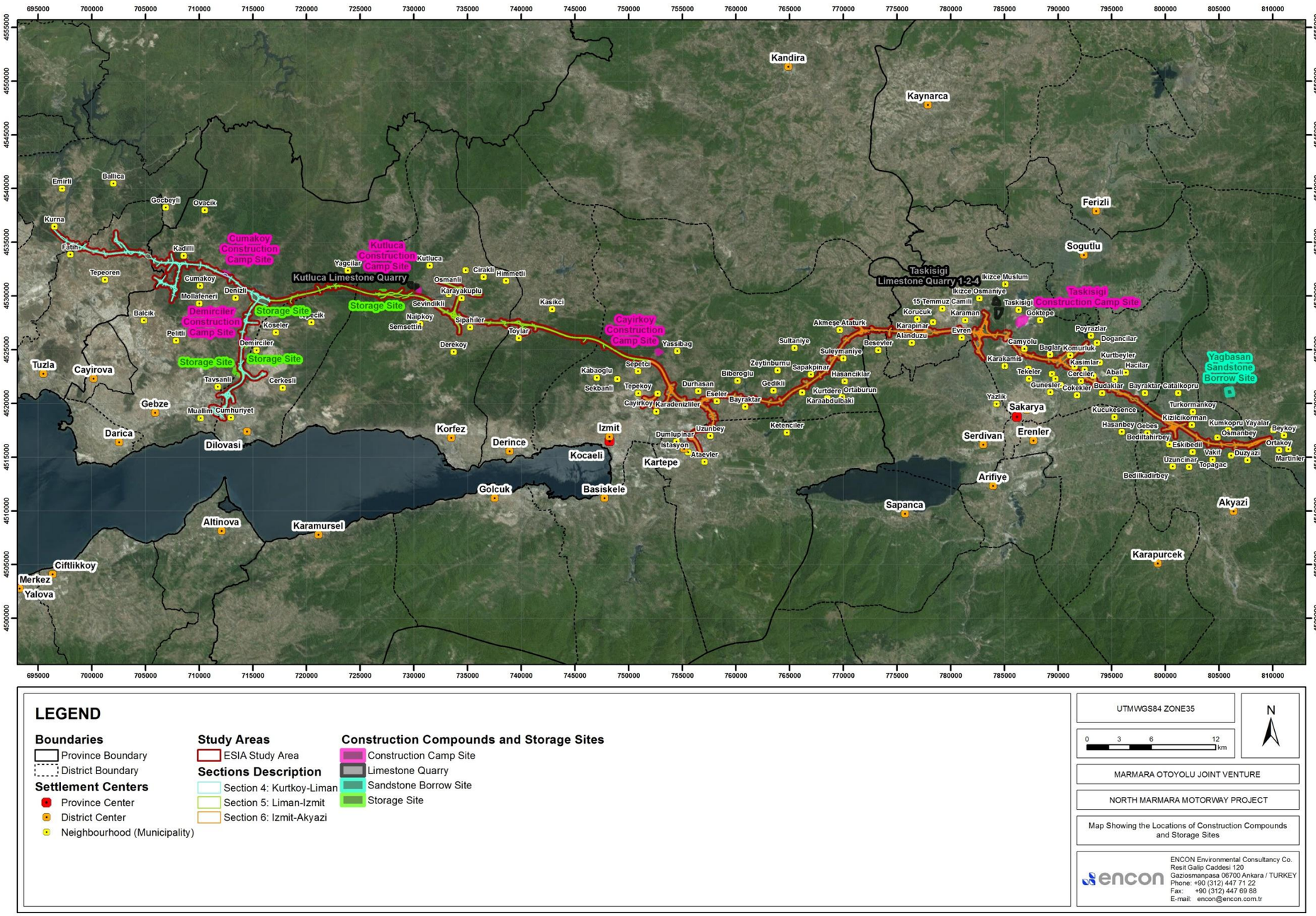
During the operation phase, road maintenance and repair works will be conducted by the Project Sponsors until the end of Contract Duration. Maintenance works will involve routine maintenance, winter maintenance and periodic maintenance works. Periodic maintenance works that will involve large scale repair of the superstructures are anticipated to be required in every 10 years. Maintenance and repair works will be performed in accordance with the Operation, Maintenance and Repair Standards and technical specifications. The rights of the Project Sponsors to operate maintain and repair the Motorway will expire at the end of the Contract Duration, when the motorway shall be transferred to the KGM free from any debt or commitment and in a well-maintained, operating, in-service condition, without any charge. Number of vehicles subject to passage fee will be identified by means of electronic passage systems to be installed in line with the specifications. Technical and legal supervision and control of the construction and operation works/periods will be executed by the personnel or independent consulting firms to be assigned by the KGM. Special structures will be inspected and released/signed off during site surveillance.

3.2.1. Construction Camp Sites and Quarries/Borrow Sites

During the construction works, temporary construction facilities/sites will be needed. These facilities and sites include construction camp sites, quarries, plants and service roads. Following the completion of construction activities, temporary facilities will be decommissioned and the sites will be rehabilitated. Table 3.3 provides a list of the camp sites and quarries/material borrow sites to be used in the scope of the Project. A map showing the locations of these facilities is provided in Figure 3.3.

Table 3.3. List of Camp Sites, Quarries/Material Borrow Sites and Plants (as of March 2017)

Location	Location			Description of the Site/Plant	Area/ Capacity Information
	Province	District	Nearest Neighborhood		
Section 4					
146+500	Kocaeli	Gebze	Cumakoy	Cumakoy Construction Camp Site	14,40 ha
				Crusher-401	550 ton/hr
				Asphalt Plant-401	320 ton/hr
				Mechanical Plant-401	500 ton/hr
				Concrete Plant-401	90 m^3/hr
150+500; 4+750	Kocaeli	Dilovasi	Demirciler	Demirciler Construction Camp Site	44,1 ha
				Crusher-402	250 ton/hr
				Crusher-403 (mobile)	150 ton/hr
				Asphalt Plant-402	240 ton/hr
				Mechanical Plant-402	500 ton/hr
150+500; 7+500	Kocaeli	Dilovasi	Demirciler	Concrete Plant-402	90 m^3/hr
Section 5					
164+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Limestone Quarry	28,94 ha
				Crusher-501	600 ton/hr
				Asphalt Plant-501	320 ton/hr
				Mechanical Plant-501	600 ton/hr
165+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Construction Camp Site	6 ha
				Concrete Plant-501	120 m^3/hr
				Concrete Plant-502	105 m^3/hr
Section 6					
188+500	Kocaeli	Izmit	Cayirkoy Hacioglu	Cayirkoy Construction Camp Site	41,42 ha
				Concrete Plant-601	60 m3/hr
				Concrete Plant-602	60 m3/hr
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Construction Camp Site	40,8 ha
				Asphalt Plant-601	200 ton/hr
				Asphalt Plant-602	160 ton/hr
				Mechanical Plant-601	500 ton/hr
				Concrete Plant-603	120 m^3/hr
				Concrete Plant-604	60 m^3/hr
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Limestone Quarry 1-2	16,8 ha
				Taskisigi Limestone Quarry-4	39,12 ha
				Crusher-601	250 ton/hr
				Crusher-602	250 ton/hr
250+000	Sakarya	Yagbasan	Hendek	Yagbasan Sandstone Borrow Site	42,89 ha



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

Construction Compounds and Storage Sites
- Construction Camp Site
- Limestone Quarry
- Sandstone Borrow Site
- Storage Site

UTMWGS84 ZONE35

N

0 3 6 12 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Map Showing the Locations of Construction Compounds and Storage Sites

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Figure 3.3. Map Showing the Locations of Construction Compounds and Storage Sites
**Storage sites for Section 6 will be determined.*

Camp Sites will include facilities such as cafeteria, medical room, shower and toilets, wastewater treatment plants/septic tanks, water supply facilities (i.e. water wells, water tanks) etc. Figure 3.4 presents an example layout for the Construction Camp Sites.

Section 4 will supply its material requirements from excavations to be done as there is excess of excavation materials having sufficient quality (with no clay content). Material requirements of Section 5 will be supplied from Kutluca Limestone Quarry. Material requirements of Section 6 is planned to be supplied from the limestone quarries located near Camp Site in Taskisigi neighborhood. Maximum operation period for the quarries will be parallel to the duration of the construction, that is 36 months. Amount of materials to be extracted or supplied from each quarry is provided in Table 3.4.

Table 3.4. Amount of Materials to be Extracted from Quarries

Location	Location			Description of the Site	Total Amount of Material to be Extracted/ Purchased (ton)	Total Operation Duration (months)
	Province	District	Nearest Neighborhood			
Section 5						
164+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Limestone Quarry	5.600.000	36
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Limestone Quarry 1-2	16.000.000	36
				Taskisigi Limestone Quarry-4	1.600.000	36
250+000	Sakarya	Yagbasan	Hendek	Yagbasan Sandstone Borrow Site	4.800.000	36

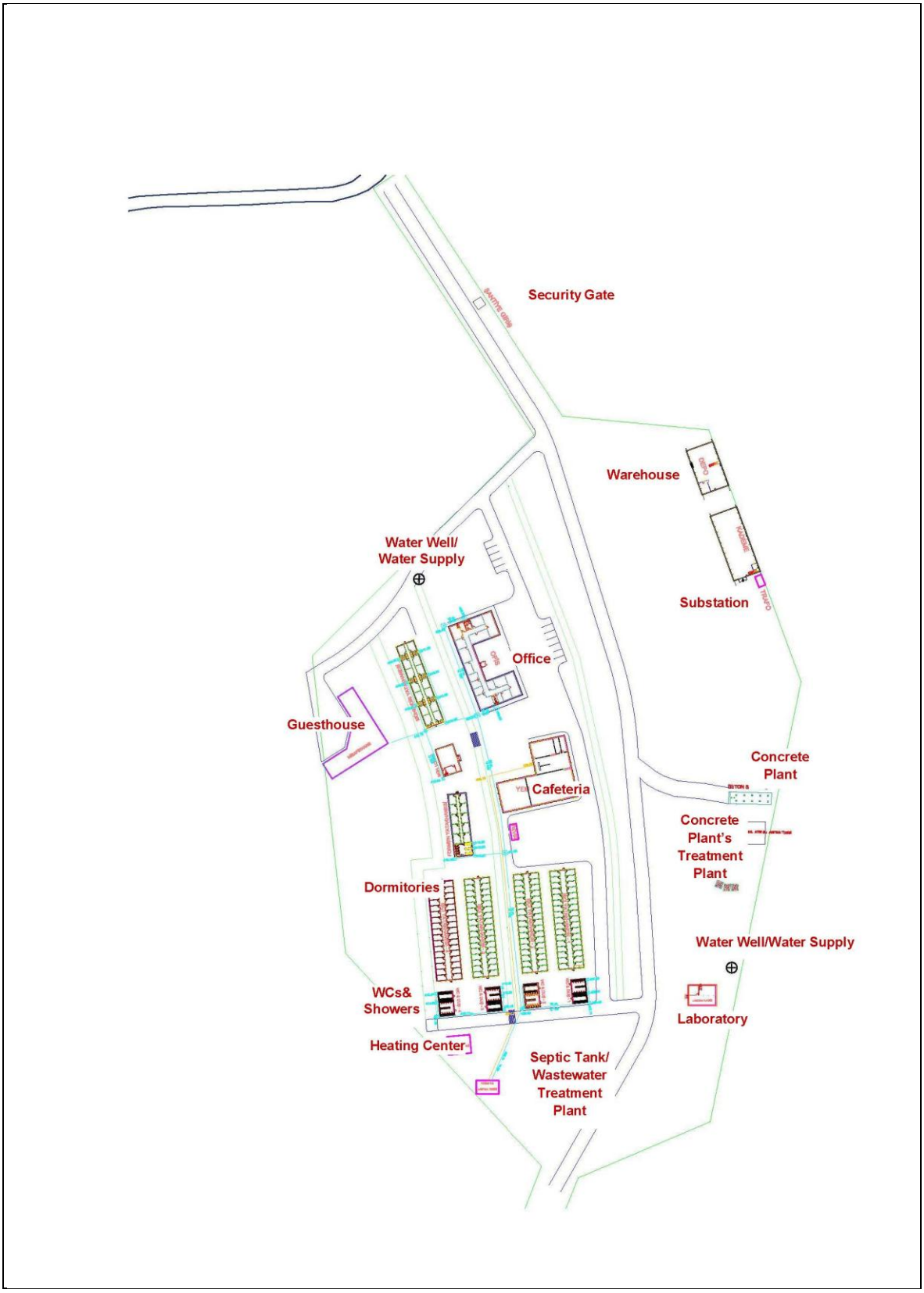


Figure 3.4. Example Layout for Construction Camp Sites

Section 4: Kurtkoy-Liman

Demirciler Construction Camp Site

Main Construction Camp Site for Section 4 is located at KM 4+750 of the Liman Access Road near Demirciler neighborhood and Demirciler and Mermerciler organized industrial sites. The Camp Site covers an area of around 44 ha, which is located on forest land. Forestry permit has been obtained. Photographs showing the Construction Camp Site are presented in Figure 3.5.

Figure 3.5. Photographs Showing Construction Camp Site for Section 4 (KM 150+500; 4+750)

Cumakoy Construction Camp Sites

Another Camp Site will be located at KM 146+500 near Cumakoy neighborhood on an area of 14,4 ha. The site corresponds to forest land, for which forestry permit has been obtained. Cambaz Creek runs in the west of the Camp Site.

Section 5: Liman-Izmit

Kutluca Construction Camp Site

Kutluca Camp Site is located around 450 m north of Motorway KM 165+500. The Camp Site is located on forest land and covers an area of around 6 ha. Forestry permit has been obtained. Photographs showing the Construction Camp Site are presented in Figure 3.6.

Figure 3.6. Photographs Showing Construction Camp Site for Section 5 (KM 165+500)

Kutluca Limestone Quarry for Section 5

A limestone quarry allocated to KGM is located in the north of Motorway KM 165+000 on forest land. For the quarry, Raw Material Production License has been obtained for 5 years for an area of 28,94 ha. Forestry permit has been obtained for the area. A crusher, an asphalt plant and a mechanical plant will be established at this site. Blasting is anticipated to be conducted in the scope of mining activities. It has been informed that currently trial production activities are being conducted. Photographs showing the site of the potential quarry for Section 5 are presented in Figure 3.7.

Trial Production Works	Trial Production Works
Potential Quarry Location	Mobilization Works for Establishment of Plants

Figure 3.7. Photographs Showing the Location of the Potential Quarry (KM 165+000)

Since there is no basalt quarry identified in the area, basalt material to be required in the scope of construction works is planned to be supplied from nearby quarries operated in the region.

Section 6: Izmit-Akyazi

Taskisigi Construction Camp Site

The main Construction Camp Site is located near Taskisigi neighborhood on a former mining area, around 2 km north-northeast of Motorway KM 226+400. There are several industrial facilities/plants in the close vicinity including ENKA Natural Gas Combined Cycle Power Plant (located in the Taskisigi neighborhood) Nuh Beton Concrete Plant and other mining facilities.

The Camp Site is located on a parcel that covers an area of about 40,8 ha. Concrete, mechanical and asphalt plants will be established at the Camp Site. Since there are nearby operating concrete plants in the area, it will be possible to supply concrete from readymade plants in case of need. Some of the buildings and structures of Taskisigi neighborhood is located in the surrounding area of the Construction Camp Site. Photographs showing the Construction Camp Site are presented in Figure 3.8.

Mobilization Works on Site

Mobilization Works on Site

Nearby Facilities

Nearby Facilities

Nearby Facilities	ENKA Natural Gas Combined Cycle Power Plant (around 1,5 km northwest of the Construction Camp Site)

Figure 3.8. Photographs Showing Construction Camp Site for Section 6 (KM 226+400)

Cayirkoy Construction Camp Site

A second Camp Site will be located for the tunnel construction works to be conducted near KM 188+500. The site corresponds to forest land that covers an area of 11 ha. Forestry permit has been obtained for the area.

3.2.2. Storage Sites

Storage sites will be used for the disposal and storage of excess excavated materials. For Section 6, there will be several sites along the Motorway route and the site selection process is still going on. List of storage sites identified to be used so far for the Asian sections is presented in Table 3.5. Locations of the identified storage sites are shown on the map provided in Figure 3.3.

Table 3.5. List of Storage Sites Planned to be Used (as of March 2017)

Location	Location			Description of the Site	Area (ha)	Storage Capacity (m^3)
	Province	District	Nearest Neighborhood			
Section 4						
150+500; 1+000	Kocaeli	Dilovasi	Demirciler	Storage Site-401 and 402	1,0	50.000
150+500; 4+000	Kocaeli	Dilovasi	Demirciler	Storage Site-403	5,5	275.000
150+500; 7+000	Kocaeli	Dilovasi	Demirciler	Storage Site-404	22,8	1.300.000
Section 4 Total					**29,3**	**1.625.000**
Section 5						
162+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Storage Site-501	14,04	1.500.000
Section 5 Total					**14,04**	**1.500.000**
Section 6						
Locations of the storage sites to be identified later						**3.125.000**

3.2.3. Engineering Structures

Main engineering structures in the North Marmara Motorway Project includes the viaducts, tunnels, overpasses and underpasses, culverts, etc. In the design of these structures, the Standard Specifications for Highway Bridges published by the American Association of State Highway and Transportation Officials (AASHTO) has been used. In the seismic calculations, the Standard Specifications used for the seismic design of the highway bridges has been taken as basis. Where required, Project-specific revisions have been/would be done with the approval of KGM to adequately adapt these specifications to the Project. Table 3.6 provides a summary of the total number of engineering structures for Asian sections of the Project.

Table 3.6. Summary Table for Engineering Structures

Type of Structure	Section 4	Section 5	Section 6	Total
Interchange	9	4	11	24
Viaduct	4	4	3	11
Bridge	11	2	64	77
Tunnel	0	4	1	5
Underpass	29	12	24	65
Overpass	15	12	35	62
Culvert	158	60	172	390

In accordance with KGM's specifications, safety, durability, aesthetics and environmental coherence, construction and maintenance costs, constructability and construction duration have been the main considerations in the design and engineering of the structures. Static and dynamic stability analyses and cross-section calculations of the engineering structures have been done by using internationally accepted computer programs approved by the KGM.

Tunnels are substructures constructed by subsurface excavations. Besides the engineering functions provided, tunnels are defined as structures that would provide best design solutions to protect high-value habitats and landscapes. Though construction costs may be high, the benefits to the natural environment will be very important. The scale of these benefits is dependent upon the method of tunnel construction. Bored tunnels allow sites of high nature conservation value to remain undisturbed and are least damaging environmentally. Cut-and-cover tunnels may be more appropriate for sites of lower conservation interest, but where the maintenance of connectivity between habitat is desirable. Viaducts are also substructures constructed on girders. Both structures are effectively used to cross challenging topographical and/or geotechnical conditions while providing protection for the corresponding habitats (e.g. forests, wetlands, river valleys, etc.). Figure 3.9 presents example illustrations/visualizations on tunnels and viaducts passing important/sensitive habitats resulting in minimum physical impact. Viaducts are suited to narrow, steep-sided valleys and they have environmental advantages as they can minimize landtake and fragmentation within a valley by allowing watercourses and any existing nature conservation interest to continue under the structure; maintain connectivity for species movement; and retain views up and down the valley (*European Cooperation in the Field of Scientific and Technical Research; Iuell, B., Bekker, G.J., Cuperus, R., Dufek, J., Fry, G., Hicks, C., Hlavá˘c, V., Keller, V., B., Rosell, C., Sangwine, T., Tørsløv, N., Wandall, B. le Maire, (Eds.) 2003*).

(a) Viaduct Visualization Passing a River Valley

(b) Photograph of a Bored Tunnel Example Passing a Hilly Area by Leaving the Habitat Above Intact

Figure 3.9. Example Illustration/Visualization for Tunnels and Viaducts Passing Corresponding Habitats

Tunnels planned in the scope of the Project will be excavated using the New Austrian Tunneling Method (NATM). Most of the tunnels will be bored while cut and cover tunnels will also be used where it is required by design. Typical cross-sections for the tunnels are given in Figure 3.10. Tunnels constructed by forming temporary side slopes and covering the sides and the top of the structure are referred as on-off tunnels. Specific measures to be taken for the emergency preparedness and response in the tunnels are described in the Emergency Preparedness and Response Plan presented in Annex-3.

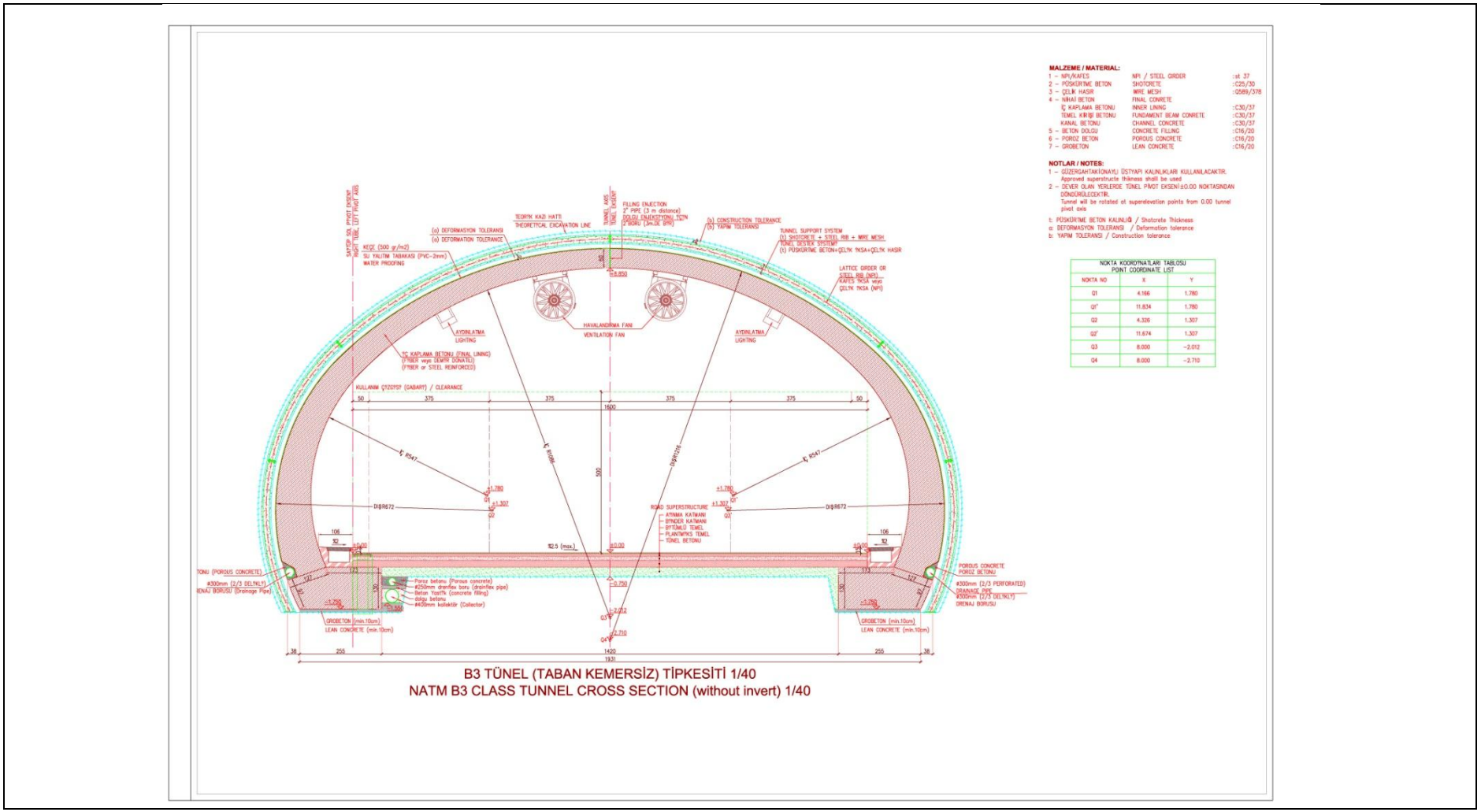


Figure 3.10. Typical Cross-section for the Tunnels (1/3)

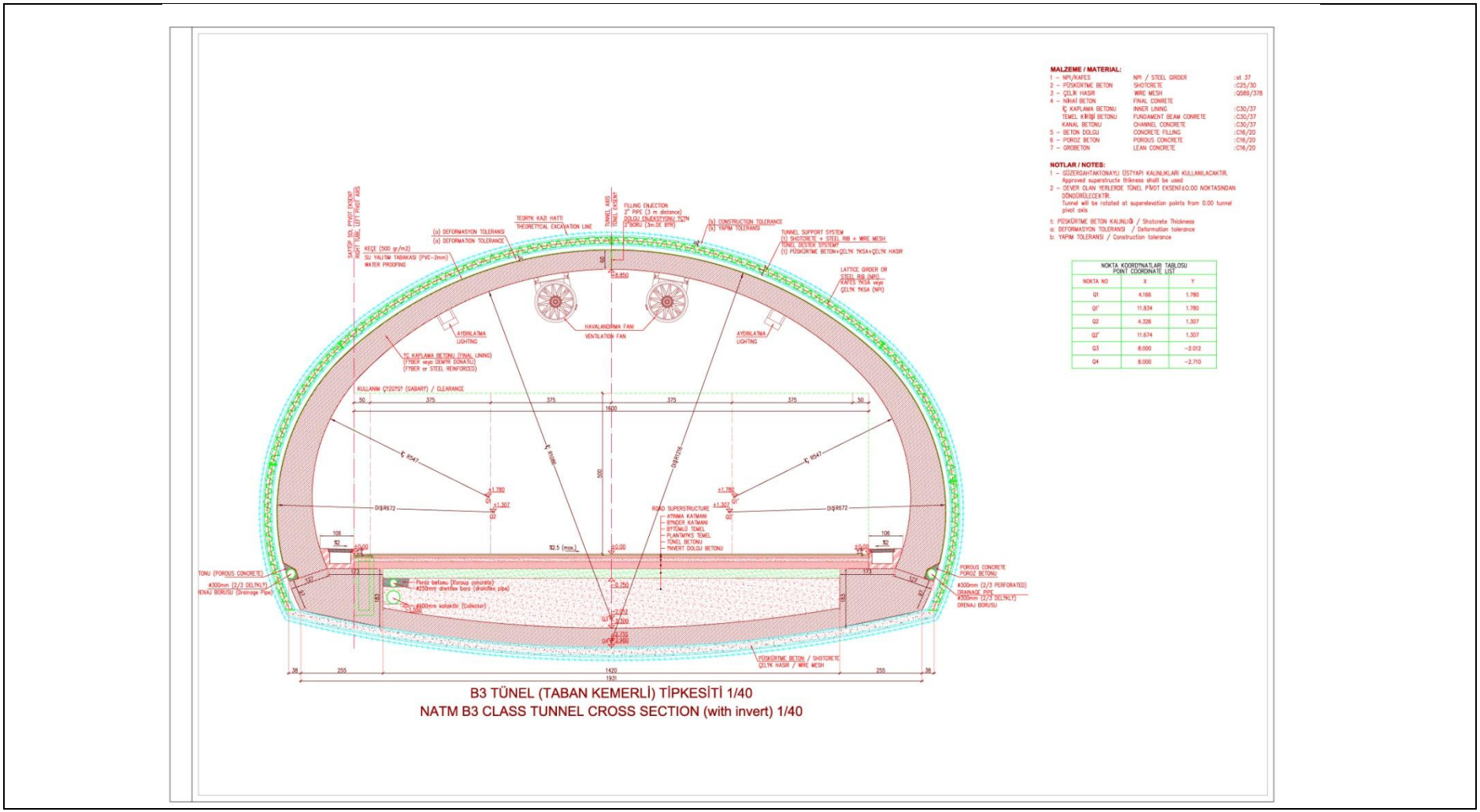


Figure 3.10. Typical Cross-section for the Tunnels (2/3)

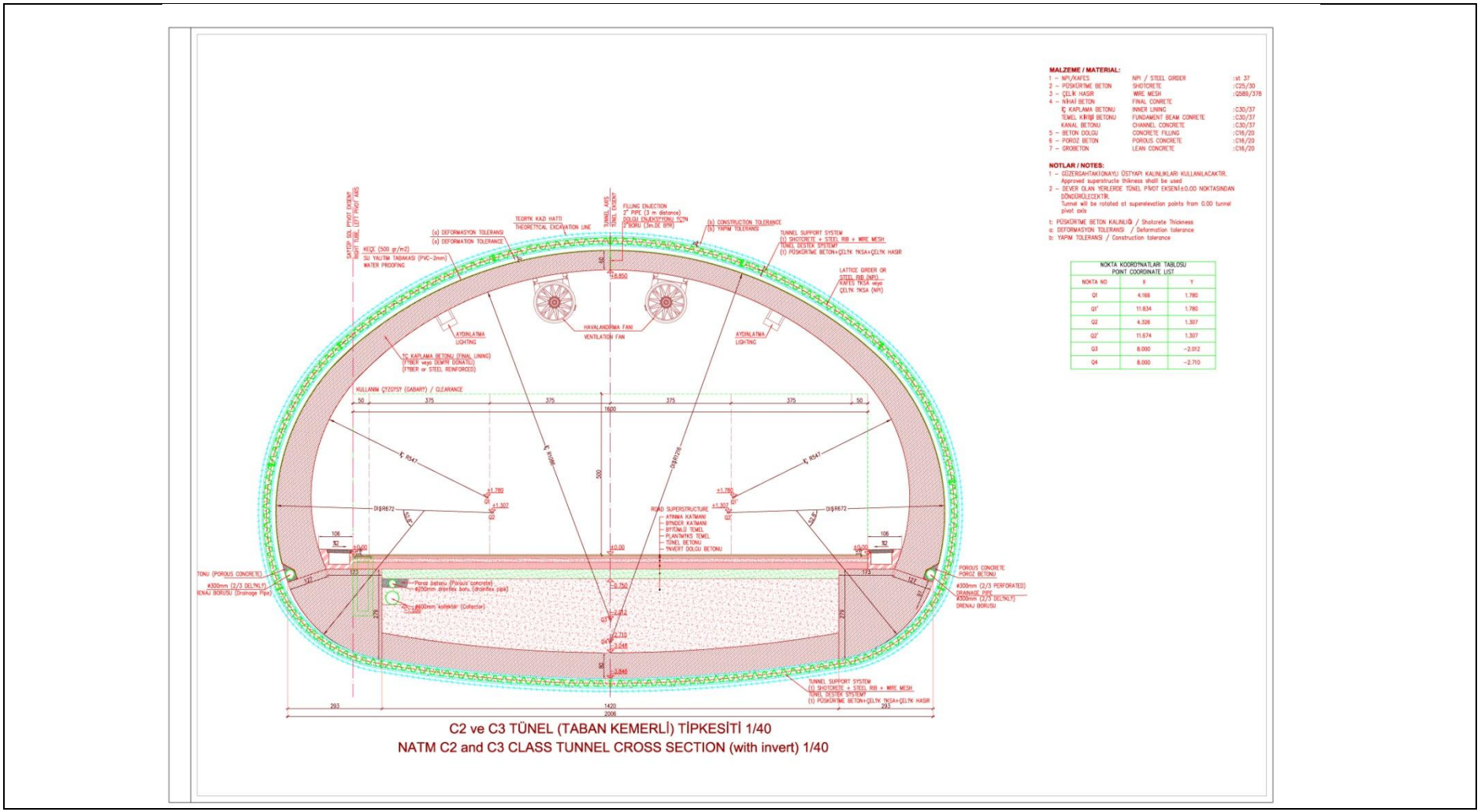


Figure 3.10. Typical Cross-section for the Tunnels (3/3)

Culverts are hydraulic engineering or service structures of small-scale that are used to ensure passage/drainage of perennial surface water bodies or creeks formed as a result of precipitation through the road body as well as passage of pedestrians, cyclists/motorcyclists and animals. Main types of culverts include box culverts, arch culverts (used under high fill areas) and bridge culverts. Photographs of culvert examples constructed under linear infrastructure projects are given in Figure 3.11.

Figure 3.11. Photographs Example Culverts Used to Provide Passage of Water Bodies or Small Animals

3.2.3.1. Section 4: Kurtkoy-Liman

Viaducts to be constructed in Section 4 of the Motorway are listed in Table 3.7.

Table 3.7. Viaducts and Tunnels in Section 4

Code	Length (m)	Location on the Route (Motorway KM)		Explanation
		Start Location	End Location	
Viaducts				
V-01	480	129+982	130+463	Topographical conditions
V-07	855	150+500; 8+950	150+500; 8+950	Topographical conditions
V-08	376	0+526	0+902	Connection to TEM Interchange
V-09	303	1+097	1+400	Connection to TEM Interchange

Interchanges to be constructed in Section 4 of the Motorway are listed in Table 3.8.

Table 3.8. Interchanges in Section 4

Code	Interchanges	Location on the Route (Motorway KM)
KAV-01 and KAV-02	Formula-1 and 2 Interchange	137+260
KAV-03 and KAV-04	Balcik-1 and 2 Interchange	142+245
KAV-05	Liman Interchange	150+500
KAV-06	Mermerciler OSB Interchange	150+500; 2+675
KAV-07	Demirciler OSB Interchange	150+500; 7+258
KAV-08	D-100 Gebze Interchange	150+500; 10+204
KAV-09	TEM Gebze Interchange	150+500; 11+570

Bridges to be constructed in Section 4 of the Motorway are listed in Table 3.9.

Table 3.9. Bridges in Section 4

Code	Bridges	Location on the Route (Motorway KM)
K01	Bridge	132+850
K31	Fatih Sultan Mehmet Avenue	136+987
K32	Formula Access Road Intersection with Fatih Sultan Mehmet Avenue	137+260; 0+244
K33	Gebze-OSB Interchange Arm-2	142+329; 0+541,276
K34	Balcik-1 Access Road Interchange Bridge	142+245;1+753
K35	Liman Interchange Arm-2	150+566+0+613
K36	Sanayi-1 Interchange Bridge	150+500; 2+674
K37	Liman Acces Road D100 Interchange Bridge	150+500; 10+180
K38	TEM Interchange Arm-4	0+320,5
K39	TEM Interchange Arm-4	0+497,5
K40	TEM Interchange Arm-4	0+627

Underpasses and overpasses to be constructed in Section 4 of the Motorway to provide connection between settlements, agricultural field roads, forest roads or zoning roads are listed in Table 3.10 and Table 3.11, respectively.

Table 3.10. Underpasses in Section 4

Code	Dimensions	Location on the Route (Motorway KM)
A01	12x5,5	131+269,691
A02	12X5,5	132+285,971
A03	12x6,0	133+056,691
A04		135+370
A05	2x(13,5x6)	137+259,374
A06		140+460
A07	2x(12,5x6,5)	141+619,933
A08	15x6	142+163
A09	12x5,5	142+900,714
A10	15x6	144+210
A11	15x6	144+778
A12	12x5,5	144+905,836
A13	12x5,5	145+710,704
A14		146+039
A15	12x5,5	148+074
A16	15x6	150+418,717
A38	15X6	150+500; 0+728,228
A39	2x(13,5x6)	150+500; 1+844,01
A40	7x5,5	150+500; 0+740,96
A41	7x5,5	150+500; 0+951,761
A42	7x5,5	150+500; 1+151,714
A43	15x6	150+500; 0+542
A44	13x5,5	150+500; 0+144
A45	9x5,5	150+500; 6+581,358
A46	2x(13,5x6)	150+500; 7+258,019
A47		150+500; 11+136
A48	15x6	150+500; 11+476,402
A49	15x6	150+500; 11+570; 0+475
A50	15x6	150+500; 11+570

Table 3.11. Overpasses in Section 4

Code	Location on the Route (Motorway KM)
U01	134+060,616
U02	135+039,159
U03	138+440,215
U04	139+831,847
U05	141+084
U06	147+285
U07	149+688,649
U08	151+304,306
U51	0+345,749
U52	2+554,19
U53	142+245; 1+367,421
U54	150+500; 1+973,502
U55	150+500; 3+520
U56	150+500; 10+709
U57	150+500; 11+008

Culverts of different dimensions to be constructed in Section 4 of the Motorway are listed in Table 3.12.

Table 3.12. Culverts in Section 4

Code	Dimensions (mxm)	Location on the Route (Motorway KM)	Code	Dimensions (mxm)	Location on the Route (Motorway KM)
M01	(4X4)	131+443,478	M204	(2x2)	0+700
M02	(7x5)	131+689,378	M205	(2x2)	0+075,011
M03	(2x2)	132+008,466	M206	(2x2)	1+671,528
M04	(3x3)	132+189,106	M207	(2x2)	0+059,605
M05	(2x2)	132+828	M208	(2x2)	0+555,557
M06	(2x2)	133+349,713	M209	(7x5)	0+080,439
M07	(2x2)	133+555	M210	(2x2)	0+397,344
M08	(7x5)	135+631,004	M211	(2x2)	0+282
M09	(2x2)	136+361	M212	(2x2)	1+179
M10	(3x3)	137+604,336	M213	(2x2)	0+095,14
M11	(2x2)	137+965	M214	(2x2)	0+306,792
M12	(3x3)	138+805,343	M215	(2x2)	0+277,451
M13	(3x3)	139+571,723	M216	(2x2)	0+508,435
M14	(2.5x2.5)	140+313,392	M217	(2x2)	1+221
M15	(2x2)	140+567	M218	(2x2)	0+159,524
M16	(2x2)	140+949,328	M219	(3x3)	0+890,32
M17	(12,5x8)	141+532,967	M220	(3x3)	0+407
M18	(2x2)	142+854,97	M221	(2x2)	0+900,875
M19	(3x3)	143+277,352	M222	(2x2)	0+410,375
M20	(3x3)	143+440,833	M223	(2x2)	0+254
M21	(2x2)	144+286	M224	(2x2)	1+083,22
M22	(2x2)	144+800	M225	(2x2)	1+131,011
M23	(7x5)	146+168,718	M226	(2x2)	1+431,408
M24	(2x2)	147+099,02	M227	(2x2)	0+509,094
M25	(2x2)	148+053,249	M228	(3x3)	0+876,923
M26	(3x3)	148+152,851	M229	(4x4)	1+271,191
M27	(5x5)	148+357,242	M230	(2x2)	1+535,221
M28	(5x5)	148+662,174	M231	(2x2)	0+280,239
M29	(2x2)	149+749,548	M232	(2x2)	0+431
M30	(3x3)	149+890,513	M233	(3x3)	2+129
M31	(3X3)	150+289	M234	(4x4)	2+221,515
M32	(2x2)	150+479,39	M235	Ø3200	2+360
M157	(2.5x2)	0+142,962	M236	(2x2)	0+495,572
M158	(2x2)	0+035,76	M237	(3x3)	0+282,522

Code	Dimensions (mxm)	Location on the Route (Motorway KM)	Code	Dimensions (mxm)	Location on the Route (Motorway KM)
M159	(2x2)	0+253,462	M238	(3x3)	0+096,791
M160	(2.5x2)	0+661,551	M239	(2x2)	0+284,246
M161	(2x2)	0+192,702	M240	Ø2000	0+099,135
M162	(2x2)	1+492,105	M241	(2x2)	0+512,432
M163	(2x2)	1+222,879	M242	Ø3000	0+655,211
M164	(3x3)	1+097,289	M243	Ø2000	2+722,564
M165	(2x2)	0+948	M244	(3x3)	2+901,424
M166	(2x2)	0+209,607	M245	Ø2000	3+157,48
M167	(3x3)	0+490	M246	(2x2)	3+681,301
M168	(2x2)	0+328,507	M247	(7x5)	5+509,113
M169	(3x3)	0+254,434	M248	(4x4)	6+445,605
M170	(2x2)	0+159,992	M249	(3x2.5)	7+000
M171	(3x3)	0+274	M250	Ø2100	7+074,56
M172	(2x2)	0+235,986	M251	(2x2)	0+132,11
M173	(3x3)	0+171,365	M252	(2x2)	0+422,425
M174	(3x3)	0+146,001	M253	Ø2100	0+164,535
M175	(2x2)	0+038,124	M254	(2x2)	0+365
M176	(2x2)	0+138,63	M255	(2x2)	7+436,526
M177	(2X2)	0+038,953	M256	(3x2.5)	0+816,26
M178	(3x3)	0+963,24	M257	Ø3000	1+406,848
M179	(2x2)	1+110	M258	(3x2.5)	2+251,285
M180	(5x5)	1+496,863	M259	(2.5x2.5)	2+605,015
M181	(2x2)	0+627,866	M260	(5x5)	8+026,503
M182	(2x2)	0+501,943	M261	(2x2)	8+443,188
M183	(2x2)	0+336,179	M262	(3x3)	0+357,256
M184	(2x2)	0+394	M263	(2.5x2)	1+100
M185	(3x3)	0+903,516	M264	(3x3)	1+701,757
M186	(2x2)	0+385,822	M265	(2x2)	0+153,756
M187	(3x3)	0+586,258	M266	Ø2000	10+276
M188	(2x2)	0+394,608	M267	(2x2)	0+066,746
M189	(2x2)	0+930,973	M268	(2x2)	0+394,625
M190	(2.5x2.5)	1+170,956	M269	(2x2)	0+170,997
M191	(4x4)	1+504,481	M270	Ø2200	10+523
M192	(4x4)	2+901,601	M271	(2x2)	11+076,917
M193	(2x2)	0+489,886	M272	(2x2)	11+439
M194	(2x2)	0+584,404	M273	(2x2)	0+323
M195	(2x2)	0+648,316	M274	(2x2)	1+343
M196	(2x2)	0+304,536	M275	(3x2.5)	0+160,674
M197	(4x4)	1+028,724	M276	(2x2)	0+448,056
M198	(2x2)	0+301,481	M277	(3x2.5)	1+102
M199	(2x2)	1+479,026	M278	(3x3)	0+607,75
M200	(2x2)	0+132,27	M279	(2x2)	0+440.06
M201	(2x2)	0+144,066	M280	(2x2)	0+550
M202	(2x2)	0+838,624	M281	(3x3)	0+452,728
M203	(7x5)	0+210+339	M282	(2x2)	0+256,48

3.2.3.2. Section 5: Liman-Izmit

Tunnel and viaducts to be constructed in Section 5 of the Motorway are listed in Table 3.13. In total, with the construction of nearly 8 km of tunnel and more than 3 km of viaducts, forests corresponding to these structures will be passed with minimum impact.

Table 3.13. Tunnel and Viaducts in Section 5

Code	Length (m)	Location on the Route (Motorway KM)		Explanation
		Start Location	End Location	
Tunnels				
T-01	1.292	178+150	179+475	Passage through forestry
T-02	4.155	183+200	185+275	Passage through forestry
T-03	345	185+500	185+880	Passage through forestry
T-04	2.190	185+898	188+070	Passage through forestry
Viaducts				
V-02	716,5	159+554	160+270	Passage through forestry (ecological passage function)
V-03	876	164+959	165+808	Passage through forestry (ecological passage function)
V-04	756	171+841	172+603	Passage through valley
V-05	790	175+800	176+590	Passage through forestry (ecological passage function)

Interchanges to be constructed in Section 5 of the Motorway are listed in Table 3.14.

Table 3.14. Interchanges in Section 5

Code	Interchanges	Location on the Route (Motorway KM)
KAV-10 and KAV-11	Sevindikli-1 and 2 Interchange	169+380
KAV-12 and KAV-13	Toylar-1 and 2 Interchange	175+700

Bridges to be constructed in Section 5 of the Motorway are listed in Table 3.15.

Table 3.15. Bridges in Section 5

Code	Bridges	Location on the Route (Motorway KM)
K2	Ecological Bridge (40 m)	161+870
K77	Bridge on Sevindikli	0+609

Underpasses and overpasses to be constructed in Section 5 of the Motorway to provide connection between settlements, agricultural field roads or zoning roads are listed in Table 3.16 and Table 3.17, respectively.

Table 3.16. Underpasses in Section 5

Code	Dimensions	Location on the Route (Motorway KM)
A17	10x5	157+239
A18	10x5	168+531
A19	2x(19x5)	168+225
A20	10x5	169+769
A51	20x5	0+254
A52	10x5	1+048
A64	10x5	1+666
A65	10x5	3+149
A66	10x5	4+825
A67	10x5	0+754
A68	10x5	0+343
A69	10x5	41+573

Table 3.17. Overpasses in Section 5

Code	Location on the Route (Motorway KM)
U9	153+550
U10	156+205
U11	157+742
U12	160+717
U13	162+645
U14	164+700
U15	167+100
U16	172+860
U17	174+280
U18	175+707; 0+477
U59	177+000
U58	0+523

Culverts to be constructed in Section 5 of the Motorway are listed in Table 3.18.

Table 3.18. Culverts in Section 5

Code	Dimensions (m x m)	Location on the Route (Motorway KM)
M33	3x3	152+090.062
M34	3x3	152+429.630
M35	2x2	152+902.403
M36	2x2	153+277.459
M37	2x2	153+442.611
M38	4x4	155+323.339
M39	2x2	155+924.592
M40	3x3	156+892.998
M41	3x3	157+123.388
M42	2x2	158+451.669
M43	2x2.5	158+928.504
M44	3x3	159+368.160
M45	2x2	160+463.250
M46	3x3	160+843.170
M47	2x2	161+210.029
M48	3x3	161+409.135

Code	Dimensions (m x m)	Location on the Route (Motorway KM)
M49	2x2	162+130.188
M50	2x2	162+308.103
M51	2x2	162+562.830
M52	3x3	163+096.933
M53	3x3	164+237.478
M54	3x3	166+557.610
M55	3x3	169+447.765
M56	3x3	169+541.554
M57	2x(9x7)	171+570.483
M58	3x3	172+964.589
M59	3x3	173+602.142
M60	3x3	174+640.414
M61	3x3	175+131.109
M62	3x3	177+400.159
M63	3x3	178+008.604
M64	3x3	179+474.643
M65	3x3	179+635.374
M66	3x3	180+148.574
M67	3x3	180+321.933
M68	3x3	180+788.491
M69	3x3	180+955.776
M70	4x4	185+334.649
M71	3x3	185+812.836
M72	3x3	188+180.808
M73	3x3	169+240.000
M74	2x2	171+422
M283	3x3	1+974.220
M284	(6x5)	3+162.468
M285	(8x8)x2	3+644.165
M286	(3x3)	4+391.475
M287	(3x3)	5+432.473
M288	(3x3)	41+220.000
M289	(2x2)	0+535.809
M290	(2x2)	0+040.089
M291	(3x3)	0+139.800
M292	3x3	0+400.857
M293	2x2	0+664.286
M294	3x3	0+121.134
M295	3x3	1+139.241
M296	2x2	0+353.218
M297	2x2	0+135.047
M298	2x2	0+450.716
M299	2x2	0+655.553
M300	2x2	0+903.191

3.2.3.3. Section 6: Izmit-Akyazi

Tunnels and viaducts to be constructed in Section 6 of the Motorway are listed in Table 3.19 and interchanges are listed in Table 3.20. In total, with the construction of nearly 8 km of tunnel and more than 3 km of viaducts, forests corresponding to these structures will be passed with minimum impact.

Table 3.19. Tunnels and Viaducts in Section 6

Code	Length (m)	Location on the Route (Motorway KM)		Explanation
		Start Location	End Location	
Tunnels				
T-01	2.720	189+060	190+420	Topographical conditions, passage through forestry
Viaducts				
V-06	1.560	188+200	189+980	Topographical conditions, passage of greenhouses
V-10	680	191+300	191+980	Topographical conditions
V-11	420	198+720	199+140	Topographical conditions

Table 3.20. Interchanges in Section 6

Code	Interchanges	Location on the Route (km)
KAV-14 and KAV-15	Kandira-1 and 2 Interchange (Cayirkoy)	191+820
KAV-16	Izmit Access Road Interchange	194+800
KAV-17	OSB Interchange (on the Izmit Access Road)	194+800; 0+830
KAV-18	TEM Interchange (on the Izmit Access Road)	194+800; 4+140
KAV-19	Akmese Interchange	212+830
KAV-20	Kaynarca-Adapazari-Karaman Camili Interchange	223+810
KAV-21 and KAV-22	Karasu-1 and 2 Interchange	231+840
KAV-23 and KAV-24	Akyazi-1 and 2 Interchange	243+350

Bridges to be constructed in Section 6 of the Motorway are listed in Table 3.21. The bridges will provide passage of rivers, roads, railway and channels intersection points.

Table 3.21. Bridges in Section 6

Code	Bridges	Location on the Route (Motorway KM)
K03	Railway Interection	194+790
K04	DSI Channel Passage	220+056
K05	DSI Channel Passage	220+791
K06	DSI Channel Passage	221+744
K07	Adapazari-Karaman Road	221+905
K08	DSI Channel Passage	222+715
K09	DSI Channel Passage	224+127
K10	DSI Channel Passage	224+783
K11	DSI Channel Passage	227+680
K12	DSI Channel Passage	228+433
K13	DSI Channel Passage	230+034
K14	DSI Channel Passage	232+049
K15	Sakarya River	232+628
K16	DSI Channel Passage	233+881
K17	DSI Channel Passage	234+189
K18	DSI Channel Passage	235+064
K19	DSI Channel Passage	235+981
K20	DSI Channel Passage	236+818
K21	DSI Channel Passage	237+794
K22	DSI Channel Passage	237+976
K23	DSI Channel Passage	239+625
K24	DSI Channel Passage	240+473
K25	DSI Channel Passage	240+549
K26	DSI Channel Passage	241+387
K27	DSI Channel Passage	243+303
K28	DSI Channel Passage	245+348

Code	Bridges	Location on the Route (Motorway KM)
K29	DSI Channel Passage	245+550
K30	DSI Channel Passage	247+666
K41	Kandira Access Road Cayirkoy Interchange Bridge	3+304
K42	Kandira Access Road Cayirkoy Interchange Arm-1 Bridge	0+640
K43	Cayirkoy Dam Spillway	0+780
K44	Cayirkoy Dam Spillway	0+150
K45	Cayirkoy Dam Spillway	0+390
K46	Cayirkoy Dam Spillway	0+330
K47	Izmit Access Road-DSI Channel Intersection	3+650
K48	Railway intersection	1+110
K49	Railway intersection	0+250
K50	Izmit Access Road TEM Intersection Interchange Bridge	4+105
K51	Main Road Intersection Adnan Menderes Avenue (Adapazarı)	223+287
K52	DSI Channel Passage	0+098
K53	DSI Channel Passage	0+205
K54	DSI Channel Passage	1+644
K55	DSI Channel Passage	3+118
K56	Kaynarca State Road-Interchange Intersection	0+210
K57	Kaynarca-Adapazari Access Road-Main Road Intersection	1+465
K58	Kaynarca-Adapazari Access Road Interchange Brdige	3+015
K59	Kaynarca State-Road-Main Road Intersection	224+900; 0+415
K60	DSI Channel Passage	0+146
K61	DSI Channel Passage	0+194
K62	Karasu Access Road-State Main Road Intersection	0+310
K63	Karasu Access Road-State Road Intersection	2+710
K64	DSI Channel Passage	0+760
K65	DSI Channel Passage	1+895
K66	DSI Channel Passage	2+571
K67	DSI Channel Passage	0+167
K68	DSI Channel Passage	0+195
K69	Akyazi Access Road-Main Road Intersection	0+215
K70	Akyazi Access Road-D-100 Intersection	1+395
K71	DSI Channel Passage	0+235
K72	DSI Channel Passage	1+870
K73	D-100 Main Road Intersection	1+530
K74	TEM Intersection	0+900
K75	Dinsiz Creek	1+395
K76	Dinsiz Creek	0+685

Underpasses and overpasses to be constructed in Section 6 of the Motorway are listed in Table 3.22 and Table 3.23, respectively. It should be noted that number of overpasses is more in Section 6 when compared to number of underpasses mainly due to the soil conditions in the area.

Table 3.22. Underpasses in Section 6

Code	Dimensions	Location on the Route (Motorway KM)
A24	12x5,5	194+122
A25	15x6	194+619
A26	12x6	195+136
A28	7x5,5	207+725
A29	12x5.5	211+156
A30	2x(12x6)	212+828
A31	12x5,5	213+856
A32	12x5,5	216+870
A33	7x5,5	219+497
A34	15x6	221+414
A35	2x(12,5x6)	221+629
A36	12x5,5	228+786
A37	12x5,5	229+453

Code	Dimensions	Location on the Route (Motorway KM)
A53	12x5,5	0+256
A54	7x5,5	0+668
A55	15x5,5	0+910
A56	15x5,5	0+312
A57	15x5,5	0+103
A58	7x5,5	0+563
A59	7x5,5	1+113
A60	7x5,5	1+022
A61	7x5,5	1+050
A62	7x5,5	2+288
A63	7x5,5	2+050

Table 3.23. Overpasses in Section 6

Code	Location on the Route (Motorway KM)
U19	193+113
U20	195+570
U21	196+272
U22	197+940
U23	199+618
U24	201+400
U25	202+563
U26	202+512
U27	206+900
U28	209+387
U29	215+336
U30	217+550
U31	218+485
U32	223+200
U33	225+382
U34	226+268
U35	228+188
U36	231+012
U37	232+136
U38	232+254
U39	233+632
U40	234+527
U41	235+820
U42	236+688
U43	237+463
U44	238+221
U45	238+700
U46	244+065
U47	246+734
U48	247+924
U49	249+150
U50	250+429
U60	2+634
U61	2+005
U62	1+091

Culverts to be constructed in Section 6 of the Motorway are listed in Table 3.24.

Table 3.24. Culverts in Section 6

Code	Location on the Route (Motorway KM)	Code	Location on the Route (Motorway KM)
M77	188+173	M314	0+637,071
M78	190+849	M315	0+469,34
M81	192+432	M316	0+640,997
M82	194+290	M317	1+463,802
M83	195+444	M318	0+137,97
M84	196+650	M319	0+853,404
M85	197+681	M320	0+094,43
M86	198+647	M321	0+197,087
M89	200+853	M322	0+217,824
M90	201+281	M323	0+288,742
M91	201+945	M324	0+002,985
M92	202+196	M325	0+107,685
M93	202+892	M326	0+410,938
M94	203+903	M327	0+772,535
M95	204+288	M328	0+886,44
M96	204+645	M329	2+718,444
M97	204+758	M330	4+101,178
M98	205+265	M331	4+228,539
M99	206+089	M332	0+027,055
M100	206+210	M333	0+224,032
M101	206+528	M334	0+466,14
M102	206+758	M335	0+198,51
M103	207+172	M336	0+372,82
M104	207+586	M337	1+090,011
M105	208+210	M338	0+164,677
M106	208+651	M339	0+124
M107	210+902	M340	0+347
M108	211+057	M341	0+238
M109	211+525	M342	0+585
M110	212+486	M343	0+186
M111	212+932	M344	0+535
M112	213+268	M345	0+328
M113	213+781	M346	0+664
M114	214+883	M347	0+213
M115	215+146	M348	0+661
M116	216+589	M349	0+423
M117	218+075	M350	1+121
M118	219+144	M351	1+254
M119	220+468	M352	1+769
M120	220+803	M353	1+975
M121	223+132	M354	2+241
M122	223+351	M355	2+665
M123	225+465	M356	0+142
M124	226+402	M357	0+219
M125	226+667	M358	0+146
M126	226+848	M359	0+184
M127	228+734	M360	0+560,
M128	230+689	M361	1+739
M129	231+219	M362	0+156
M130	232+493	M363	0+193
M131	233+160	M364	2+983
M132	236+471	M365	0+134
M133	239+029	M366	0+249
M134	239+862	M367	0+322
M135	240+766	M368	0+186
M136	241+955	M369	0+142
M137	242+816	M370	0+177
M138	243+421	M371	0+041

Code	Location on the Route (Motorway KM)	Code	Location on the Route (Motorway KM)
M139	243+555	M372	1+037
M140	243+905	M373	1+235
M141	244+024	M374	0+096
M142	244+946	M375	0+210
M143	245+148	M376	0+093
M144	246+420	M377	0+296
M145	246+680	M378	0+302
M146	247+047	M379	0+276
M147	247+400	M380	0+182
M148	248+170	M381	0+454
M149	248+367	M382	0+139
M150	248+535	M383	0+468
M151	248+756	M384	0+216
M152	248+968	M385	0+351
M153	249+402	M386	0+420
M154	250+496	M387	0+291
M155	250+738	M388	0+596
M156	250+953	M389	0+809
M303	1+904	M390	1+378
M304	2+824	M391	1+478
M305	2+951	M392	0+235
M306	3+141	M393	0+265.740
M307	3+414	M394	0+697.230
M308	3+545,328	M395	0+804.090
M309	0+194,335	M396	0+088.020
M311	0+391,82	M397	0+133.870
M312	0+288,936	M398	0+212.750
M313	0+588,072	M399	212+791.060

3.2.4. Toll Collection Areas

As the Motorway is to be operated with an access-controlled system, all the entrance and exit points will be equipped with toll collection stations where automatic passage (OGS), fast passage (HGS) infrastructures are available.

Toll plazas, toll passage lanes, operation building(s), transformer building(s) and parking areas will be available at the toll collection areas. Toll plazas and passage lanes will be designed to have sufficient capacity for the existing and future traffic projections. Thus, number of toll booths will change from location to location. At toll stations with free passage system (FPS), no toll booth will be present but plate recognition system will be installed. Communication infrastructure will be provided to allow data transfer to traffic management systems. List of toll plazas to be located at the interchanges is given in Table 3.25. An example layout drawing for toll stations is provided in Figure 3.12.

Table 3.25. List of Planned Toll Plazas

Section	Location/Description of the Toll Collection Area	Number of Toll Collection Areas
Section 4	Kurnakoy	12
	Akfirat	
	Kadilli	
	Denizli FPS	
	Demirciler FPS	
	Demirciler FPS	
	Tavsanli FPS	
	Tavsanli FPS	
	Dilovasi FPS	
	Dilovasi FPS	
	Muallim FPS	
	Muallim FPS	
Section 5	Sevindikli	4
	Toylar	
	Cayirkoy	
	Uzunbey	
Section 6	Akmese Ataturk	6
	Evrenkoy	
	Karaman	
	Poyrazlar	
	Gebes	
	Beykoy	

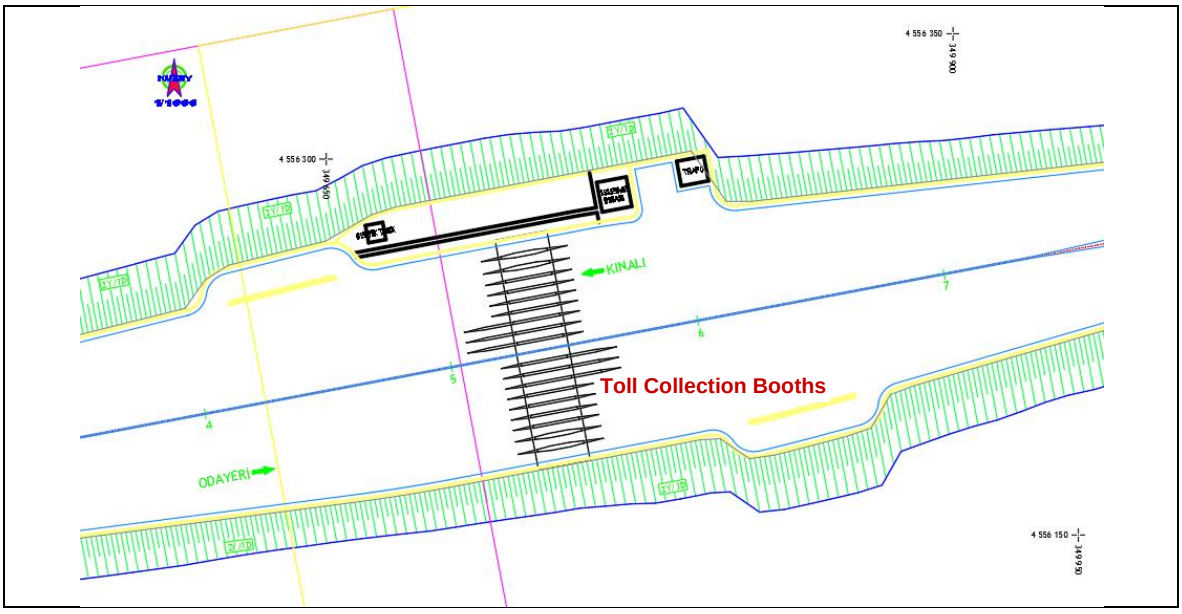


Figure 3.12. Example Layout of Toll Station

3.2.5. Service Areas

Service areas are facilities built at international standards in every 20-50 km to meet the needs of the users of the Motorways in a continuous (24 hours 7 days) and efficient way and allow the drivers have a break for resting purposes. Four different types (A, B, C, and D) of services areas can be built on Motorways. In the North Marmara Motorway Project, Type B and Type D service areas will be built. Characteristics of these types of service areas are explained below:

- Type D: refers to facilities built in about every 20 km of motorways (minimum) to serve for short rest stops. Parking areas for different types of vehicles, resting areas, restaurant for drivers and passengers, kiosk and restrooms are provided at this type of area.

- Type B: refers to facilities built in about every 50 km of motorways (minimum) to serve for short rest stops. Sale of certain spare parts, washing-lubrication, tire repair and emergency maintenance services as well as Parking areas, gas and service station, teahouse, kiosk, restrooms and phone boxes are provided at this type of area.

In the scope of the North Marmara Motorway Project, service areas will be built on each side of the Motorway, opposing to each other. Connection between two sites will be provided by suitable road structures (e.g. culvert, overpass, etc.). Parking areas for passenger vehicles and heavy vehicles will be separated. Service areas to be constructed in the Asian part of the Motorway are listed in Table 3.26. An example layout for service areas is presented Figure 3.13.

Table 3.26. Service Areas in Asian Part

Service Areas	Location on the Route (Motorway KM)
Section 4	
Type B Service Area	139+170
Type D Service Area	146+700
Type B Service Area	150+500; 4+500
Section 5	
Type B Service Area	163+650
Section 6	
Type D Service Area	198+500
Type B Service Area	219+000
Type D Service Area	240+000
Type D Service Area	250+000

Under normal circumstances, an average surface of 5.000-20.000 m^2 is provided for service areas, enabling future expansion possibilities. For the parking of passenger cars and heavy vehicles, separate spaces to be provided will be as follows:

- 3 m x 6 m for passenger cars
- 3,6 m x 18 m for heavy vehicles

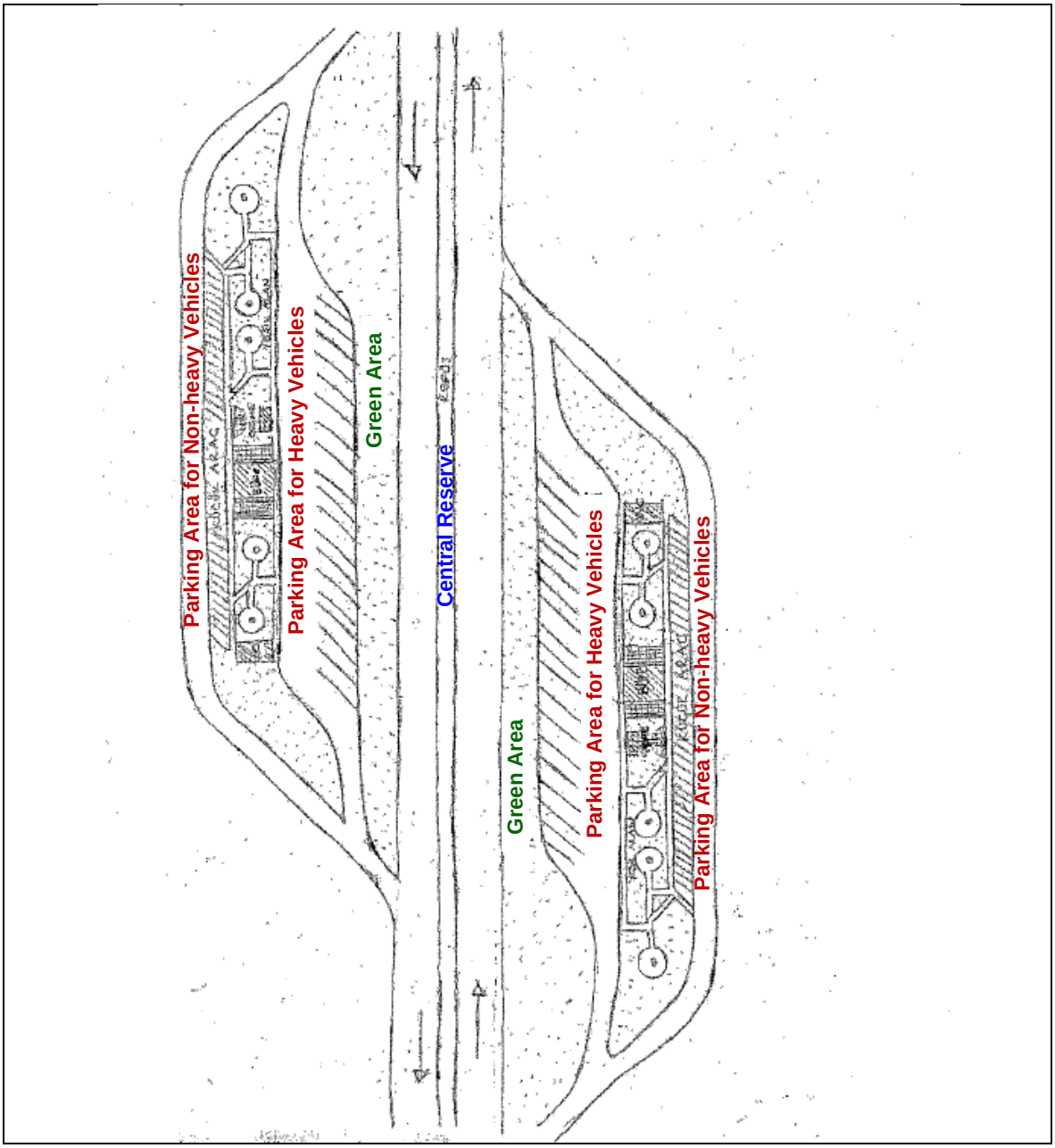


Figure 3.13. Example Layout for Service Areas (Type D)
(Source: KGM, 2012)

Average number of passenger cars that would visit each service area in a day is foreseen as 50, thus the average number of visitors for the service areas has been estimated as 200 persons a day. The service areas will be designed to meet the requirements for the maximum estimated number of visitors (anticipated to take place in summer months). Drivers of the heavy vehicles will use separate facilities to be allocated to them. Personnel to be employed at the service areas will be trained to provide quality services. Facilities at the service areas will be kept functional and maintained at all times.

3.2.6. Maintenance and Operation Centers

To ensure that the level of services is adequately provided and maintenance and repair works are regularly performed, maintenance centers are built minimum in every 50-60 km in motorways. Additionally, in every 120-150 km, main maintenance centers are to be located. In the maintenance centers, offices, workshops, salt tanks, warehouse, garage, gas station, management dwellings, dormitories and parking areas are provided. Maintenance and operation centers to be built in the scope of the North Marmara Motorway Project are provided in Table 3.27. General layout for maintenance centers is provided in Figure 3.14.

Table 3.27. Maintenance and Operation Centers in Asian Part

Maintenance and Operation Centers	Location on the Route (Motorway KM)
Section 5	
Maintenance Center (Sevindikli)	168+000
Main Control and Operation Center (Sevindikli)	177+000
Section 6	
Maintenance Center (Akmese)	212+500

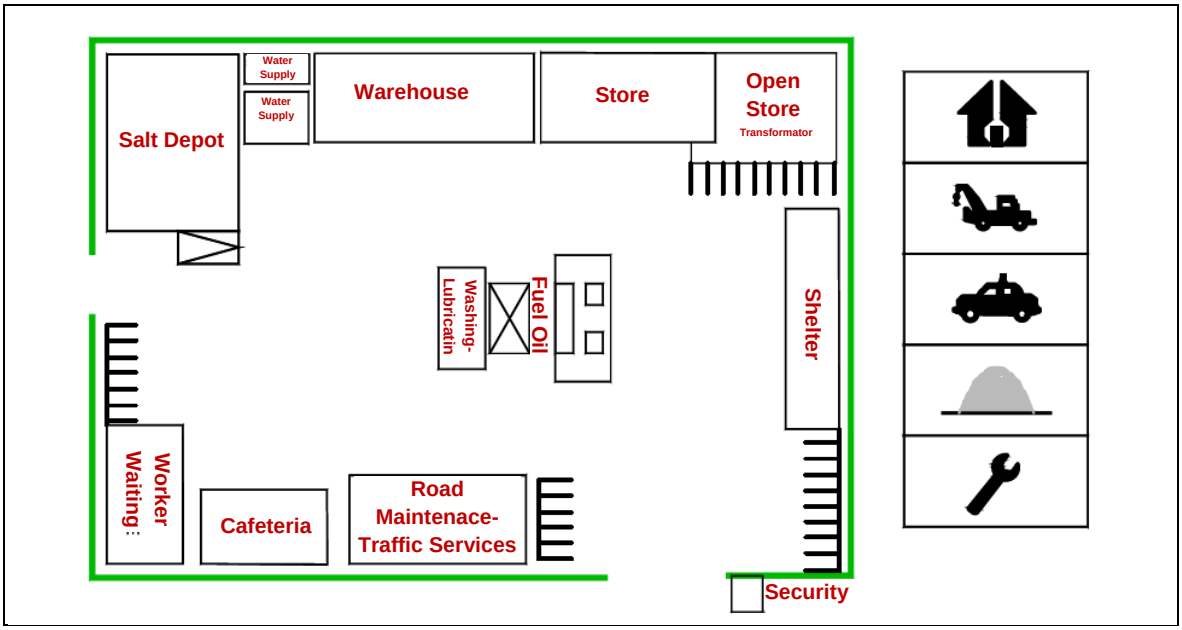


Figure 3.14. General Layout for Maintenance Centers

3.2.7. Pavement Structure

Layers of the road pavement and their thickness for the motorway, access roads and other roads according to Motorway specifications is listed in Table 3.28 and demonstrated on the sketch given in Figure 3.15. Mainly crushed and screened quarry materials will be used for the preparation of the pavement layers.

Table 3.28. Pavement Layers and their Thickness

Layer	Thickness of Layers (cm)		
	Motorway	**Access Roads**	**Ancillary Roads**
Abrasion/Wearing Coarse*	4	4	4
Binder	10	8	7
Bituminous Binder	13	11	11
Plant-Mix Base	20	20	20
Plant-Mix Subbase	25	20	20
Total	**72**	**63**	**62**
Selected Material	40	40	40

**Abrasion layer shall be of modified bituminous stone mastic asphalt.*

3.3. Expropriation Corridor

In motorway projects, expropriation corridor is minimum 100 meters according to KGM standards. Where required, expropriation corridor is widened to cover the excavation and embankment areas and construction areas for the larger structures such as interchange areas, acceleration lanes, park and service areas, drainage ditches, etc. In the North Marmara Motorway Project, expropriation corridor will be minimum 100 meters in accordance with the KGM's specifications, while it can be widened up to 350 meters depending on the topographical conditions and type and location of large Project components. The area to be allocated to the Motorway will be enclosed by suitable structures/materials (e.g. wire fence, welded wire, wall, etc.)

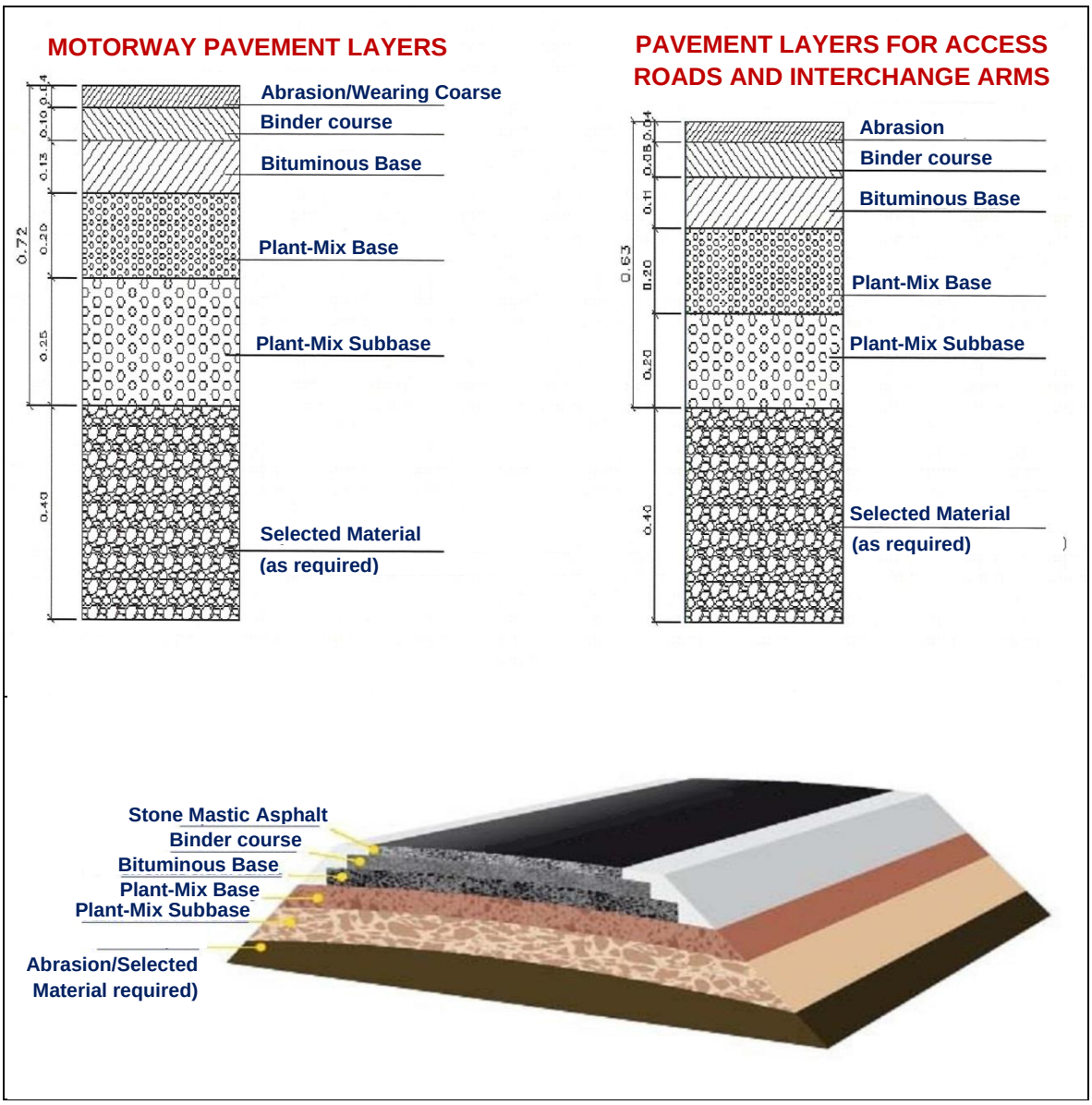


Figure 3.15. Road Pavement for the Motorway and Access Roads (*Source: KGM, August 2010*)

3.4. Description of the Route

The Asian sections of the North Marmara Motorway start near Kurnakoy (in the south-southeast of Pasakoy interchange) in Pendik district of Istanbul and ends at Akyazi TEM Interchange in Akyazi district of Sakarya.

Section 4: Kurtkoy-Liman

Section 4 of the Motorway has a length of 21,9 km plus access roads of 21,7 km. Around 14 km of the access roads is included in the Liman Access Road section, which diverges from the Motorway at KM 150+500 towards Izmit Bay and is the longest access road in the Project. Main carriageway of the Motorway runs through agricultural fields and locally through forest vegetation, while the Liman Access Road crosses forest lands in the northern part (150+500; 0+000-10+500) and industrial sites in the southern part (150+500; 10+500-13+500). The settlements located in the vicinity of the route are listed in Table 3.29.

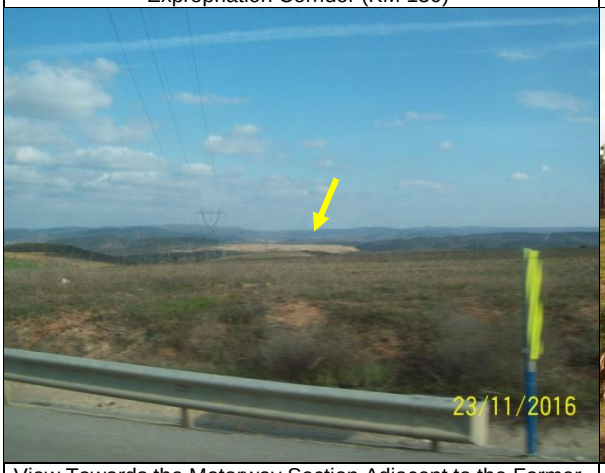
Table 3.29. Settlements Located in the Vicinity of the Motorway Components in Section 4

Districts	Neighborhoods	Nearest Approximate Motorway KM	Approximate Distance of the Settlement Center to Nearest Motorway Components	Direction with respect to Motorway Components	Population (Turkstat 2015)
Istanbul					
Pendik	Kurnakoy	130+000	95	Northeast	1.233
Tuzla	Tepeoren	135+000	25	South	6.252
Tuzla	Akfırat	137+000	400	South	2.386
Kocaeli					
Gebze	Kadilli	142+000	400	North	502
Gebze	Cumakoy	145+000	1.500	South	1.707
Gebze	Denizli	148+000	900	South	1.200
Gebze	Tavsanli	10+000	400	West	2.275
Gebze	Muallim	12+000	1.000	West	1.690
Dilovası	Koseler	3+000	2.000	East	554
Dilovası	Demirciler	5+000	1.000	East	497
Dilovası	Cerkesli	8+000	3.600	Southeast (East)	1.055

The Section starts in Kurnakoy, where a few buildings/structure were identified to be located within the expropriation corridor. The route passes D020 State Road with a viaduct and runs mainly through agricultural fields up until Formula Interchange located at KM 137. Between KM 137+000 and 138+500, route passes forestry areas and continues from the south border of a former excavated materials disposal site (operation of the site has been ceased due to Motorway route) at KM 140-141. Passing through the forestry areas in the south of Kadilli neighborhood at KM 142-143, the Motorway crosses the agricultural fields located in the north Cumakoy neighborhood. In the south of Denizli Pond located around 500 m north of Motorway KM 150, Liman Access Road starts at KM 150+500. Liman Access Road continues for 14 kilometers until Izmit Bay and connection with Anatolian Motorway (E80) and Izmit Bay Bridge is achieved with TEM Gebze Interchange located at KM 11 of the Liman Access Road. First 7 kilometers of the Liman Access Road is located adjacent to the Ballikayalar Nature Park's protection borders (regarding the Motorway locations that intrude into Nature Park's protection area KGM has started the required permit processes) and runs mainly through forestry land until KM 10. At KM 5, the Access Road runs in the west of Demirciler neighborhood, where an industrial site is located. There is a former quarry site operated by Polisan near KM 8 of the Liman Access Road. At the end of Section 4 (KM 152-153), forest vegetation starts to dominate the land use character. Photographs showing different route sections in Section 4 are presented in Figure 3.16.

Kurnakoy Neighborhood where there are Houses within the Expropriation Corridor (KM 130)

View Towards the Location of Formula Interchange (KM 137)



View Towards the Motorway Section Adjacent to the Former Excavated Material Disposal Site (KM 140-141)

Location of Balcik Interchange (KM 142)

	
Near Denizli Neighborhood where there are Houses/ Structures within the Expropriation Corridor (KM 147-148)	View Towards Motorway from 100 m South (KM 149+400)
	
Location of Liman Access Road Interchange (KM 150+500)	Construction Works in Section 5 Observed from Section 4 (KM 150+500)
	
Road Construction Works on Liman Access Road (KM 150+500; 2+000)	Steel Culvert Construction on Liman Access Road (KM 150+500; 3+157)

Road Construction Works on Liman Access Road (KM 150+500; 7+350)

Road Construction Works on Liman Access Road (KM 150+500; 8+000)

Viaduct Location on Liman Access Road (KM 150+500; 8+640)

Viaduct Location on Liman Access Road (Looking Towards the Viaduct End at KM 150+500; 8+640)

Figure 3.16. Photographs Showing Different Route Sections in Section 4

Section 5: Liman-Izmit

Section 5 of the Motorway has a length of 36,8 km plus access roads of 20,2 km. First 15 kilometers of Section 5 (between KM 151+000 and 166+000) runs through forest areas mostly far from settlements. In this section viaducts and over/underpasses are included in the design. Several viaducts located between KM 159 and 176 are designed to cross forestry areas and serve for ecological passage functions. Similarly, subsequent tunnels will be constructed between KM 178 and KM 188 for the passage of forest mountains. At KM 161-162, an additional ecological bridge will be constructed in line with the requirements of related forestry directorates. Between KM 167 and KM 176 (location of Toylar Interchange), the Motorway and the access roads passes through the agricultural fields of the nearby settlements including Sevindikli, Kutluca, Karayakuplu and Toylar neighborhoods. At KM 171-172, the route continues in the south of Sipahiler Pond and passes the residential area with a viaduct of 770 m at KM 171-172. Around KM 172, a few structures/buildings of Sipahiler neighborhood are located within the expropriation corridor. At around KM 176, land use character dominated by forest vegetation starts and continues until KM 188 where the section ends with a tunnel. The settlements located in the vicinity of the route are listed in Table 3.30. Photographs showing different route sections in Section 5 are presented in Figure 3.17.

Table 3.30. Settlements Located in the Vicinity of the Motorway Components in Section 5 (Kocaeli)

Districts	Neighborhoods	Nearest Approximate Motorway KM	Approximate Distance of the Settlement Center to Nearest Motorway Components	Direction with respect to Main Carriageway	Population (Turkstat 2015)
Izmit	Tepecik	155+000	100	South	1.281
Gebze	Yagcilar	159+000	1.000	North	174
Korfez	Kutluca	166+000	760	North	299
Korfez	Semsettin	167+500	1.000	North	214
Korfez	Sevindikli	168+500	1.400	North	285
Korfez	Karayakuplu	170+000	140	North	226
Korfez	Sipahiler	171+000	130	South	306
Derince	Toylar	175+500	425	South	207
Derince	Kasikci	178+000	1.800	North	396
Izmit	Sepetci	188+000	460	Northeast	681

Location where Road Construction Works Started near the Beginning of Section 5 (KM 151-152)

Forestry Area
(KM 156)

Road Construction Works near a Forest Regeneration Zone (KM 162-163)

Location of Viaduct that will Serve of Ecological Bridge (near KM 161-162)

View Towards Sevindikli Interchange from a Location near Karayakuplu Neighborhood (KM 168)

Location of Viaduct near Sipahiler Pond where Structures are Located within the Exp. Corridor (KM 172)

Figure 3.17. Photographs Showing Different Route Sections in Section 5

Section 6: Izmit-Akyazi

Section 6 is the Motorway section, which has highest interaction with the surrounding settlements. This Section, with a length of 62,9 km plus access roads of 23,4 km, passes through the lands of several neighborhoods in Kocaeli and Sakarya provinces as listed in Table 3.31, as well as through forestry areas to a certain extent. At the beginning of this section, a Viaduct located at Km 188 near Hacioglu Hamlet of Cayirkoy Neigborhood crosses over a recreational walking trail and several greenhouses. From KM 188 up until the end of the Section at KM 196, mainly agricultural fields and locally forest lands are crossed.

Table 3.31. Settlements Located in the Vicinity of the Motorway Components in Section 6 (Kocaeli and Sakarya)

Districts	Neighborhoods	Nearest Approximate Motorway KM	Approximate Distance of the Settlement Center to Nearest Motorway Components	Direction with respect to Main Carriageway	Population (Turkstat 2015)
Kocaeli					
Izmit	Yassibag	190+000	1.000	Northeast	740
Izmit	Cayirkoy	191+500	450	South-West	1.426
Izmit	Durhasan	194+500	120	North	677
Izmit	Eseler	196+500	200	South	350
Izmit	Biberoglu	198+000	1.300	North	104
Izmit	Bayraktar	199+500	500	South	996
Izmit	Gedikli	201+500	600	North	405
Izmit	Karaabdulbaki	205+000	160	South	504
Izmit	Sapakpinar	206+000	400	North-West	339
Izmit	Suleymaniye	209+000	0	East	416
Izmit	Akmese Ataturk	211+000	750	North-Northwest	783
Sakarya					
Serdivan	Besevler	215+000	1.500	South	608
Adapazari	Alanduzu	218+000	400	South	863
Adapazari	Korucuk	218+000	200	North	19.404
Adapazari	Karapinar	219+000	700	North	428
Adapazari	Camili	221+000	1.000	North	17.631
Adapazari	Evrenkoy	222+000	280	South	2488
Adapazari	Karaman	222+000	140	North	13.085
Adapazari	Taskisigi	226+500	2.000	North	1.316
Adapazari	Camyolu	228+500	100	North	1.535
Adapazari	Dagdibi	229+500	850	South	1.519
Adapazari	Poyrazlar	232+000	150	North	341
Adapazari	Dogancilar	232+000	300	North	256
Adapazari	Komurluk	232+500	700	North	257
Adapazari	Celebiler	233+500	120	North	132
Adapazari	Kasimlar	234+500	400	North	323
Adapazari	Cerciler	235+000	280	South	210
Adapazari	Haciramazanlar	236+000	0	North	337
Adapazari	Budaklar	237+000	270	South	1.356
Adapazari	Abali	238+000	500	North	1.364
Erenler	Kucukesence	239+000	2.200	South	836
Akyazi	Gebes	243+000	1.600	South	129
Akyazi	Bediltahirbey	244+500	1.000	South	259
Akyazi	Catalkopru	244+500	1.800	North	1.154
Akyazi	Turkormankoy	245+000	900	North	435
Akyazi	Kizilcikorman	246+000	250	North	756
Akyazi	Eskibedil	247+000	970	South	608
Akyazi	Vakif	248+000	0	South	1.145
Akyazi	Osmanbey	249+000	200	North	985
Akyazi	Kumkopru	250+000	625	North	460
Akyazi	Topagac/Ramasli	250+500	450	South	1.253
Akyazi	Duzyazi	251+000	1.000	South	525

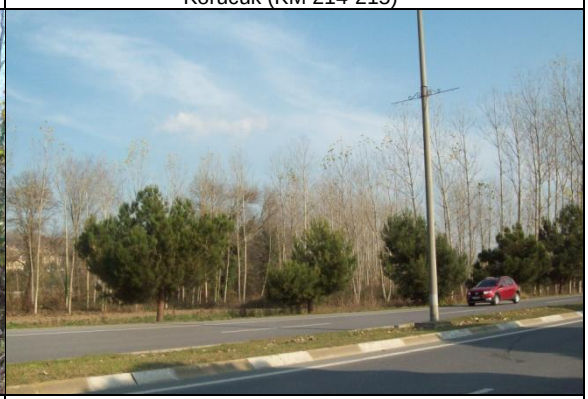
Between KM 195-200, Section 6 passes through the agricultural lands of Durhasan, Eseler and Bayraktar neighborhoods. Near Bayraktar and Biberoglu neighborhoods, located in the south and north of KM 199-200 respectively, several stud farms and greenhouses are observed besides the agricultural fields. Motorway passes from 500 m south of Bayraktar Pond at KM 199+500. In this area, there are a few greenhouses and buildings located within the expropriation corridor. At around KM 200, the Motorway enters a route dominated by forest vegetation, with local agricultural fields near Sapakpinar, Karabadulbaki and Suleymaniye neighborhoods, up until KM 210. Around KM 209, several buildings of Suleymaniye fall within the expropriation corridor. From KM 211 in the south of Akmese neighborhood, the route passes through agricultural fields until KM 215+500. In the south of Korucuk, which is a settlement understood to be urbanized after the 1999 Marmara Earthquake, forest lands redominate the route between KM 216 and 218+500. Starting from KM 221 until the end of Section 6, the route of the Motorway is located almost completely on agricultural lands, where it passes between several settlement in Sakarya province. North of KM 226+500, where the Construction Camp Site for Section 6 will be located near Taskisigi neigborhood, hosts several industrial facilities including ENKA Natural Gas Combined Cycle Power Plant, Nuh Concrete Plant, quarries, etc. Around KM 229 near Camyolu neighborhood, a few buildings are crossed by the Motorway route. Sakarya River is crossed by the Motorway route at KM 233. Storage areas for excavated materials are yet to be determined at several locations along the route. Photographs showing different route sections in Section 6 are presented in Figure 3.18.

Viaduct Location near Hacioglu Hamlet of Cayirkoy Neigborhood (KM 188)

View Towards Tunnel Exit Portal (KM 190)

Location of Road Crossing near Durhasan-Solaklar Neighborhood (KM 195+500)

Location of Road Crossing on the Biberoglu neighborhood Road (198)

	
Location of Service Area on Gedikli Neighborhood Road (KM 200)	View Towards Motorway Section Passing through between KM 202-204
	
View towards Motorway from Sapakpinar Neighborhood Road (KM 205+500)	View Towards Planned Excavation Material Storage Area Within the Forestry Area (KM 206+000)
	
Road Crossing near Besevler-Suleymaniye Neighborhoods (KM 209)	View towards Motorway Section Passing from South of Korucuk (KM 214-215)
	
Location of Overpass near Besevler Neighborhood (KM 217)	Location of Overpass between Karaman and Evrenkoy Neighborhoods (KM 222)

	
Road Crossing at the location of Kaynarca-Adapazari-Karaman Camili Interchange (KM 223+500)	Location of Overpass at the east of Kaynarca-Adapazari-Karaman Camili Interchange (KM 225)
	
Location of Underpass in the Southeast of Camyolu (Structures within Expropriation Corridor (KM 229)	Road Crossing near Baglar neighborhood (KM 231)
	
Location of Karasu Interchange (KM 232)	Sakarya River Crossing in the Southwest of Celebiler Neighborhood (233)
	
Location of Akyazi Interchange (KM 244)	Road Crossing; Industrial Buildings are located within the Expropriation Corridor Near Osmanbey (KM 248)

Figure 3.18. Photographs Showing Different Route Sections in Section 6

3.5. Workforce

Project workforce will include personnel to be employed by contractors (direct workers) and sub-contractors (contracted workers). These personnel will be categorized as site personnel and office/administrative personnel. Site personnel refers to the workers who are directly involved in the construction activities at field; while office/administrative personnel refers to the office managers, administrative staff, drivers, etc. who are not directly engaged with the construction works conducted at site. Maximum number of direct and contracted workers/personnel anticipated to be employed in each section of the Asian part is given in Table 3.32 for the peak period of construction works.

Table 3.32. Maximum Number of Personnel anticipated to be Employed at Peak Construction Works

Location	Number of Maximum Personnel Anticipated to be Employed in Each Section		
	Contractor	Sub-contractor	Total
Section 4 (Limak)	1.000	1.500	2.500
Section 5 (Cengiz)	400	500	900
Section 6 (Kolin)	850	250	1.100
Total	**2.350**	**2.250**	**4.500**

Site personnel are mainly composed of engineers, technicians, foremen, topographers, operators, drivers, laboratory workers and unskilled workers. On the other hand, composition of office/administrative personnel generally includes Project Manager, Site Manager, office engineers, financial staff and other drivers.

In the operation phase, relevant personnel will work at the toll plazas, control, operation and maintenance centers. At each toll plaza, 4-5 personnel will provide services in shifts for the arrangement of cash payments. In addition, 4-5 personnel will work at each control center that will be established at the toll collection areas. Total number of toll plazas for the Asian sections is estimated as 22. Personnel to be employed at operation and maintenance centers will include white and blue-collar workers who will provide snow removal services and conduct maintenance, technical, repair and workshop operations. At each operation and maintenance center, on average 70 workers will be employed. Number of operation personnel anticipated to be employed at each facility is summarized in Table 3.33.

Table 3.33. Number of Personnel to be Employed at Operation Facilities

Location	Estimated Number Personnel Anticipated to be Employed at the Operation Facilities
Asian Side	
Toll Plazas (x22)	90
Control Centers (x22)	90
Main Control and Operation Center (KM 177)	5
Operation and Maintenance Centers (x2)	140
Total	**325**

In addition to the personnel to be employed at the toll collection areas and operation, control and maintenance works, Project will create employment opportunities for local people at the service areas that will include restaurants, tea and coffee houses, shops, gas stations, kiosks, etc.

3.6. Construction Machinery

Maximum number and distribution of construction machinery foreseen for each section of the Project during the peak construction period are provided in Table 3.34.

Table 3.34. List of Estimated Construction Machinery for Peak Construction Period

Type of Machinery	Asian Side		
	Section 4	Section 5	Section 6
Crawler excavator	35	16	30
Wheeled excavator	3	1	5
Grader	10	2	3
Dozer	12	3	6
Wheeled loader	10	5	8
Backhoe loader	3	2	2
Crawler loader		5	1
Roller	20	7	3
Truck	130	65	200
Rock Driller	8	-	4
Water Truck	4	5	6
Light tower	15	-	4
Trailer	-	1	4
Crane	-	2	3
Fueloil Tanker	-	2	4
Maintenance Vehicle	-	1	3
Concrete Pump	-	2	6
Others (ROC)	-	4	-
Total	**250**	**123**	**292**

3.7. Materials to be Used

Aggregate, concrete, steel, aluminum, cement, bitumen, cables, etc. will be used in construction works. Concrete will be required for the construction of bridges, retaining walls, culverts, and other engineering structures. Aggregate to be used for concrete production will be supplied from licensed quarries. Following extraction, aggregate will be crushed, screened and washed where necessary. Concrete types/classes to be used in the Project will include the following:

- Precast prestressed beam concrete
- Post-tensioned prestressed beam concrete
- Reinforced concrete
- Plain concrete

During the operation phase, use of salt (NaCl), calcium chloride ($CaCl_2$) and magnesium chloride ($MgCl_2$) will be required in the scope of road deicing activities. These materials would be used directly or blended in proper ratios. Amount of chemicals to be used per m^2 of road surface will depend on the road conditions (i.e. open roads prior to the start of snowfall event, snow covered roads, slippery ice bound roads) and weather temperatures (between 0^0C and -12^0C).

Suitable chemicals and materials (e.g. concrete, cement, epoxy, repair mortar, rust removing chemicals, hydrochloric acid, etc.) will also be used for the repair and maintenance of engineering structures.

3.8. Traffic Projections

The minimum traffic (as passenger car equivalents-PCE) guaranteed under the related terms of the BOT contracts for Asian sections of the Motorway is provided below:

- Section 4 (Kurtkoy-Liman) : 125.000 PCE/day
- Section 5 (Liman-Izmit) : 90.000 PCE/day
- Section 6 (Izmit-Akyazi) : 60.000 PCE/day

3.9. Implementation Program

Implementation Program for Asian sections of the Project is presented in Table 3.35. Project expropriation and land use permitting works have already started in all sections and progressing at different paces and different locations. Land preparation and construction works start only after expropriation or land use permitting works are completed at a certain location. Mobilization activities at the camp sites are currently going on.

Table 3.35. Project Implementation Program for the Sections Located in the Asian Side

Activity/Task	Year/Months																																														
	2016												2017												2018												2019											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1. Administrative Stages, Planning and Coordination							■	■	■																																							
1.1. Contract Signing							■																																									
1.2. Site Delivery							■																																									
1.3. Mobilization								■	■																																							
2. ESIA Studies											■	■	■	■	■	■	■	■	■	■	■	■																										
2.1. Environmental and Social Baseline Studies (inc. Field Work)											■	■	■	■	■	■	■	■																														
2.2. Stakeholder Engagement Activities											■	■	■	■	■	■	■	■	■	■																												
2.3. ESIA Reporting											■	■	■	■	■	■	■	■	■	■																												
2.4. Disclosure of Key ESIA Documents																					■																											
2.5. Finalization of ESIA Process																						■																										
3. Project Design and Expropriation Works							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																										
3.1. Preparation of Expropriation Plans								■	■	■	■	■	■	■	■	■	■	■																														
3.3.Expropriation Works								■	■	■	■	■	■	■	■	■	■	■	■	■	■																											
3.3. Preparation of Implementation Projects							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																										
4. Construction Works									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
4.1. Earthworks									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■														
4.1.1. Topsoil Stripping and Poor Soil Excavation									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																
4.1.2. Cut and Fill ting Operations									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■														
4.2. Bridges, Underpasses, Overpasses										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
4.2.1. Overpasses (Section 4, 5 and 6)										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
4.2.2. Underpasses (Section 4, 5)										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■														
4.2.3. Overpasses (Section 6)										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■													
4.2.4. Bridges (Section 4)											■	■	■	■	■	■	■	■																														
4.2.5. Bridges (Section 6)											■	■	■	■	■	■	■	■	■	■	■	■																										
4.4. Culverts (Sections 4, 5 and 6)									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
4.4. Viaducts									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
4.4.1. Viaduct km: 140+000															■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
4.4.2. Viaduct km: 8+644 (Section 4)												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■													
4.4.3. Viaduct km: 159+540 (Section 5)										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■													
4.4.4. Viaduct km: 164+960 (Section 5)											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■															
4.4.5. Viaduct km: 171+865 (Section 5)									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																								
4.4.6. Viaduct km: 185+400 (Section 5)											■	■	■	■	■	■	■	■	■	■																												
4.4.7. Viaduct km: 1+180 (Section 5)								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■													
4.4.8. Viaduct km: 4+920 (Section 5)															■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
4.4.9. Viaduct km: 196+775 (Section 6)										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																		
4.4.10. Viaduct km: 202+080 (Section 6)															■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																			
4.4.11. Viaduct km: 215+845									■	■	■	■	■	■	■	■	■	■	■	■	■																											
4.4.12. Viaduct km: 226+220 (Section 6)																		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
4.5. Tunnels (km: 10+455 (Section 4))											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																			
4.6. Superstructures																		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
4.6.1. Sub-grade																			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
4.6.2. PMAT																				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
4.6.4. PMT																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
4.6.4. Bituminous Foundation and Binder																						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
4.6.5. TMA																													■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
4.7. Finishing Operations																																							■	■	■	■	■					
4.7.1. Horizontal and Vertical Traffic Signs																																							■	■	■	■	■					
4.7.2. Guardrails amd Fences																																							■	■	■	■	■					
4.8. Others																													■	■	■	■	■	■	■	■	■	■	■	■	■	■						
4.8.1. Park and Service Areas																													■	■	■	■	■	■	■	■	■	■	■	■	■	■						
4.8.2. Maintenance and Operation Center and Toll Collection Systems																													■	■	■	■	■	■	■	■	■	■	■	■	■	■						
5. Tests and Commissioning																																							■	■	■	■	■					
6. Demobilization and Closure																																										■	■					

3.10. Project Costs and Incomes

As the North Marmara Motorway Project will be implemented in the framework of a BOT model, financing, planning/design, building/construction, operation and full range of maintenance and repair works will be under the responsibility of the Project Sponsors during the Contract Duration, which covers both the construction and operation phases. Total investment cost for the Asian sections of the North Marmara Motorway Project has been estimated as 4.487.000.000 TL including the expropriation costs up to 500 Million TL and excluding the value added tax (VAT). The Project is planned to be financed by the Sponsors' own resources/equity and the loan to be obtained from potential lenders. In accordance with the BOT Contract, equity to be allocated by the Sponsors will be minimum 20% of the total investment cost. Finance structure of the North Marmara Motorway as a BOT Project is represented in Figure 3.19.

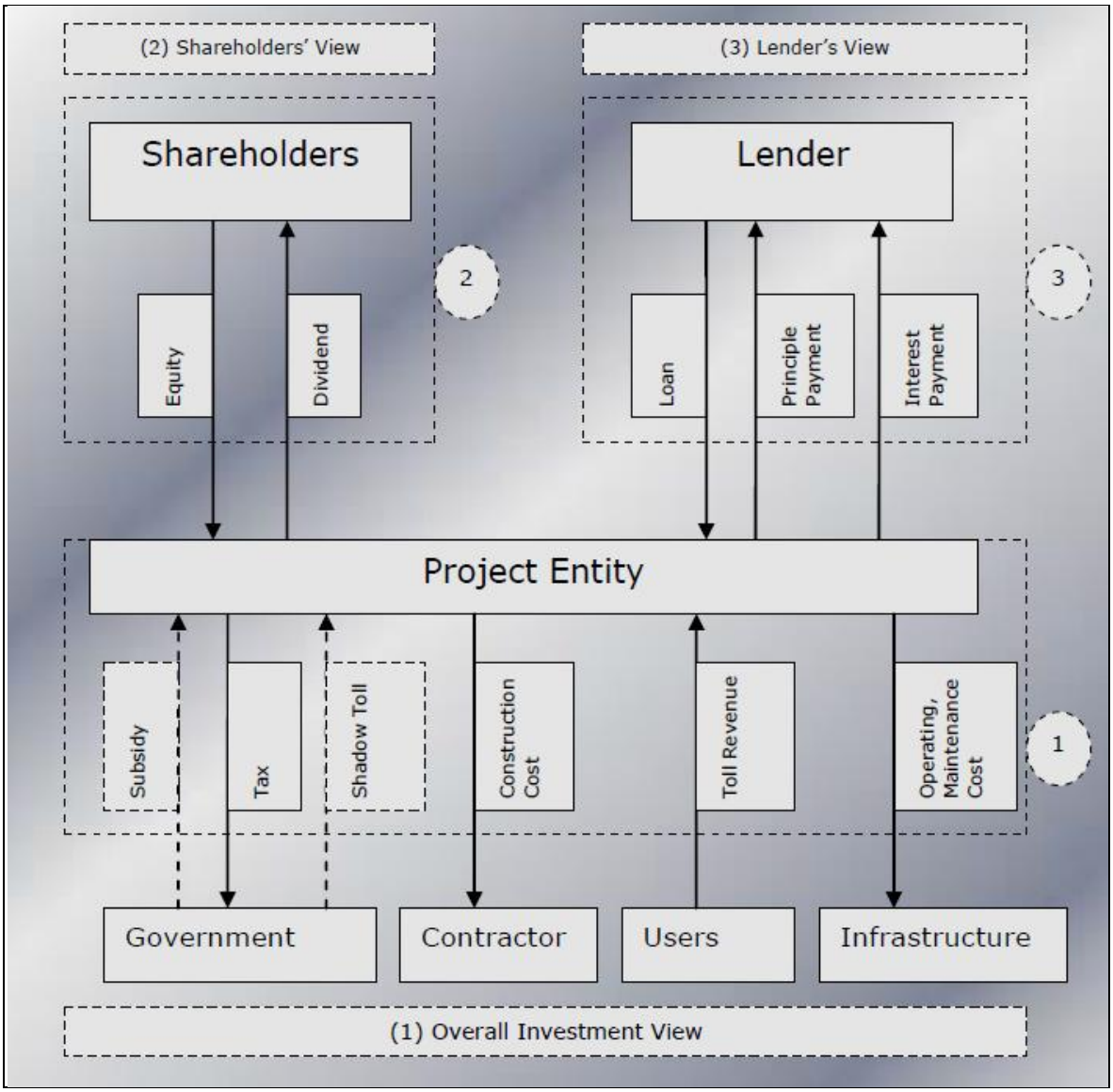


Figure 3.19. Representation of the Finance Structure of BOT Projects (*Source: KGM, August 2010*)

The main cost items for the pre-operation and operation phases of the Project would include the following (*KGM, June 2011*):

- Expropriation costs;
- Construction costs for the Motorway components and access roads;
- Maintenance and repairment costs during the operation phase (routine maintenance, winter maintenance, periodic maintenance in every 10 years);
- Other operation costs;
- Taxes;
- Reimbursement of credit principal and interest.

Construction costs will mainly include the costs for the expropriation, surveys, design, consulting services, earthworks, construction of engineering structures, tunnels, bridges, overpasses, underpasses, etc. According to the BOT Contract, Project Sponsors does not have any responsibility or authority regarding the execution of expropriation works but they are liable to provide up to 500 million TL for the expropriation costs. The costs exceeding this amount will be provided by the KGM. The costs related with the procurement of services for the valuation works and others will be separately covered by the Project Sponsors.

Following the completion of the construction works (shall be maximum 3 years) and commissioning of the Motorway, toll revenues will be collected from the road users by the Project Sponsors until the end of the Contract Duration, which has been specified as 6 years 9 months 12 days. In case the toll revenues collected are below the revenue projected to be collected for the minimum traffic guaranteed under the BOT Contract (see Section 3.8), the difference will be paid to the Project Sponsors. Additional earnings will be obtained as a result of the operation of the service areas. Initial toll levels according to the BOT Contract are given in Table 3.36. Toll levels for the subsequent levels will be determined based on the formula given in the BOT Contract.

Table 3.36. Toll Levels according to BOT Contract

Class	Type of Vehicle	Initial Ceiling Toll Level (USD/km + 18% VAT)	Numbers Axes	Passenger Car Unit (PCU)
1	Passenger cars	0,0600	2	1
2	Truck	0,0960	2*	1,6
	Bus			
	Semi-trailer tractor, rescue vehicle			
3	Truck	0,1140	3	1,9
	Semi-trailer tractor			
	Two-axed rescuer pulling single-axled vehicle on ground			
4	Two-axled rescuer pulling two or more semi-trailers	0,1512	4-5	2,52
	Wagon			
	Three-axled rescuer pulling vehicle			
5	6-7-8 axled trailer (including tractor)	0,1908	6	3,18
6	Motorcycle	0,0420	-	0,7

**Axe distance is minimum 3,20 m or larger.*

CHAPTER 4

ESIA METHODOLOGY

CHAPTER 4. ESIA METHODOLOGY

In its simplest form, impact assessment is defined as the process of identifying the future consequences of a current or proposed action by the International Association for Impact Assessment. Good Environmental and Social Impacts Assessment (ESIA) practice requires the task of identifying and assessing environmental effects to commence at the early inception of the project (*UK Highways Agency 205/08: Design Manual for Roads and Bridges; http://www.standardsforhighways.co.uk/ha/standards/dmrb/*).

The environmental and social impact assessment (ESIA) study to be conducted for the North Marmara Motorway Project will conform to both the requirements of international standards including Equator Principles III and IFC's Performance Standards on Environmental and Social Sustainability (including general and sector-specific EHS guidelines). IFC, in its Guidance Note 1 on the Assessment and Management of Environmental and Social Risks and Impacts, specifies the key process elements of an ESIA study as follows:

(i) initial screening of the project and scoping of the assessment process;

(ii) examination of alternatives;

(iii) stakeholder identification (focusing on those directly affected) and gathering of environmental and social baseline data;

(iv) impact identification, prediction and analysis;

(v) generation of mitigation or management measures and actions;

(vi) significance of impacts and evaluation of residual impacts;

(vii) documentation of the assessment process (i.e. ESIA Report)

Based on IFC's approach that summarizes the international good practice for impact assessment, the systematic process that have been conducted for the assessment of North Marmara Motorway Project's environmental and social impacts and development of mitigation measures and plans for the management of significant impacts is illustrated in Figure 4.1.

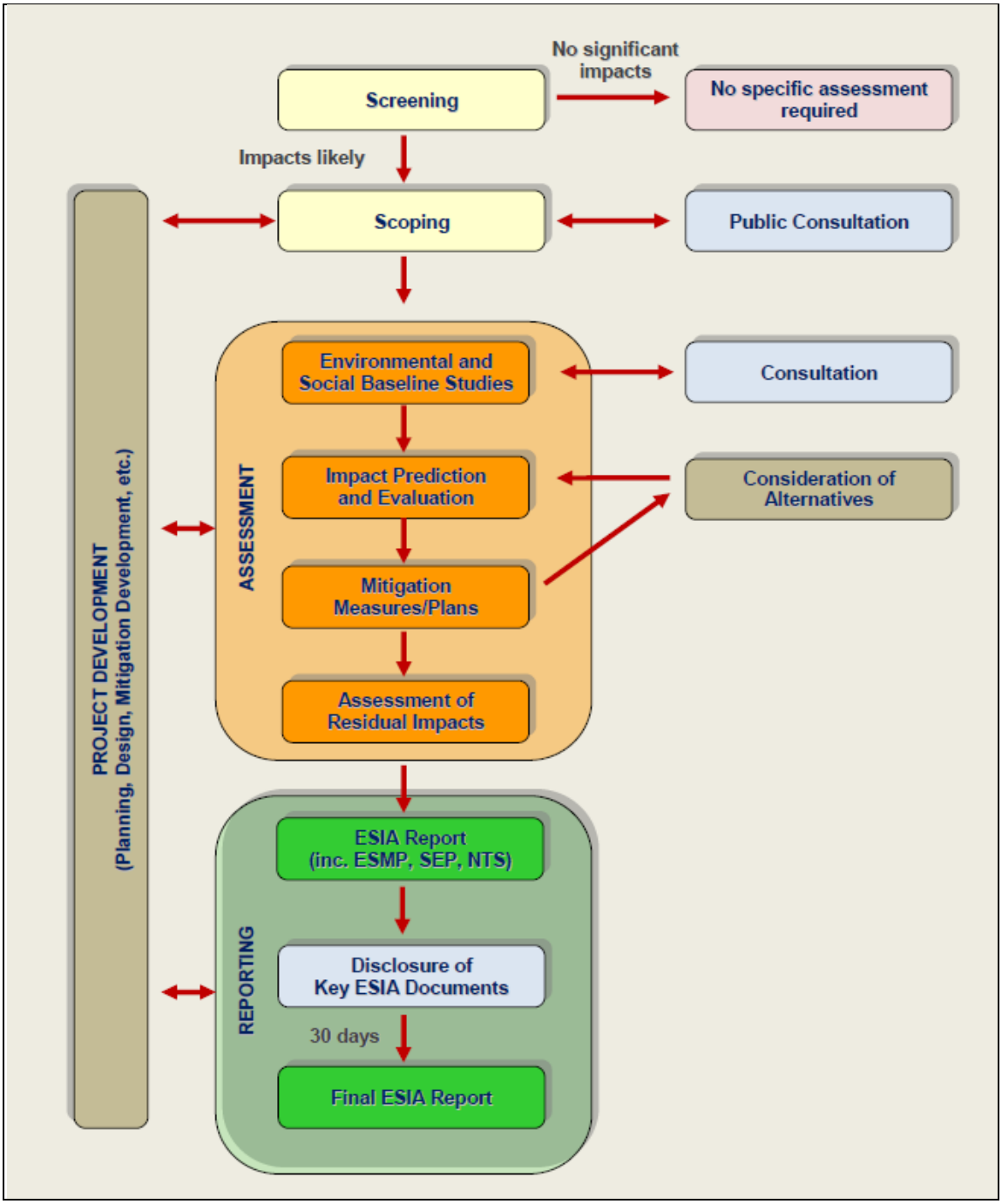


Figure 4.1. ESIA Process (*adapted from IFC's Guide to Biodiversity for the Private Sector*)

In the ESIA Process, screening is used to make a rapid, high-level analysis to determine whether a full ESIA is necessary. As a part of the screening process conducted for the North Marmara Motorway, the Project has been classified as a Category A Project, for which the borrower is responsible for preparing an EIA Report/full-scale ESIA.

Following the screening of the Project, scoping works have been conducted to determine which impacts are likely to be significance and should become the main focus of the ESIA. Findings of the scoping studies have been compiled in a Scoping Report.

A comprehensive baseline information assembly program has been designed for the Project to establish a reference point against which any future changes associated with a project can be assessed and offer information for subsequent monitoring. The baseline program has relied on both desk-based studies to analyze readily available information from governmental organizations, academic publications, internet resources, etc. and field surveys to gather site environmental and social information.

Impact prediction and evaluation has been the heart of the ESIA and involved analyzing the impacts identified in the scoping and baseline work to determine their nature (adverse or beneficial, direct or indirect), temporal (permanent or temporary) and spatial (local, regional, national, etc.), reversibility (reversible or irreversible), magnitude and likelihood. Such detailed impact analysis has required professional judgment and input from relevant experts.

Once the potential impacts have been more fully understood, the significance of each impact has been judged to determine whether it is acceptable, requires mitigation or is unacceptable. Cumulative impacts, which may result from multiple actions on valued receptors, have been separately assessed as a part of the study to the extent the level of readily available information allowed. As an iterative process, emerging findings of the assessments have been conveyed to design teams to develop mitigation plans for the Project, where feasible.

It should be noted that determining the significance of impacts is a complex and subjective process. A number of factors affect significance including the importance of resources at local, regional, national or international levels; whether the area is subject to formal or informal protection; the ecological values of potentially affected animal and plant species and habitats, and the value of the ecosystems as sources of food or livelihood for local communities (*IFC, 2016. A Guide to Biodiversity for the Private Sector: The Social and Environmental Impact Assessment Process*).

Study Area and Area of Influence (AoI)

Good ESIA practice suggests that the study area for ESIA is to be defined on a case-by-case basis reflecting the project and the surrounding environment over which significant effects can reasonably be thought to have the potential to occur both from that project in combination with other projects. The study area is recommended to be set for each individual topic (*UK Highways Agency 205/08).*

According to IFC PS 1, the Area of Influence (AoI) is to encompass the following as appropriate:

- The area likely to be affected by: (i) the Project (e.g. Project sites, immediate airshed and watershed, or transport corridors) and the Project Sponsors' activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project (e.g. tunnels, access roads, borrow and disposal areas construction camps); (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

- 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.

In this respect, the Motorway including all of its components (i.e. interchanges, tunnels, viaducts, service areas, etc.) as well as the components including tunnels, viaducts, Construction Camp Sites, service roads, quarries, material borrow sites and storage sites have been considered in the ESIA to the extent the level of information allowed. For each environmental and social component (e.g. water, air, ecology, etc.) individual study areas ("sub study area") have been determined depending on the nature and characteristics of specific impacts. The sub study areas are larger than the direct impact area, which would be referred as the Project AoI. The overall study area for the ESIA has been determined based on the largest sub study area; thus covers all the sub study areas specified for different environmental and social components.

Study areas and AoI's for each environmental and social component are listed in Table 4.1. As mentioned previously, the AoI has been determined in consideration of the direct impact area of the Project activities. In this respect, the Motorway width (43 m) and the minimum width of the expropriation corridor (100 m) has been considered. It should be noted that the expropriation corridor will extend up to maximum 350 m at the locations of interchanges, large embankment and cut sites, service areas, etc. In addition, some of the Construction Camp Sites, quarries and disposal sites are located out of the expropriation corridor. Thus, in consideration of such components, study area had to be expanded exceptionally as needed. Disregarding such exceptional cases, the general Study Area for an example Motorway section is shown in Figure 4.2. The overall study area covering all the sub study areas has been determined 4.000 m corridor (2.000 m from each side in addition to the road width) on the basis of the air quality component.

Table 4.1. Proposed Study Area for the Motorway

Environmental and Social Component	General Study Area**	General Area of Influence (AoI)**
Land Use and Property	400 m	100 m
Topography, Soils and Geology	400 m	100 m
Ecology and Biodiversity	400 m	100 m
Air Quality	4.000 m	2.000 m
Noise and Vibration	2.000 m	1.000 m
Landscape	400 m	400 m
Protected Areas	400 m	100 m
Cultural Heritage	400 m	100 m
Socio-economic Environment *	4.000 m	2.000 m
Health and Safety	2.000 m	1.000 m

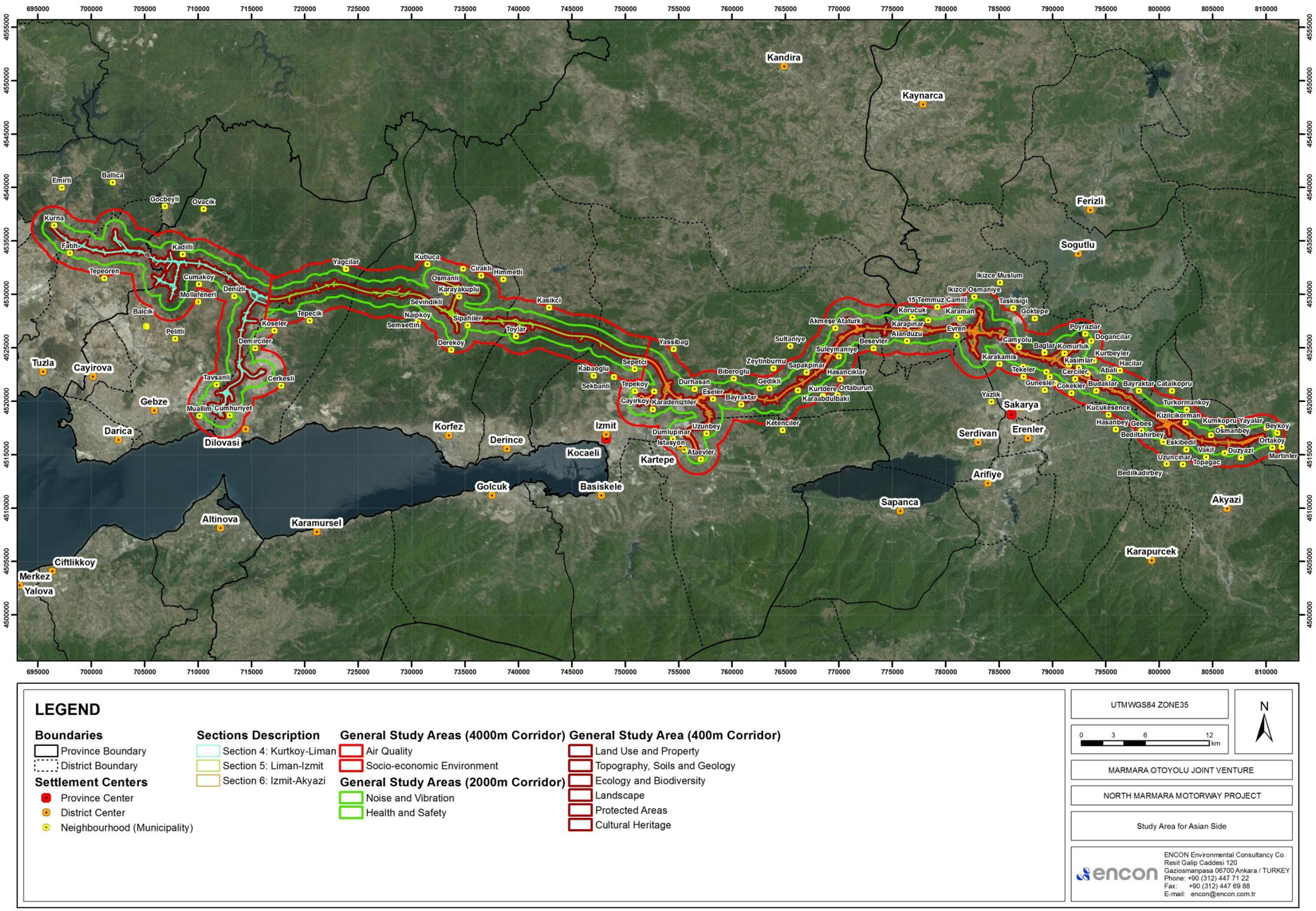
**It should be noted socio-economic environment, due to its nature, propound a distinction in the ESIA approach; thus the study area specified in the table for socio-economic environment should be considered as the minimum study area. Settlements, whose lands extend beyond the proposed study area, have also been included in the scoping assessments, whenever if they are likely to be affected.*

***Represents the total width. For example; a 400 m study area is composed of 2 x 200 m corridors (200 m located in the left side and 200 m located in the right side of the Motorway's axis, making a total of 400 m in total).*

Assessing Significance of Impacts

Significance of impacts is the key output of the environmental and social impact assessment process as the mitigation strategies/approaches of Projects are developed depending on the level of significance.

The significance of impacts is a function of the value and/or sensitivity of the receptor and/or resource and the magnitude of the impact that cause change in the conditions of the receptor and/or resource. Thus, assigning environmental and/or social value/sensitivity of the resources and receptors and estimation of the magnitude of impact are the initial steps to be complete to assess the significance of impacts.



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

General Study Areas (4000m Corridor)
- Air Quality
- Socio-economic Environment

General Study Areas (2000m Corridor)
- Noise and Vibration
- Health and Safety

General Study Area (400m Corridor)
- Land Use and Property
- Topography, Soils and Geology
- Ecology and Biodiversity
- Landscape
- Protected Areas
- Cultural Heritage

UTMWGS84 ZONE35

N

0 3 6 12 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Study Area for Asian Side

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Figure 4.2. Study Area for an Example Motorway Section

Once the value/sensitivity of the receptor/resource as well as the magnitude of impact is determined, assessment of significance is generally done on the basis of impact categorization matrices. For the evaluation of the significance of the impacts for construction and operation phases of the North Marmara Motorway Project, the categorization matrix (3 x 3) given in Table 4.2 will be used. This matrix allows the evaluation of the magnitude of impacts in combination with the sensitivity/value of receptors/resources. Once the overall significance of impacts are categorized on the basis of this matrix, mitigation measures will be developed for the significant (i.e. high and/or medium) impacts, and the residual impacts will be evaluated after the implementation of the mitigation measures.

Table 4.2. Impact Significance Categorization Matrix*

		Sensitivity/Value of Receptor/Resource		
		High (3)	**Medium (2)**	**Low (1)**
Magnitude of Impact	**Major (A)**	High (A3)	High (A2)**	Medium (A1)
	Moderate(B)	High (B3)	Medium (B2)	Low (B1)
	Minor (C)	Medium (C3)	Low (C2)	Low (C1)

**Adapted from World Bank, December 2012.*

***It should be noted that the significance level represented by A2 was ranked as "medium" in the source document; but it has been modified to "high" in this assessment in order to be on the safe side and make a stricter assessment.*

Impact Significance		**High**	Imperative to reduce impact significance but relevant mitigation required before proceeding; represent key factors in the decision-making process. These impacts are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
		Medium	Significance is to be reduced to a lower category as long as it is feasible by taking relevant mitigation measures; if not possible can be proceeded by acceptance of associated risks. These impacts effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
		Low	Acceptable to proceed without additional measures assuarance of compliance with standards and safety criteria is assured. These impacts may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.

** Adapted from L. Canter, 1993 and Highways Agency 205/08: Design Manual for Roads and Bridges.*

The structure of the impact categorization matrix to be used in the scope of the assessments entails categorization of value/sensitivity and magnitude in three levels. In the scope of the ESIA conducted for North Marmara Motorway Project, the environmental and/or social "sensitivity/value" of a receptor/resource will be defined as "high", "medium" or "low", individually for each type of receptor/resource depending on their value/importance for the community (i.e. cultural or economic) or wild life, existing quality, protection status that will be identified based on the findings of the baseline studies (desk-based and field) and consultation to be done with local stakeholders. When there are government-established thresholds or national/international scientific literature defined for a receptor/resource this will be taken into consideration; otherwise sensitivity/value designation will be done by using professional judgement of the ESIA experts. Typical descriptors that would be considered to describe specific sensitivity/value criteria for each individual environmental and/or social component under the relevant chapters of this ESIA are provided in Table 4.3.

Table 4.3. Typical Descriptors to be Considered in Assigning Individual Value/Sensitivity Criteria

Value/Sensitivity Level	Typical Criteria Descriptors
High	High importance and rarity, international or national scale, and very limited potential for substitution.
Medium	Medium importance and rarity, regional scale, limited potential for substitution.
Low	Low importance and rarity, local scale.

** Adapted from Highways Agency 205/08: Design Manual for Roads and Bridges.*

The "magnitude" of the impacts is a measure for the degree of change. Magnitude represents impacts' physical/geographical extent/range (in terms of area, length, etc.), duration (long-term, medium-term or short term), reversibility of the impact (short-term reversible, long-term reversible or irreversible), frequency (one-off, intermittent or continuous) and likelihood (unlikely, probable or certain) etc. In consideration of these individual factors, overall magnitude of the impacts will be determined for each impact. The categorization of the overall magnitude (as minor, moderate, major) would change for each resource (i.e. environmental media) under consideration and this categorization will be done in the relevant chapters of the ESIA Report. Magnitude factors and the typical descriptors that would be considered to estimate overall magnitude for impacts under the relevant chapters of this ESIA are provided in Table 4.4.

Applying the matrix, the greater the environmental sensitivity/value of the receptor/resource, and the greater the overall magnitude of impact, the more significant the impact. For example, the consequences of a highly valued environmental resource or highly sensitive receptor suffering a major detrimental impact of high magnitude would be a very significant adverse impact (*Highways Agency 205/08: Design Manual for Roads and Bridges).*

Table 4.4. Impacts Magnitude Criteria

Magnitude Factors						Typical Criteria Descriptors for Overall Magnitude*		
Type	**Geographic Extent**	**Duration**	**Reversibility**	**Frequency**	**Magnitude**	**Overall Magnitude Level**	**Adverse/Negative**	**Beneficial/Positive**
Beneficial/ Positive	Restricted (within the expropriation corridor; <200 m at each side of the Motorway axis)	Short (less than 1 year)	Short term reversible (within 3 years)	One-off/ Occasional	Low (e.g. amount of land use to be affected is less than 5% of the total amount of land use within the impact area)	Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Neutral	Local (200 to 1.000 m at each side of the Motorway axis)	Medium (1-3 years)	Long term reversible (3-15 years)	Intermittent	Medium (e.g. amount of land use to be affected is less than 10% of the total amount of land use within the impact area)	Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Adverse/ Negative	Wide (>1.000 m at each side of the Motorway axis)	Long (more than 3 years)	Irreversible	Recurrent/ Continuous	High (e.g. amount of land use to be affected is more than 10% of the total amount of land use within the impact area)	Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring .

** Adapted from Highways Agency 205/08: Design Manual for Roads and Bridges.*

Mitigation and Residual Impacts

Once the impacts are predicted and evaluated including judgment of significance, mitigation measures and plans will be developed, by taking the results of the consultations done, to eliminate or reduce/minimize adverse impacts and maximize the benefits. The mitigation hierarchy given in Figure 4.3 will be followed, whenever technically and financially possible. In this hierarchy, avoidance is considered the most acceptable form of mitigation. It may require changes to be made on the project's design or location that would be done wherever technically and financially feasible. Minimization and mitigation through environmental and social measures/treatments/design is aimed where avoidance is not a possible option. Compensation/offset for residual risks and impacts is considered to be the last option in this hierarchy where avoidance or minimization and/or mitigation measures are not available. This option does not eliminate the identified adverse risks and impacts, but they seek to offset it with an (at least) comparable positive one.

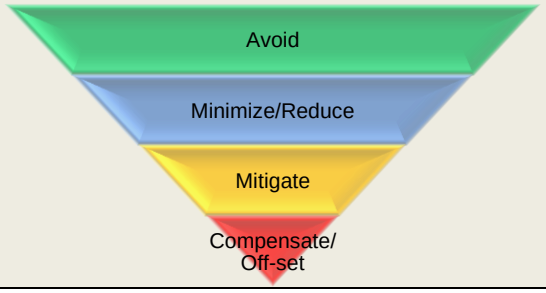
1. Avoidance of impacts altogether 2. Minimization/reduction of impacts where unavoidable 3. Mitigation of impacts (e.g. restoration of habitats to their original state, relocation of affected species and habitats, etc.) 4. Compensation for any residual, unavoidable damage	

Figure 4.3. Mitigation Hierarchy to be Adopted

Within this ESIA, impact categorisation and significance have been evaluated with reference to definitive standards, accepted/published criteria and legislation, where available. Where it has not been possible to quantify impacts and effects, qualitative assessments have been carried out, based on expert knowledge, GIIP and professional judgement. Quantitative methods predict measurable changes as a result of the North Marmara Motorway Project and rely on accurately measuring baseline conditions to make accurate predictions/estimations regarding the potential impacts. Qualitative assessment methods rely on expert judgement and experience.

While it is important to identify the initial significant impacts associated with the Project, the key focus of the impact assessment has been to define the significance of residual impacts and effects following application and/or consideration of mitigation measures. A residual impact is one which continues to be present following the application of avoidance and/or mitigation measures. In this regard, a summary table is provided in the final section of each Chapter to indicate the potential significance of impacts first in the absence and then in the presence of mitigation to assist in demonstrating the anticipated effectiveness of proposed mitigation measures and assign the significance of residual impacts.

Once the significance of Project-level impacts of North Marmara Motorway is determined under relevant Chapters of this ESIA, cumulative impacts will be separately assessed in Chapter 17. Methodology for the cumulative impact assessment is provided in this Chapter.

CHAPTER 5

LAND USE AND PROPERTY

CHAPTER 5. LAND USE AND PROPERTY

This Chapter identifies the existing land use characteristics and ownership properties along the Asian sections of the Motorway route and assesses the potential impacts of the North Marmara Motorway Project on these aspects. Measures proposed for the mitigation of the potential impacts and the residual impacts are also described in this Chapter. Potential socio-economic impacts on local communities and/or owners/users of the affected lands (e.g. physical displacement, economic displacement, etc.) associated with the changes in the existing land use characteristics are covered in Chapter 14 ("Socio-economic Environment").

5.1. Assessment Methodology and Data Sources

Land use characteristics for each section of the Motorway will be initially identified for a study area (corridor) having a total width of 400 meters (around 200 meters in each side of the Motorway axis). The study area for the land use analyses has been determined based on the width of the expropriation corridor, which will have a minimum width of 100 meters in accordance with motorway standards and may expand up to 350 meters depending on the topographical conditions, associated cut and fill plans as well as footprints of the large Project components such as interchanges, service areas, etc. Thus, the study area has been determined to totally cover the maximum corridor along the entire Motorway.

The land use characteristics within the study area will be initially analyzed by using the "Coordination of Information on the Environment (CORINE) Land Cover" (2006) database with the aid of Geographic Information System (GIS) tools. In addition, Land Use Database of the former Turkish General Directorate for Rural Services prepared for Istanbul (in 1987), Kocaeli (in 1991) and Sakarya (in 1995) will also be used to identify the previous land use characteristics of the area, which would allow a comparison of the changes that have had happened in the past 20-30 years. A general review of the existing upper scale Environmental Master Plans of the three provinces will also be done to verify the analyses done in the previous steps and identify the future development potential of the cities.

It should be noted that several tunnels and viaducts have been included in the Project design to overcome geotechnical and/or topographic challenges along the route as well as to protect environmental and/or social resources/receptors such as forest areas, important water bodies, residential areas and/or cultural heritage sites corresponding to those sites. Owing to their design features and structures, the land use characteristics corresponding to the tunnels and viaducts will not be physically affected resulting no or minimal change in the existing land use and ownership properties, which are limited with the footprint of entrance/exit portals of the tunnels and foundation legs for the viaducts. Therefore, in the land use analyses, the area to be preserved by the engineering structures had to be taken into consideration. Correspondingly, a special approach has been adopted for the parts of the study corridor where engineering structures, such as tunnels and viaducts, will prevent/minimize the direct impacts on the land use.

As the land use at the route section over the tunnels (not including cut-cover tunnels) will not change (for example the forestlands over the tunnel route will be totally conserved) and the land use under the viaducts will only be impacted by the foundations, which would be negligible when compared to the entire length of the structure, the sections between the starting and ending points of these structures have been eliminated from the study area to avoid misinterpretations.

The study area itself does not directly represent the amount of land to be affected by the land preparation and construction activities, as it has been identified based on the maximum width of the expropriation corridor, which is 350 meters, and in actual case the expropriation corridor will be as low as 100 meters along an important portion of the Motorway route. Accordingly, to make more accurate judgments on the amount of land to be affected, as the next step, expropriation plans prepared for the North Marmara Motorway Project and land use (i.e. forestry) permits obtained/to be obtained for the lands to be used will also be analyzed to characterize the land use patterns and ownership information. To characterize the forestry features within the study corridor, relevant Forest Management Plans and Forest Stand Maps will be analyzed by the aid of GIS. For the construction facilities that are located on registered lands, database of the General Directorate of Land Registry and Cadastre and land use permits will also be used. The result of the analyses to be conducted will be presented in tabular formats and land use maps will also be produced for visual representation.

The data sources to be used in this scope are listed below:

- Coordination of Information on the Environment (CORINE) Land Cover" (2006)
- Land Use Database of the former Turkish General Directorate for Rural Services (GDRS)
- Database of the General Directorate of Land Registry and Cadastre
- Forest Management Plans and relevant Forest Stand Maps (official data from the General Directorate of Forestry)
- 1/100.0000 scale Environmental Master Plan of Istanbul
- Environmental Master Plan of Kocaeli
- 1/100.0000 scale Environmental Master Plan of Sakarya
- Expropriation Plans prepared for the North Marmara Motorway Project
- Land use permits/easement rights obtained by KGM in the scope of the Project.

Significance Criteria

The significance criteria for the impacts on land use and property will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on the land use components, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 5.1. Detailed explanation of the sensitivity components for each ecosystem component is provided in the following "Baseline Conditions" section.

Table 5.1. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	**Moderate (2)**	**Low (1)**
Forest lands	Forests having ecological functions according to Forestry Management Plans	Forests having social and cultural funcitons according to Forestry Management Plans	Forests having economic function according to Forestry Management Plans
Agricultural areas	Lands having land use capability of Class I-II according to GDRS Database (agricultural lands suitable for agricultural soil cultivation)	Lands having land use capability of Class III-IV according to GDRS Database (agricultural lands not suitable for soil cultivation)	Lands having land use capability of Class V-VIII according to GDRS Database (Non-arable lands)
Pasturelands	Lands having land use capability of Class I-V according to GDRS Database	Lands having land use capability of Class VI according to GDRS Database	Lands having land use capability of Class VII-VIII according to GDRS Database

5.2. Baseline Conditions

Existing land use characteristics along the Asian part of the Motorway route changes from section to section. Section 4 (Kurtkoy-Liman) of the Motorway corresponds to a variety of land use types distributed between forests, agricultural and shrubs. Main land use type along Section 5 (Liman-Izmit) is agricultural, while forests also crossed considerably. Section 6 (Izmit-Akyazi) passes predominantly through agricultural lands, while forestry areas are also present along the initial part of the route. Further evaluation of the baseline land use characteristics according to different information sources is provided below.

5.2.1. Land Use Characteristics within the Study Area

5.2.1.1. Land Use Characteristics according to CORINE Database

The CORINE program was initiated in the European Union in 1985 (*http://www.eea.europa.eu/*). The land cover project is a part of the CORINE program and is intended to provide consistent localized geographical information on the land cover of the member states of the European Community. The studies in the scope of CORINE program in Turkey were started by the former State Statistical Institute (currently acting as Turkish Statistical Institute-Turkstat) in 2001. Later on, former Ministry of Environment and Forestry (currently acting as Ministry of Environment and Urbanization) was involved in the process and as a result of the efforts of the Ministry, CORINE 2000 and CORINE 2006 projects were approved by the European Environment Agency in 2008 and 2009, respectively. In the current situation, Turkey has submitted the databases produced under the program to the European Environment Agency and the relevant maps have been integrated with the European land cover maps (*http://corine.ormansu.gov.tr/corineportal*). The overall land cover classification of CORINE database, which provides a conceptual framework for understanding the different types of land cover, is listed in Table 5.2.

Table 5.2. Land Cover Classification of CORINE Database

Level 1	Level 2	Level 3	Definition
1. Artificial surfaces	1.1. Urban Fabric	1.1.1. Continuous Urban Fabric	Most of the land is covered by buildings, roads and artificially surfaced area covering almost all the ground. Non-linear areas of vegetation and bare soil are exceptional.
		1.1.2. Discontinuous urban fabric	Most of the land is covered by structures. Buildings, roads and artificially surfaced areas associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces.
	1.2 Industrial, commercial and transport	1.2.1. Industrial or commercial units	Artificially surfaced areas (with concrete, asphalt, tamacadam, or stabilised, e.g. beaten earth) devoid of vegetation, occupy most of the area in question, which also contains buildings and/or vegetated areas.
		1.2.2. Road and rail networks and associated land	Motorways, railways, including associated installations (stations, platforms, embankments). Minimum width to include: I00 m.
		1.2.3. Port areas	Infrastructure of port areas, including quays, dockyards and marinas.
		1.2.4. Airports	Airport installations: runways, buildings and associated land.
	1.3. Mine, dump and construction sites	1.3.1. Mineral extraction sites	Areas with open-pit extraction of industrial minerals (sandpits, quarries) or other minerals (opencast mines). Includes flooded gravel pits, except for river-bed extraction.
		1.3.2. Dump Sites	Landfill or mine dump sites, industrial or public.
		1.3.3. Construction Sites	Spaces under construction development, soil or bedrock excavations, earthworks.
	1.4. Artificial, non-agricultural vegetated areas	1.4.1. Green Urban Areas	Areas with vegetation within urban fabric. Includes parks and cemeteries with vegetation.
		1.4.2. Sport and Leisure Facilities	Camping grounds, sports grounds, leisure parks, golf courses, racecourses, etc. Includes formal parks not surrounded by urban zones.
2. Agricultural areas	2.1. Arable Land	2.1.1. Non-irrigated arable land	Cultivated areas regularly ploughed and generally under a rotation system.
		2.1.2. Permanently irrigated land	Crops irrigated permanently and periodically, using a permanent infrastructure (irrigation channels, drainage network). Most of these crops could not be cultivated without an artificial water supply. Does not include sporadically irrigated land.
		2.1.3. Rice fields	Land developed for rice cultivation. Flat surfaces with irrigation channels. Surfaces regularly flooded.
	2.2. Permanent crops	2.2.1. Vineyards	Areas planted with vines.
		2.2.2. Fruit trees and berry plantations	Parcels planted with fruit trees or shrubs: single or mixed fruit species, fruit trees associated with permanently grassed surfaces. Includes chestnut and walnut groves.
		2.2.3. Olive groves	Areas planted with olive trees, including mixed occurrence of olive trees and vines on the same parcel.
	2.3. Pastures	2.3.1. Pastures	Dense, predominantly graminoid grass cover, of floral composition, not under a rotation system. Mainly used for grazing, but the fodder may be harvested mechanically. Includes areas with hedges (bocage).
	2.4. Heterogeneous agricultural areas	2.4.1. Annual crops associated with permanent crops	Non-permanent crops (arable lands or pasture) associated with permanent crops on the same parcel.
		2.4.2. Complex cultivation	Juxtaposition of small parcels of diverse annual crops, pasture and/or permanent crops.
		2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation	Areas principally occupied by agriculture, interspersed with significant natural areas.
		2.4.4. Agro-forestry areas	Annual crops or grazing land under the wooded cover of forestry species.
3. Forests and semi-natural areas	3.1 Forests	3.1.1 Broad-leaved forest	Vegetation formation composed principally of trees, including shrub and bush understories, where broad-leaved species predominate.

Level 1	Level 2	Level 3	Definition
		3.1.2 Coniferous forest	Vegetation formation composed principally of trees, including shrub and bush understories, where coniferous species predominate.
		3.1.3 Mixed forest	Vegetation formation composed principally of trees, including shrub and bush understories, where broad-leaved and coniferous species co-dominate.
	3.2. Shrub and/or herbaceous vegetation associations	3.2.1. Natural grassland	Low productivity grassland. Often situated in areas of rough uneven ground. Frequently includes rocky areas, briars, and heathland.
		3.2.2. Moors and heathland	Vegetation with low and closed cover, dominated by bushes, shrubs and herbaceous plants (heath, briars, broom, gorse, laburnum, etc.).
		3.2.3. Sclerophyllous vegetation	Bushy sclerophyllous vegetation. Includes *maquis and garrige.* *Maquis:* a dense vegetation association composed of numerous shrubs associated with siliceous soils in the Mediterranean environment. *Garrigue:* discontinuous bushy associations of Mediterranean calcareous plateaus. Generally composed of kermes oak, arbutus, lavender, thyme, cistus, etc. May include a few isolated trees.
		3.2.4. Transitional woodland/shrub	Bushy or herbaceous vegetation with scattered trees. Can represent either woodland degradation or forest regeneration/colonization.
	3.3. Open spaces with little or no vegetation	3.3.1. Beaches, dunes, and sand plains	Beaches, dunes and expanses of sand or pebbles in coastal or continental, including beds of stream channels with torrential regime.
		3.3.2. Bare rock	Scree, cliffs, rocks and outcrops.
		3.3.3. Sparsely vegetated areas	Includes steppes, tundra and badlands. Scattered high-attitude vegetation.
		3.3.4. Burnt areas	Areas affected by recent fires, still mainly black.
		3.3.5. Glaciers and perpetual snow	Land covered by glaciers or permanent snowfields.
4. Wetlands	4.1. Inland wetlands	4.1.1. Inland marshes	Low-lying land usually flooded in winter, and more or less saturated by water all year round.
		4.1.2. Peatbogs	Peatland consisting mainly of decomposed moss and vegetable matter. May or may not be exploited.
	4.2. Coastal wetlands	4.2.1. Salt marshes	Vegetated low-lying areas, above the high-tide line, susceptible to flooding by sea water. Often in the process of filling in, gradually being colonised by halophilic plants.
		4.2.2. Salines	Salt-pans, active or in process of . Sections of salt marsh exploited for the production of salt by evaporation. They are clearly distinguishable from the rest of the marsh by their segmentation and embankment systems.
		4.2.3 Intertidal flats	Generally unvegetated expanses of mud, sand or rock lying between high and low water-marks. On contour on maps.
5. Water bodies	5.1. Inland waters	5.1.1. Water courses	Natural or artificial water-courses serving as water drainage channels. Includes canals. Minimum width to include: 100 m
		5.1.2. Water bodies	Natural or artificial stretches of water.
	5.2. Marine waters	5.2.1. Coastal lagoons	Unvegetated stretches of salt or brackish waters separated from the sea by a tongue of land or other similar topography. These water bodies can be connected with the sea at limited points, either permanently or for parts of the year only.
		5.2.2. Estuaries	The mouth of a river within which the tide ebbs and flows.
		5.2.3. Sea and ocean	Zone seaward of the lowest tide limit.

NB: When the various national CORINE land cover projects are carried out, the above definitions may be tightened up and supplemented in order to make them more operational.

Land use characteristics within the study corridor have been analyzed according to CORINE database (2006). The results of the analyses are presented in Table 5.3 for the Asian part of the Motorway route. Maps demonstrating the land-use character of the route along the Asian sections are presented in Figure 5.1, Figure 5.2 and Figure 5.3.

Table 5.3. Land Use Characteristics within the Study Corridor for Asian Sections of the North Marmara Motorway Route (*according to CORINE, 2006*)

Level 1	Level 2	Level 3	Level 4	Code 2006	Section 4			Section 5			Section 6			Total Area (ha)							
														Level 1		Level 2		Level 3		Level 4	
					Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
1. Artificial surfaces	1.1. Urban Fabric	1.1.2. Discontinuous urban fabric	1.1.2.1. Discontinuous urban fabric	1121	76023,56	7,60	0,30	-	-	-	27171,14	2,72	0,06	358,13	3,95	154,20	1,70	154,20	1,70	10,32	0,11
			1.1.2.2. Discontinuous rural fabric	1122	370989,97	37,10	1,44	-	-	-	1067838,25	106,78	2,25							143,88	1,59
	1.2. Industrial, commercial and transport	1.2.1. Industrial or commercial units		121	1009871,16	100,99	3,92	-	-	-	171991,38	17,20	0,36			118,19	1,30	118,19	1,30	118,19	1,30
	1.3. Mine, dump and construction sites	1.3.1. Mineral extraction sites		131	-	-	-	-	-	-	40031,67	4,00	0,08			47,50	0,52	4,00	0,04	4,00	0,04
		1.3.3. Construction Sites		133	203555,59	20,36	0,79	-	-	-	231381,79	23,14	0,49					43,49	0,48	43,49	0,48
	1.4. Artificial, non-agricultural vegetated areas	1.4.1. Green Urban Areas		141	-	-	-	-	-	-	38077,96	3,81	0,08			38,24	0,42	3,81	0,04	3,81	0,04
		1.4.2. Sport and Leisure Facilities		142	344360,44	34,44	1,34	-	-	-	-	-	-					34,44	0,38	34,44	0,38
2. Agricultural areas	2.1. Arable Land	2.1.1. Non-irrigated arable land	2.1.1.1. Dry Farming Area	2111	4055576,61	405,56	15,76	7762818,63	776,28	44,34	30140033,65	3014,00	63,53	5472,82	60,35	4195,84	46,27	4195,84	46,27	4195,84	46,27
	2.3 Pastures	2.3.1. Pastures		231	-	-	-	-	-	-	1110794,92	111,08	2,34			111,08	1,22	111,08	1,22	111,08	1,22
	2.4. Hetero geneous agricultural areas	2.4.2. Complex cultivation	2.4.2.1. Non-irrigated Complex cultivation	2421	436180,18	43,62	1,69	-	-	-	6276329,14	627,63	13,23			1165,89	12,86	671,25	7,40	671,25	7,40
		2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation		243	3916111,08	391,61	15,21	916742,98	91,67	5,24	113576,81	11,36	0,24					494,64	5,45	494,64	5,45
3. Forests and semi-natural areas	3.1. Forests	3.1.1. Broad-leaved forest		311	1837949,42	183,79	7,14	4069438,26	406,94	23,24	5530547,60	553,05	11,66	3237,86	35,70	2092,11	23,07	1143,79	12,61	1143,79	12,61
		3.1.2. Coniferous forest		312	95366,95	9,54	0,37	-	-	-	1661005,09	166,10	3,50					175,64	1,94	175,64	1,94
		3.1.3. Mixed forest		313	4776096,82	477,61	18,55	2434331,80	243,43	13,90	516394,59	51,64	1,09					772,68	8,52	772,68	8,52
	3.2. Shrub and/or herbaceous vegetation associations	3.2.1. Natural grassland		321	2838605,96	283,86	11,03	-	-	-	-	-	-			1145,75	12,63	283,86	3,13	283,86	3,13
		3.2.3. Sclerophyllous vegetation		323	626458,34	62,65	2,43	-	-	-	-	-	-					62,65	0,69	62,65	0,69
		3.2.4. Transitional woodland/shrub		324	5153196,27	515,32	20,02	2323746,37	232,37	13,27	515451,22	51,55	1,09					799,24	8,81	799,24	8,81
Total					**25740342,35**	**2574,03**	**100,00**	**17507078,04**	**1750,71**	**100,00**	**47440625,21**	**4744,06**	**100,00**	**9068,80**	**100,00**	**9068,80**	**100,00**	**9068,80**	**100,00**	**9068,80**	**100,00**

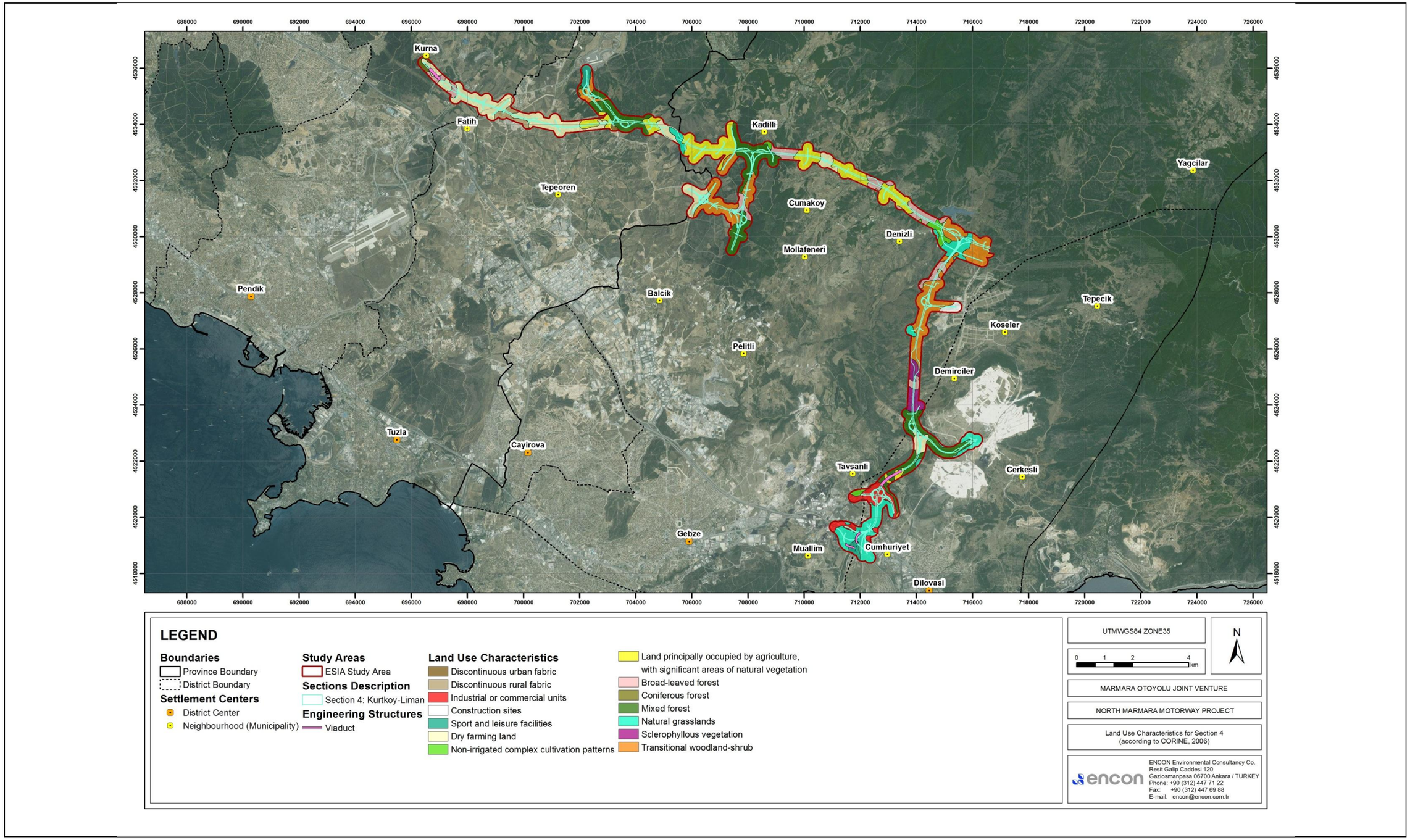


Figure 5.1. Land Use Characteristics for Section 4 (*according to CORINE, 2006*)

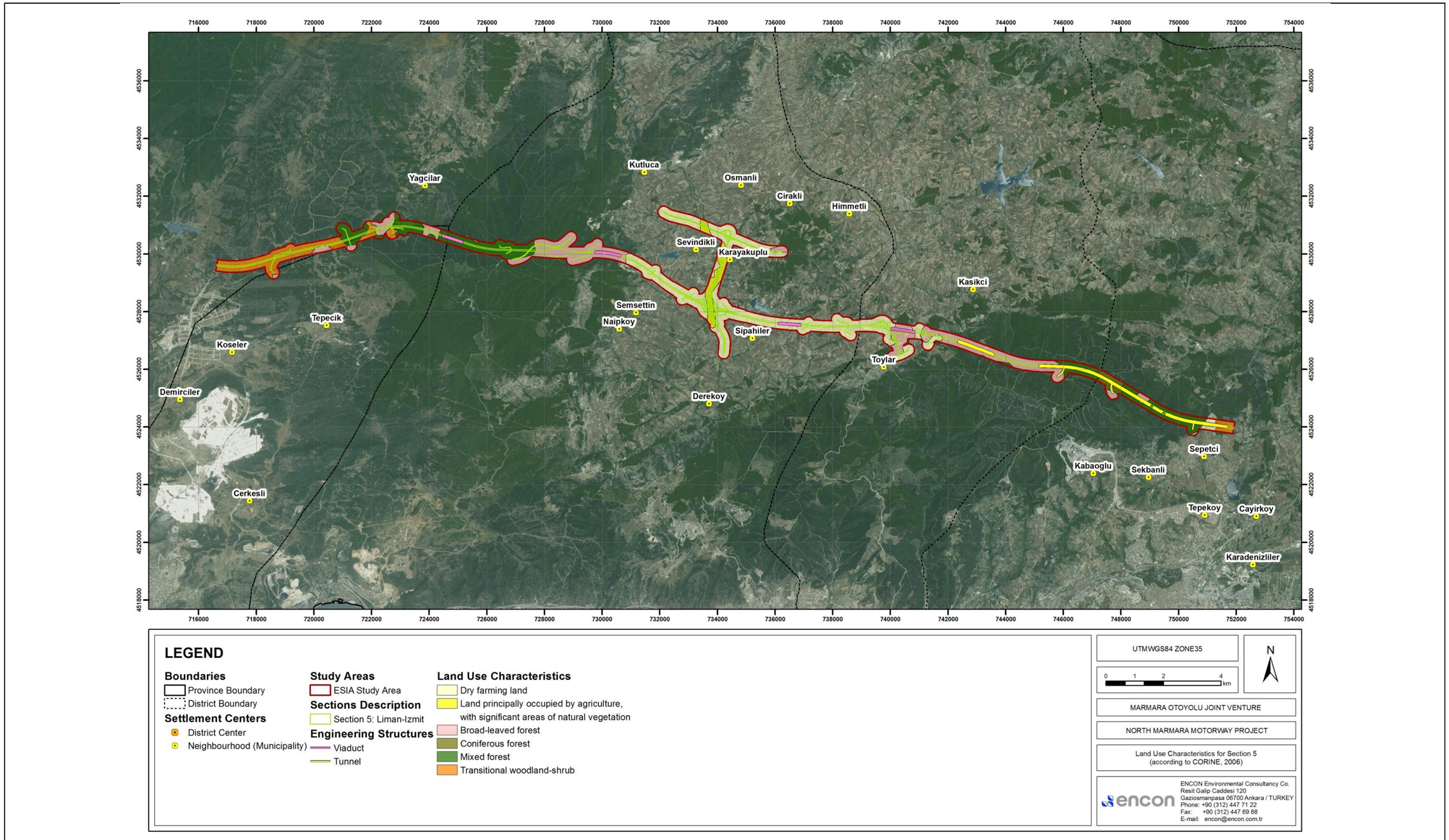
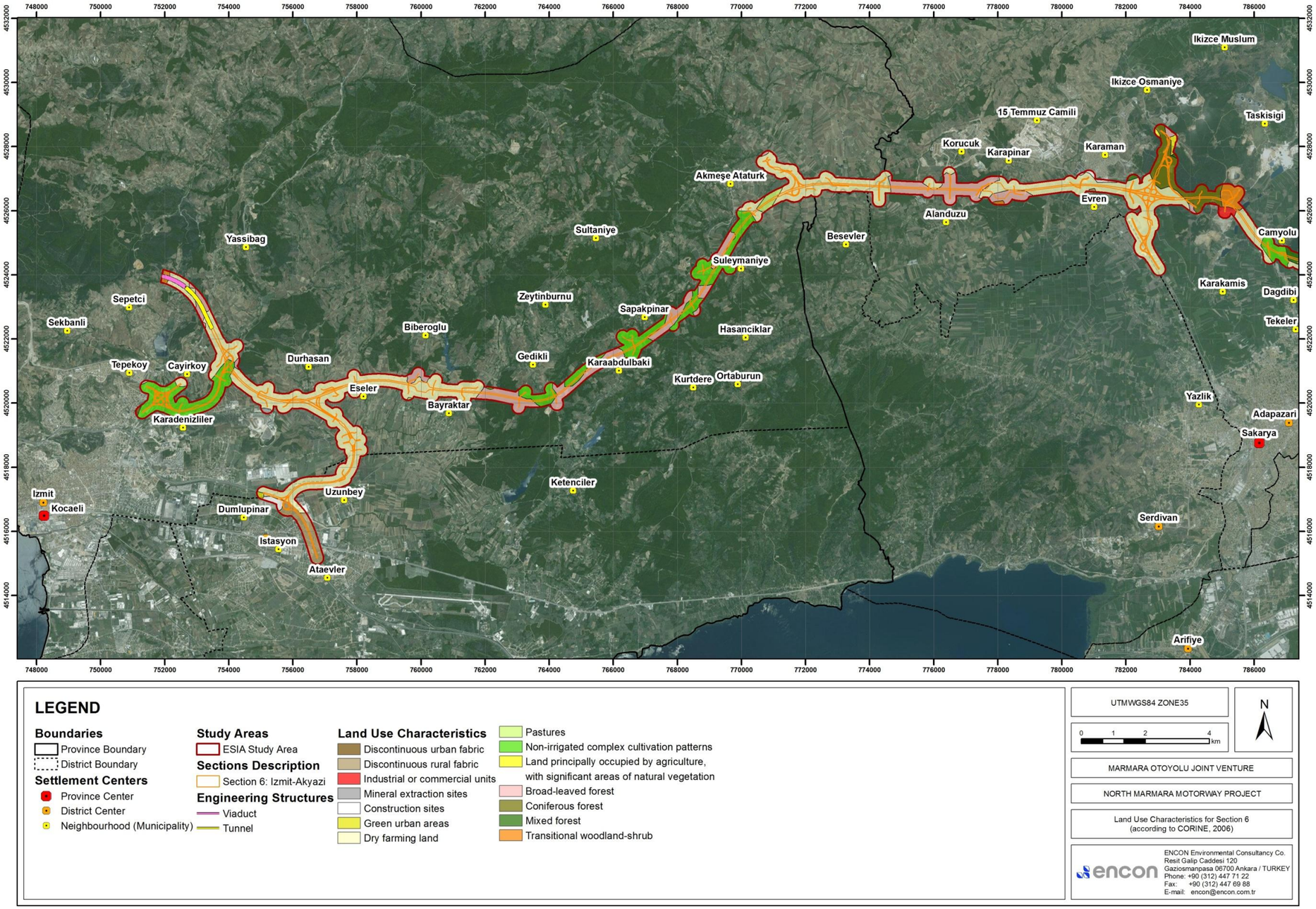


Figure 5.2. Land Use Characteristics for Section 5 (*according to CORINE, 2006*)



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 6: Izmit-Akyazi

Engineering Structures
- Viaduct
- Tunnel

Land Use Characteristics
- Discontinuous urban fabric
- Discontinuous rural fabric
- Industrial or commercial units
- Mineral extraction sites
- Construction sites
- Green urban areas
- Dry farming land
- Pastures
- Non-irrigated complex cultivation patterns
- Land principally occupied by agriculture, with significant areas of natural vegetation
- Broad-leaved forest
- Coniferous forest
- Mixed forest
- Transitional woodland-shrub

UTMWGS84 ZONE35

N

0 1 2 4 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Land Use Characteristics for Section 6
(according to CORINE, 2006)

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Figure 5.3.a. Land Use Characteristics for Section 6 (*according to CORINE, 2006*)

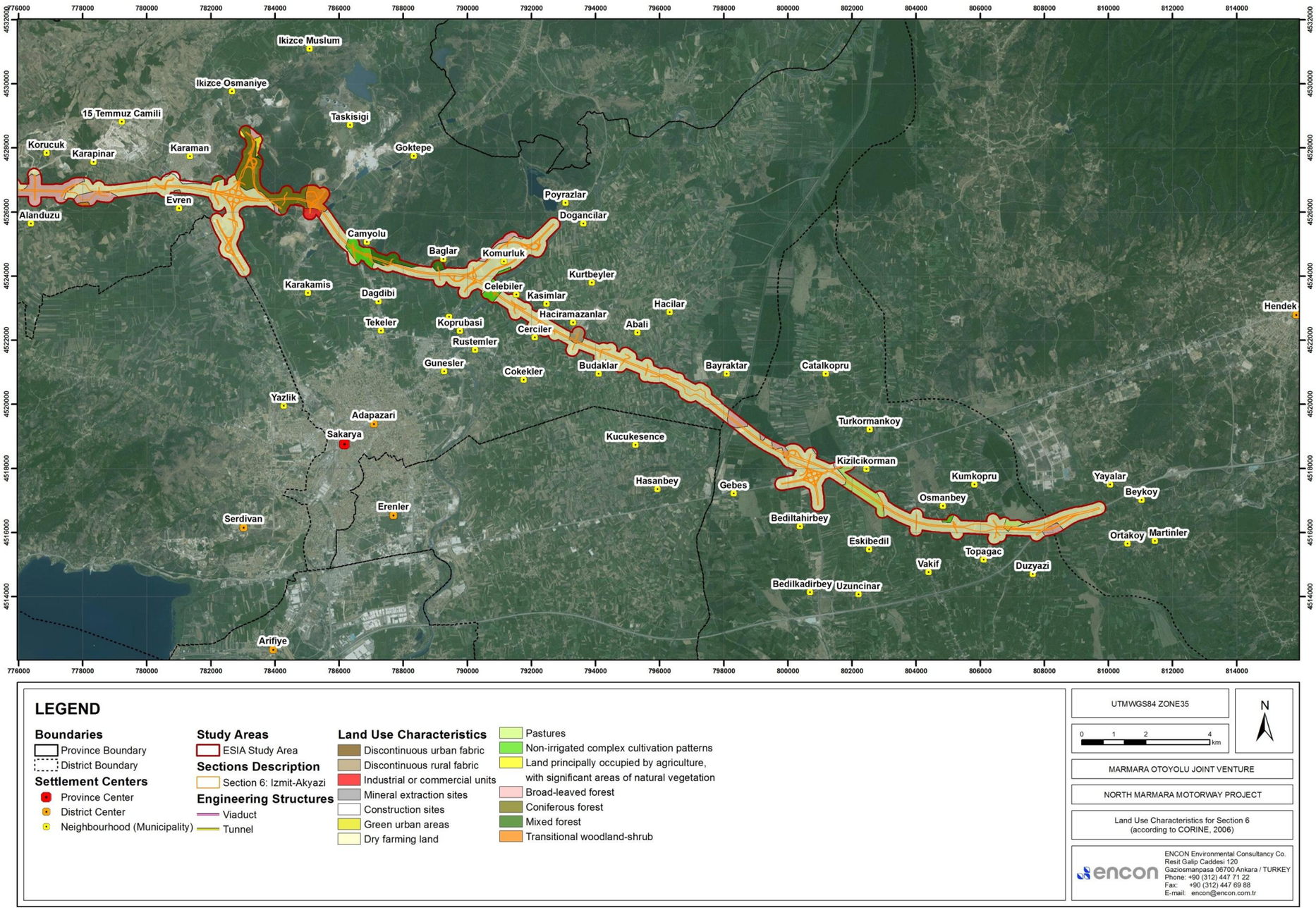


Figure 5.3.b. Land Use Characteristics for Section 6 (*according to CORINE, 2006*)

The entire study corridor for the Asian part covers an area of 9.068,8 ha (for a width of 400 meter along the total length of the route in the Asian part except the length of tunnels and viaducts as discussed previously). The key findings of the analyses done based on CORINE database (2006) is summarized below.

- A considerable part (60,3%; 5.472,8 ha) of the entire study corridor is covered by agricultural areas consisting of arable lands, pastures and heterogeneous agricultural areas.

- Forests (broad-leaved, coniferous and mixed types) cover 23,1% (2.092,1 ha) of the entire study corridor. When the semi natural areas including the shrubs and/or herbaceous vegetation associations and open spaces are added, this ratio increases up to 35,7% (3.237,9 ha).

- Artificial surfaces that mainly consist of urban fabric, industrial, commercial and transport (road networks, etc.) and mine, dump and construction sites cover only 3,9% (358,1 ha) of the study corridor.

- The study corridor in Section 4 forms 28,4% (2.574 ha) of the entire study corridor for Asian part of the Motorway. The land cover is almost equally formed of agricultural lands, forests and shrubs and/or herbaceous vegetations. The remainder of the corridor is covered by forests (16,2%; 770,8 ha). Viaducts planned in this Section will pass over a total distance of around 2 km, causing minimum change in the existing land use at the footprints of the foundation legs.

- For Section 5 it should be noted that the forests present between a distance of 10 km (KM 178-188) will be passed by means of consecutive tunnels having a total length of 8 km, causing no change on the corresponding forest land use, except the locations of entering and exit portals (each having estimated dimensions of 150 m x 30 m), which have negligible footprint areas when compared to the Motorway components. Similarly, viaducts planned in this Section (KM 160-177) will pass over a total distance of 3,1 km, causing minimum change in the existing land use (forest) at the footprints of the foundation legs.

- Almost 80% (3.764,1 ha) of Section 6 is occupied by agricultural areas, which are mainly formed of dry farming areas. The study corridor in Section 5 forms around 19,3% (1.750,7 ha) of the entire study corridor for Asian part of the Motorway. Arable lands consisting of dry farming areas is the predominant type of land cover with 44,3% (776,3 ha). Broad leaved and mixed forests is the second dominant type of land cover with 37,1% (650,4 ha). The remainder of this Section is occupied by transitional shrubs with 13,3% (232,4 ha).

- In Section 6, between KM188-190, a tunnel (2,7 km) and viaduct (1,6 km) is planned to pass over a total distance of about 4,3 km where forests and greenhouses are located.

5.2.1.2. Land Use Characteristics according to Land Use Database of the former Turkish General Directorate for Rural Services

Former Turkish General Directorate for Rural Services (GDRS) developed national land use and soil characteristics databases for all provinces based on the surveys performed by the General Directorate for Soil and Water (TOPRAKSU, one of the founding institutions of the Turkish General Directorate for Rural Services) in 1966-1971 and updated in 1982-1984 (*Ministry of Environment and Forestry, 2004*). Land use and soil databases for Istanbul, Kocaeli and Sakarya were established in 1987, 1991 and 1995 respectively.

The results of the land use analyses (land use type and land use capability) done for the study corridor (9.068,8 ha; for a width of 400 meter along the total length of the route in the Asian part except the length of tunnels and viaducts as discussed previously) based on the Turkish General Directorate for Rural Services database are provided in Table 5.4 and the relevant land use type and capability maps are presented between Figure 5.4 and Figure 5.9 for Section 4, Section 5 and Section 6.

Table 5.4. Land Use Characteristics within the Study Corridor for Asian Sections (*according to Turkish General Directorate for Rural Services, 1987, 1991 and 1995)*

Land Use Type	Land Use Capability	Section 4			Section 5			Section 6			Total Area according to Land Use Type	
		Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (ha)	Percent
Irrigated farmland	I	-	-	-	1030925,18	103,09	5,89	-	-	-	313,99	3,46
	II	-	-	-	218411,96	21,84	1,25	1887174,61	188,72	3,98		
	VI	-	-	-	3426,72	0,34	0,02					
Sub-total (Irrigated farmland)		**0,00**	**0,00**	**0,00**	**1252763,86**	**125,28**	**7,16**	**1887174,61**	**188,72**	**3,98**		
Irrigated farmland (insufficient)	II	-	-	-	-	-	-	1590818,73	159,08	3,35	159,08	1,75
Sub-total (Irrigated farmland)		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**1590818,73**	**159,08**	**3,35**		
Dry farmland (non-fallow)	I	-	-	-	438309,15	43,83	2,50	-	-	-	5581,41	61,55
	II	362760,45	36,28	1,41	1232584,57	123,26	7,04	14882786,47	1488,28	31,37		
	III	2285431,25	228,54	8,88	1382846,92	138,28	7,90	8453505,78	845,35	17,82		
	IV	220817,92	22,08	0,86	-	-	-	697581,37	69,76	1,47		
	VI	9233228,89	923,32	35,87	4267136,60	426,71	24,37	7392145,08	739,21	15,58		
	VII	-	-	-	340584,89	34,06	1,95	4624406,47	462,44	9,75		
Sub-total (Dry farmlands)		**12102238,51**	**1210,22**	**47,02**	**7661462,13**	**766,15**	**43,76**	**36050425,17**	**3605,04**	**75,99**		
Orchard (non- ir.)	VI	593087,53	59,31	2,30	-	-	-	-	-	-	59,31	0,65
Sub-total (Orchard)		**593087,53**	**59,31**	**2,30**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**		
Forestry	III	-	-	-	-	-	-	250910,05	25,09	0,53	950,09	10,48
	IV	-	-	-	-	-	-	935698,41	93,57	1,97		
	VI	-	-	-	3583837,95	358,38	20,47	-	-	-		
	VII	2250378,43	225,04	8,74	2480103,96	248,01	14,17	-	-	-		
Sub-total (Forestry)		**2250378,43**	**225,04**	**8,74**	**6063941,92**	**606,39**	**34,64**	**1186608,46**	**118,66**	**2,50**		
Shrubbery	II	-	-	-	-	-	-	362648,15	36,26	0,76	1124,84	12,40
	III	1765606,30	176,56	6,86	-	-	-	1822155,16	182,22	3,84		
	IV	1382669,66	138,27	5,37	1687881,90	168,79	9,64	-	-	-		
	VI	1382139,49	138,21	5,37	194797,62	19,48	1,11	658465,53	65,85	1,39		
	VII	1754088,39	175,41	6,81	108374,26	10,84	0,62	129561,55	12,96	0,27		
Sub-total (Shrubbery)		**6284503,85**	**628,45**	**24,41**	**1991053,79**	**199,11**	**11,37**	**2972830,39**	**297,28**	**6,27**		
Meadow	II	-	-	-	-	-	-	2007537,51	200,75	4,23	200,75	2,21
Sub-total (Meadows)		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**2007537,51**	**200,75**	**4,23**		
Pasture	III	-	-	-	-	-	-	1261121,22	126,11	2,66	620,17	6,84
	IV	907892,08	90,79	3,53	-	-	-	-	-	-		
	VI	3533356,02	353,34	13,73	499309,52	49,93	2,85	-	-	-		
Sub-total (Pastures)		**4441248,10**	**444,12**	**17,25**	**499309,52**	**49,93**	**2,85**	**1261121,22**	**126,11**	**2,66**		
Settlements		68885,94	6,89	0,27	38546,83	3,85	0,22	354646,03	35,46	0,75	59,15	0,65
Pond		-	-	-	-	-	-	46820,80	4,68	0,10		
River		-	-	-	-	-	-	82642,29	8,26	0,17		
Total		**25740342,35**	**2574,03**	**100,00**	**17507078,04**	**1750,71**	**100,00**	**47440625,21**	**4744,06**	**100,00**	**9068,80**	**100,00**

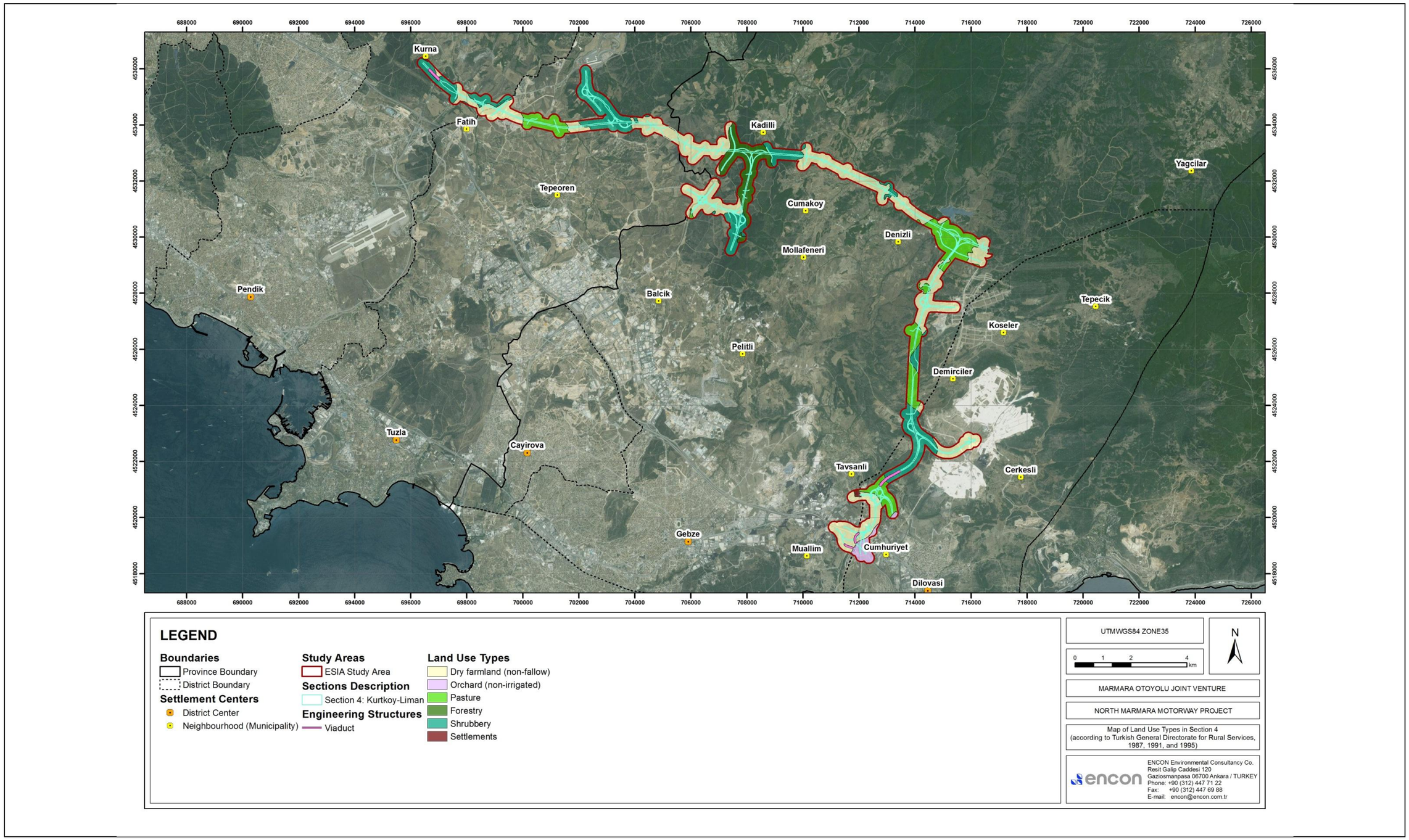


Figure 5.4. Map of Land Use Types in Section 4 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

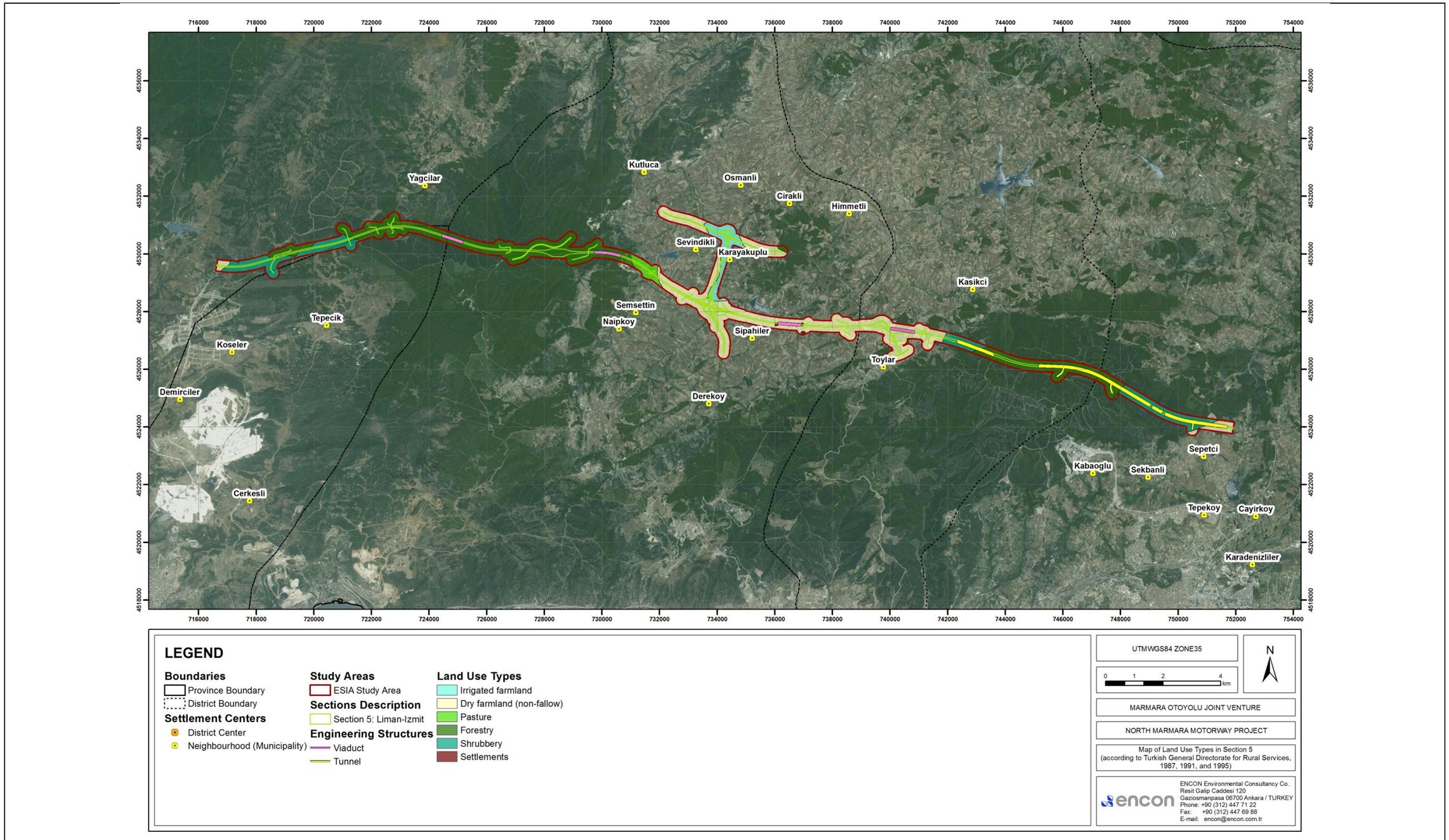


Figure 5.5. Map of Land Use Types in Section 5 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

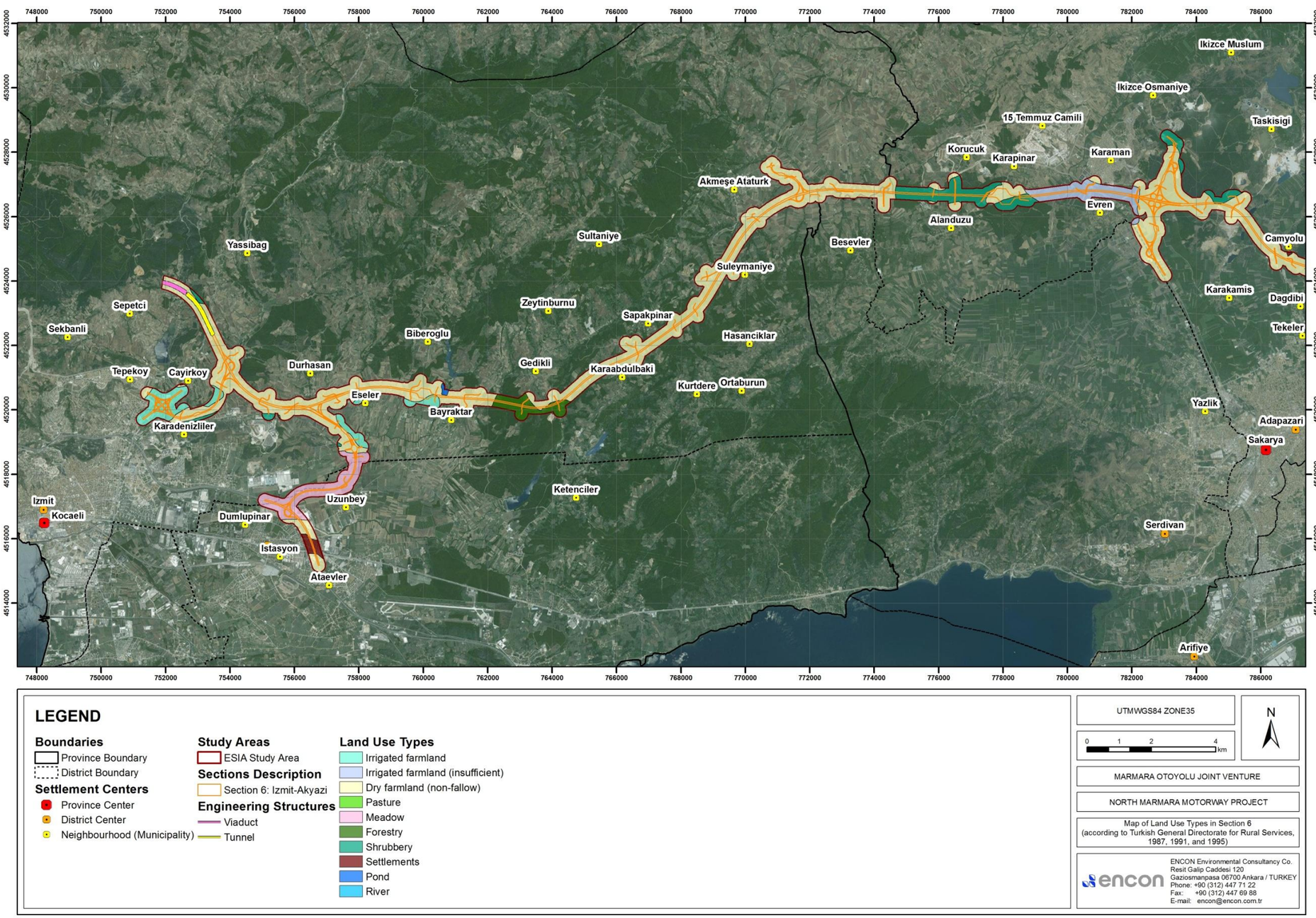


Figure 5.6.a. Map of Land Use Types in Section 6 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

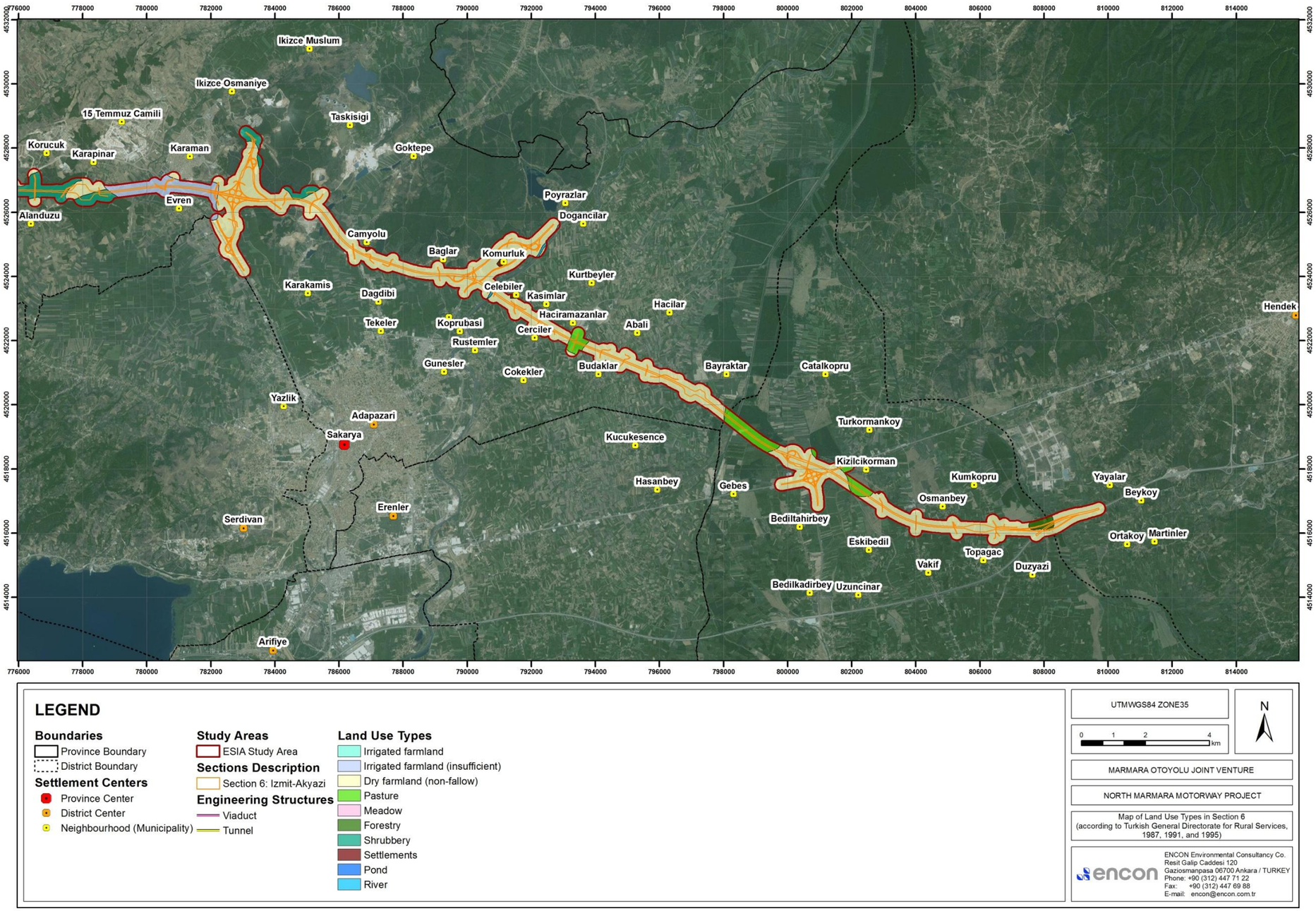


Figure 5.6.b. Map of Land Use Types in Section 6 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

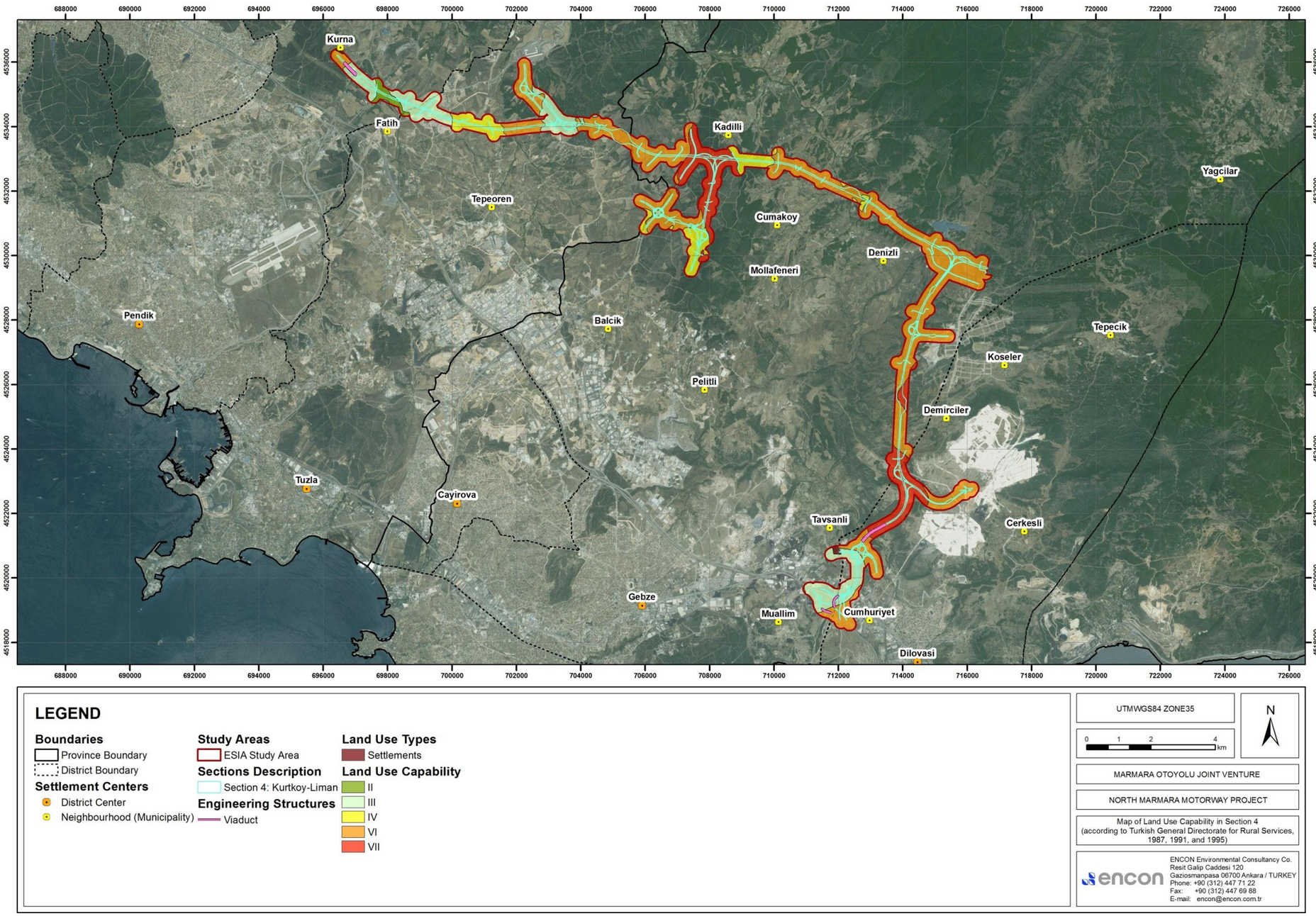


Figure 5.7. Map of Land Use Capability in Section 4 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

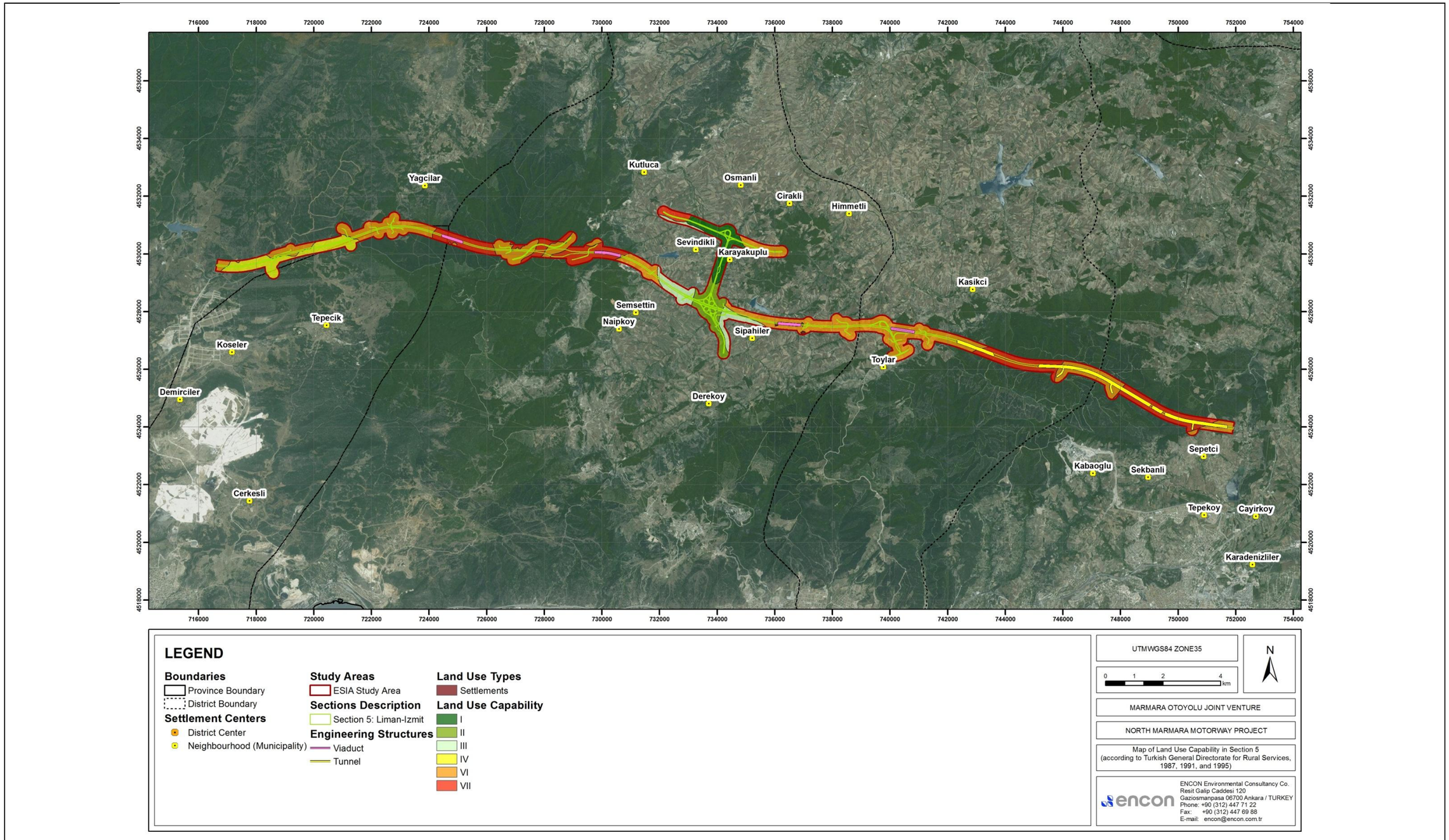


Figure 5.8. Map of Land Use Capability in Section 5 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

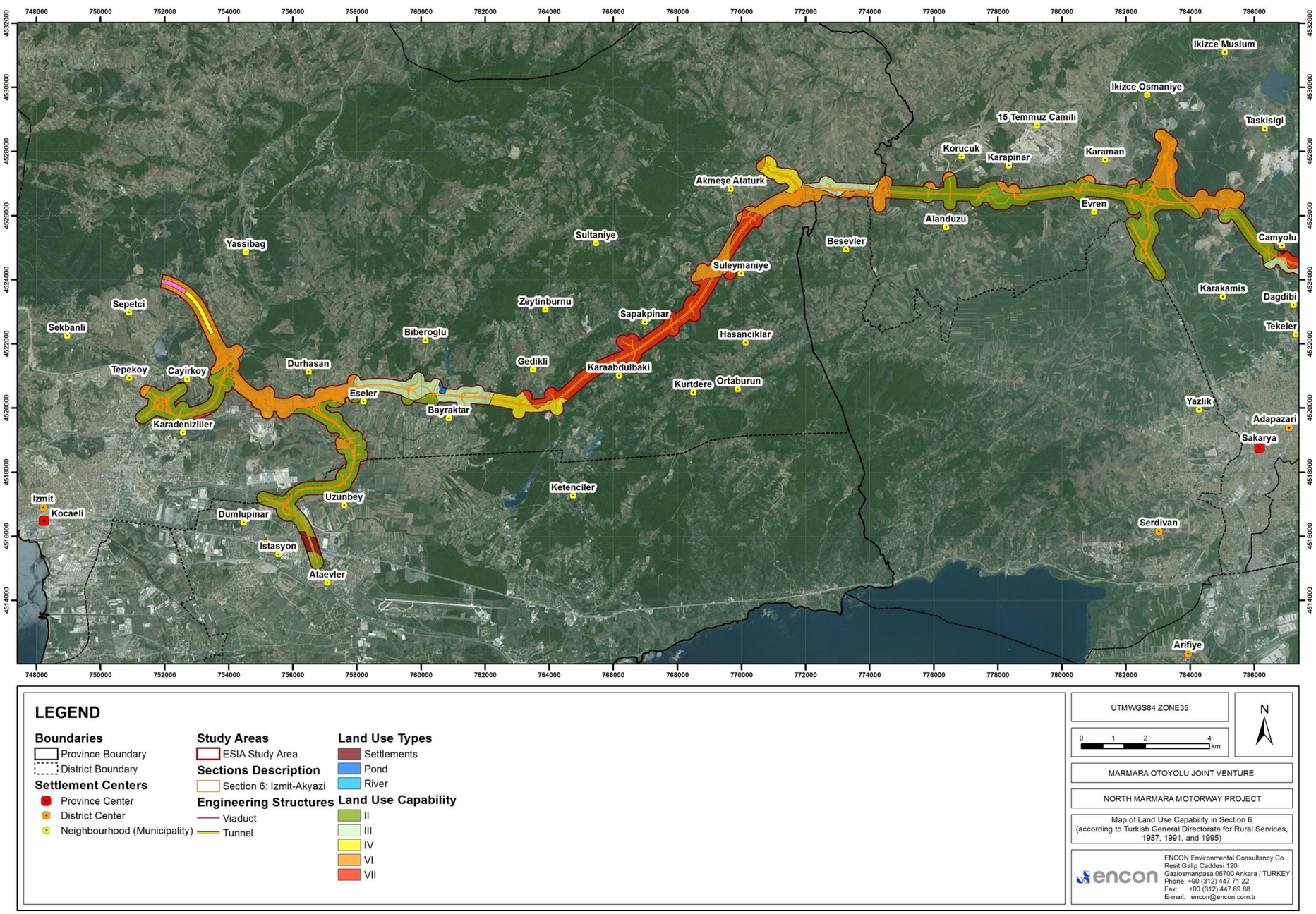
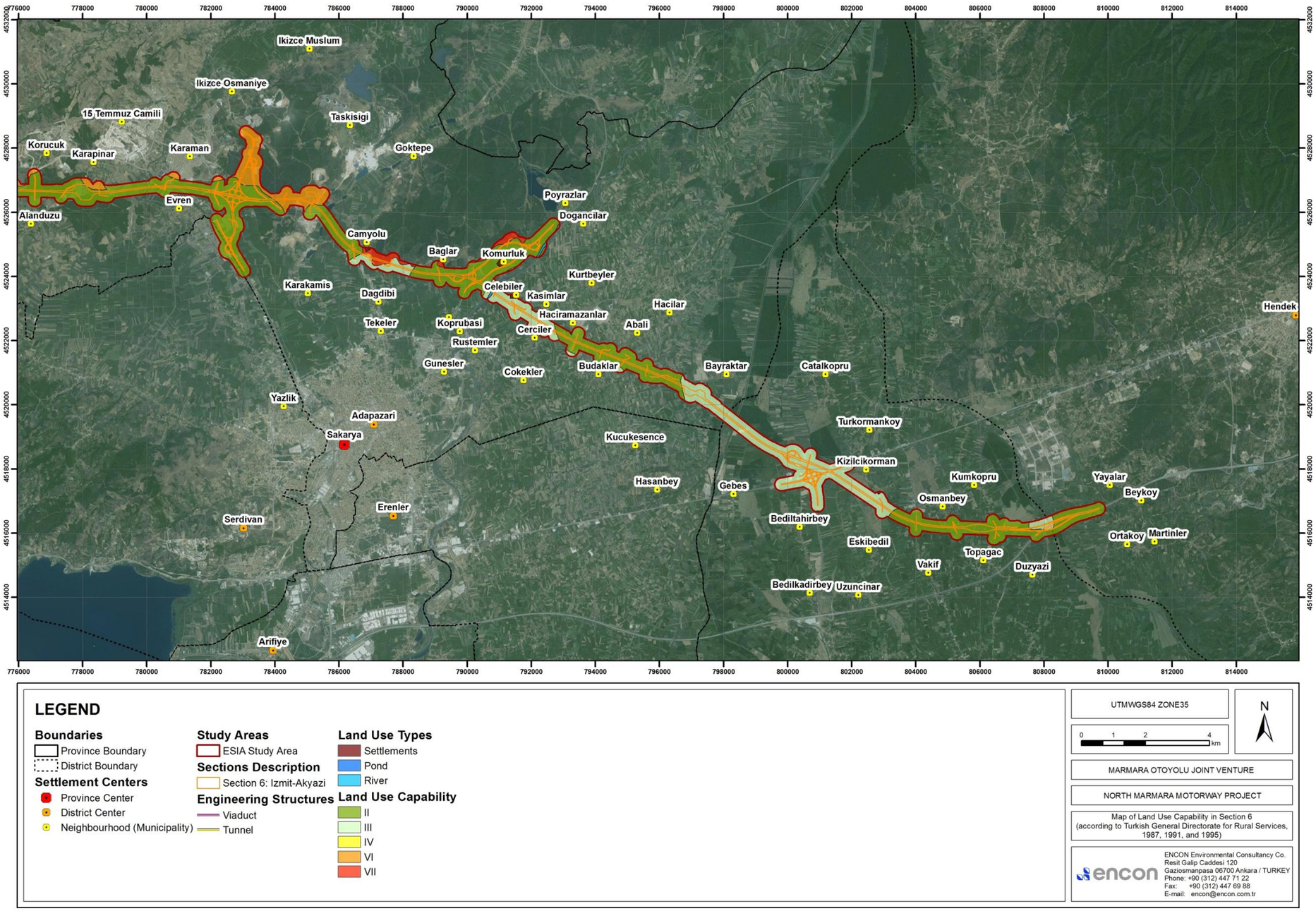


Figure 5.9.a. Map of Land Use Capability in Section 6 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 6: Izmit-Akyazi

Engineering Structures
- Viaduct
- Tunnel

Land Use Types
- Settlements
- Pond
- River

Land Use Capability
- II
- III
- IV
- VI
- VII

UTMWGS84 ZONE35

N

0 1 2 4 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Map of Land Use Capability in Section 6
(according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995)

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Figure 5.9.b. Map of Land Use Capability in Section 6 (*according to Turkish General Directorate for Rural Services, 1987, 1991, and 1995*)

A comparison of the areas occupied by different land use types under CORINE (2006) and GDRS (1987, 1991 and 1995) databases is provided in Table 5.5 to allow an evaluation of the changes within 20-30 years. It should be noted that the classification system of the two database differs and the following comparison is given to provide a general overview of the development.

Table 5.5. Comparison of the Areas for Different Land Use Types According to CORINE (2006) and GDRS (1987, 1991 and 1995) Databases

Land Use Type	Data Source			
	CORINE (2006)		GDRS (1987)	
	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Agriculture/Farmlands	5.361,7	59,2	6.113,8	67,4
Forestry	2.092,1	23,1	950,1	10,5
Shrubbery	1.145,7	12,6	1.124,8	12,4
Pastures, Meadows, etc.	111,1	1,2	820,9	9,0
Others (Settlements/Urban Fabric, Mineral Extraction Sites, Transport Networks, etc.)	358,1	3,9	59,2	0,7
Total	**9.068,8**	**100,0**	**9.068,8**	**100,0**

Turkish General Directorate for Rural Services database defines the land use capabilities in 8 different classes as summarized in Table 5.6. These classes represent the agricultural potential of the soils. In this classification system, soils are categorized between Class I, which represent the arable lands on which agricultural activities can be conducted in the most efficient, economic and simplest way without causing erosion, and Class VIII, which represent the lands that are not arable, cannot even be used as grassland or forest areas but support only wildlife development or can be used as resting area or national park by human. Characteristics of each class are summarized in Table 5.6 (*Former Ministry of Agricultural and Rural Services, July 2008*).

The Land Use Capabilities of the soils corresponding to the study corridor for Asian sections were given in Table 5.4. The key findings of the land use capability analyses are summarized below (settlement areas, ponds and rivers that cover %0,7 of the study corridor and not categorized under any of the land use capability classes are not taken into consideration in the following figures):

- Agricultural lands suitable for soil cultivation (Classes I, II, III and IV) covers more than half of the entire study corridor (52%; 4.706,8 ha), where Class II and Class III lands are the prominent types. Class I lands have a minor ratio (1,6%; 147 ha) within the study corridor and among the agricultural lands suitable for soil cultivation.

- The remainder of the study corridor (47,4%; 4.302,5 ha) is covered by agricultural lands that are not suitable for soil cultivation (Class VI and VII). Class V and Class VIII (non-arable lands) soils are not present within the corridor.

Table 5.6. Agricultural Potentials Represented by Different Land Use Capability Classes and Their Characteristics

Class	Agricultural Potential	Definition of Land Use Capability
Class I	Agricultural lands suitable for agricultural soil cultivation	Class I lands are; flat or near flat, deep, fertile and easily cultivated so that the conventional agricultural methods can be applied; potential for water and soil erosion are minimal; have good drainage; are not prone to flood damage exposure; suitable for hoe plants and other intensively grown crops; Class I irrigated lands with low precipitation rates have slope values less than 1% slope, loamy structure, good water holding capacity and medium level permeability.
Class II		Class II lands are decent lands that can only be processed after taking some special precautions. Their difference from Class I lands are one or more of the limiting factors such as slight slope, moderate exposure to erosion, moderately thick soil, exposure to occasional moderate floods and a moderate level of moisture that can easily be isolated.
Class III		Class III lands are moderately good lands for hoe plants which can generate solid income provided they are utilized with a good cropping system and proper agricultural methods. Moderate slope, increased erosion sensitivity, excessive moisture, exposed soil, presence of stones, having a lot of sand and/or gravel, low water holding capacity and low yield are properties of this type of land.
Class IV		Class IV lands can be constantly utilized as meadows. Field crops can also be occasionally grown. High levels of slope, bad soil characteristics, erosion and climate are the factors limiting agricultural activities on these lands. Soils with low slopes and poor drainage are also classified as Class IV lands. These soils are not subject to erosion, but they are unsuitable for growing many agricultural products as they have a low yield and a tendency to suddenly dry up in the spring. In semi-arid regions, cropping systems incorporating legumes are generally not possible due to climate.
Class V	Agricultural lands not suitable for soil cultivation	Class V lands are reserved for long-life plantations such as meadows and forests as they generally are unsuitable for cultivated plants. A few factors such as stony structure and sogginess hinder cultivation here. The land is flat or near-flat. It is not subject to an excessive amount of wind and water erosion. Grazing and tree logging activities can be carried out on condition that a good soil cover is constantly maintained.
Class VI		Class VI lands require moderate precautions even when they are used as forest or meadow since they have quite a bit of slope and are subject to severe erosion. Exposed, soggy or very dry conditions make this type of land unsuitable for cultivation.
Class VII		Class VII lands have high slope, are stony and have been subject to violent erosion. Exposed soils, dry and/or some unfavourable conditions and swamps can be classified as Class VII soil. These can be used as forest or meadow without showing due care. If the vegetation on these soils diminishes, erosion can get quite violent.
Class VIII	Non-arable lands	Class VIII lands exhibit features that prevent them from being used as forest, meadow or cultivated land. This type of land is habitat to wild life and can also be used for recreational purposes or as catchment basins for streams. These include lands containing marshes, swamps, deserts as well as areas of high mountainous regions, rocky lands or lands with very deep craters.

Former Ministry of Agriculture and Rural Services, in its Technical Procedure on Soil and Land Classification Standards dated 2008, specifies the suitability of different land classes for cultivation, grazing and forestry activities as summarized in Table 5.7. As can be seen from the table and mentioned previously, Class VIII lands are not suitable for cultivation, grazing or forestry activities but can provide habitat use to wildlife components only. Similarly, Class VII lands are suitable only for forestry and grazing activities to a limited extent. Level of suitability for agricultural and grazing uses differs by classes.

Table 5.7. Usage Suitability Matrix for Different Land Use Classes

Land Use Capability Class	Wild life	Forestry	Grazing			Cultivation			
			Limited	Moderate	Intensive	Limited	Moderate	Intensive	Very Intensive
I									
II									
III									
IV									
V									
VI									
VII									
VIII									

**Colored boxes show the suitable uses for each type of activity.*
Source: Former Ministry of Agricultural and Rural Services, July 2008.

5.2.1.3. Forestlands

In 1990, Helsinki Process began with the aim of developing guidelines for the sustainable management of forests in Europe. The Process has sought to identify measurable criteria and indicators for the evaluation of how European countries have progressed in their efforts to follow the principles of sustainable forest management and conservation of the biological diversity of European forests. There have been four meetings in this process, two at the ministerial level and two at the expert level. (*http://www.iisd.ca/forestry/hel.html*). The guidelines developed in the scope of the process concluded that forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual human needs of present and future generations. In alignment with the outcomes of the Helsinki process, Turkish Regulation on the Forestry Management categorizes the forestry functions under three groups as ecological, social/cultural and economic and attributes specific management goals for each sub-function as listed in Table 5.8.

Forests with economic functions are operated/managed with the aim of production of forest products (wood and non-wood) having economic value and meet the economic demand for these products in a continuous and regular way. These forests are particularly allocated to economic functions, while they can co-perform other functions (e.g. ecological) as well. This function includes areas (i.e. wood productions forests) that are suitable for forest maintenance and regeneration works both in terms of growing conditions and also social considerations.

Some of the forests are established on sensitive ecological balances and shelter high ecological value so that these forests primarily serve for ecological functions as the irreversible impacts of forest production activities cannot be tolerated on such environments. Consequently, even if these types of forests have an economic value in terms of forest product production, conservation of them for their ecological value or environmental functions becomes the first priority.

Forests having social and/or cultural functions primarily serve for the protection of public health by preventing noise and/or air emissions and aesthetic and scientific research purposes and provide recreational areas for natural activities, sports, ecotourism purposes, etc. Forest zones in the vicinity of motorways or railways, having a width of minimum 50-100 m, are considered to be effective in mitigating the adverse impacts of noise generation and forming an aesthetic view.

Table 5.8. Functions of Forests and Associated Management Goals

Functions	General Forestry Functions	Management Goals
Economic	Forest products production	Industrial plantation
		Quality and featured wood production
		Industrial wood production in maximum capacity
		Firewood production
		Others (specific afforestation, etc.)
		Production of non-wood forestry products
		Honey production areas
		Herbal products
		Animal products
		Water and mineral products
Ecological	Nature protection	Nature protection
		Gene conservation forest
		National park
		Protection forest
		Nature park
		Nature protection area
		Wildlife protection and development sites
		Alpine zone
		Natural old growth forest
		Ecological transition zone
		Sensitive ecosystems
		Coastal forests
		Forest ecosystem improvement areas
		Very unfavorable growth grounds
		Areas with very high protection value
		High mountain forest ecosystems
		Seed stands
		Seed orchards
		Areas to be protected from social stress
		Wild life protection and management sites of General Directorate of Forestry
		Biological diversity conservation and development areas
	Erosion protection/ Soil conservation	Avalanche prevention
		Landslide prevention
		Stone and rock fall prevention
		Soil conservation
		Flood prevention
	Climate protection	Forests primarily allocated to climate protection
Social/ Cultural	Hydrological	Drinking water protection
		Utility water protection
		Conservation of water resources
	Public Health	Noise prevention
		Air pollution prevention
		City forests
		Protection of health facilities
	Aesthetics	Road protection for aesthetic purposes (green road)
		Aesthetic appearance
	Ecotourism and recreation	Nature trekking areas
		Rock climbing sites
		Bird watching sites
		Recreational areas (picnic areas, fest areas, etc.)
		Sports area
		Hunting area
		Tourism intended forests
	National security	Military installations and drill sites
		National border and strategic areas
	Scientific	Research intended areas
		Arboretum research forest
		Educational purposes
		Faculty research
		Forestry research forest

For the Asian part, North Marmara Motorway Project falls within the jurisdiction of four different Forestry Management Directorates (Kanlica, Izmit, Adapazari and Akyazi) under Sakarya Regional Directorate of Forestry as summarized in Table 5.9.

Table 5.9. Relevant Forestry Directorates for the Project (Asian Part)

Section	Regional Directorate	Forestry Management Directorate	Management Sub-directorate
Section 4	Istanbul Regional Directorate of Forestry	Kanlica Forestry Management Directorate	Kartal Forestry Management Sub-directorate
			Sultanbeyli Forestry Management Sub-directorate
	Sakarya Regional Directorate of Forestry	Izmit Forestry Management Directorate	Derince Forestry Management Sub-directorate
			Dilovasi Forestry Management Sub-directorate
			Gebze Forestry Management Sub-directorate
			Hereke Forestry Management Sub-directorate
			Izmit Forestry Management Sub-directorate
			Kargali Forestry Management Sub-directorate
			Korfez Forestry Management Sub-directorate
			Taskopru Forestry Management Sub-directorate
			Uzuntarla Forestry Management Sub-directorate
Section 5	Sakarya Regional Directorate of Forestry	Adapazari Forestry Management Directorate	Adapazari Forestry Management Sub-directorate
Section 6	Sakarya Regional Directorate of Forestry	Akyazi Forestry Management Directorate	Akyazi Forestry Management Sub-directorate

Forest Management Plans covers both the actual forests where forest cover (e.g. trees) are present at different density levels and open areas where forest cover is absent (unwooded forest soils) or where uses other than forestry such as settlement, agricultural, quarry, etc are present. Forest Management Plans categorize the actual forests as high forests and coppice forests. Each category is further classified as productive forests where canopy cover rates ranges between 11-100% and degraded forests, where canopy cover rate is lower than 10%. Classification of canopy levels as 1, 2 and 3 according to the density of cover is done as summarized in Table 5.10.

Table 5.10. Canopy Cover Classification According to Forest Management Plans

Canopy Cover Classification	Canopy Cover Levels	
	Symbol	Rate (%)
Absent to sparse	-	0-10
Sparse	1	11-40
Moderately closed	2	41-70
Closed to fully closed	3	71-100

Areas of actual forests (covered by forest vegetation) and open areas corresponding to the study area according to their functions and canopy levels have been analyzed by using the Forest Management Plans and the relevant database. The results of the analyses are presented in Table 5.11. Forest stands maps are presented in Figure 5.10, Figure 5.11 and Figure 5.12 for each section.

Table 5.11. Distribution of Forestlands according to their Functions and Types for Asian Sections within the Study Area

Forest Functions		Area of Actual Forests (ha)								Open Areas (ha)									
		High Forests				Coppice Forests													
		Canopy Cover Classification				Canopy Cover Classification													
		Productive			Degraded	Productive			Degraded										
		Level 3 (71-100%)	Level 2 (41-70%)	Level 1 (11-40%)	(0-10%)	Level 3 (71-100%)	Level 2 (41-70%)	Level 1 (11-40%)	(0-10%)										
SECTION 4										**Unwooded Forest Soil**	**Settlements**	**Agricultural Land**	**Quarry-Mine Pit**	**Facility**	**Highway**	**Energy Transmission Line**	**Graveyard**	**KDA**	**Green Field**
Economic	Forest Products Production	322,47	118,69	20,45	68,58														
Ecological	Nature Protection	5,59	3,74	11,14	142,10														
	Erosion Protection/Soil Conservation	0,53			109,47														
	Climate Protection																		
Social and Cultural	Hydrological	58,83	5,44	56,09	25,23														
	Public Health	6,15		18,34															
	Aesthetics	14,03	2,38	1,27	36,76														
	Ecotourism and Recreation	1,38																	
	National Security	6,73	2,27																
	Scientific																		
Private Afforestation					22,28														
Sub-total (Canopy Levels)		**415,72**	**132,52**	**107,29**	**404,41**	**0,00**	**0,00**	**0,00**	**0,00**										
Total (Actual Forest/Open Area Type)					**1059,95**				**0,00**	**62,45**	**254,38**	**1100,34**	**3,85**	**83,35**	**0,89**	**1,42**	**2,44**	**3,00**	**1,97**
Total (Actual Forests/Open Areas)									**1059,95**										**1514,08**
Grand Total (Section 4)																			**2574,03**

SECTION 5										**Unwooded Forest Soil**	**Settlements**	**Agricultural Land**	**Quarry-Mine Pit**	**Energy Transmission Line**	**KDA**
Economic	Forest Products Production	384,11	43,00	53,22	60,35										
Ecological	Nature Protection														
	Erosion Protection/Soil Conservation	51,36		0,73	0,98										
	Climate Protection														
Social and Cultural	Hydrological	6,17	0,12		1,31										
	Public Health														
	Aesthetics	128,74	31,44	9,81	33,02										
	Ecotourism and Recreation	20,18	2,93		11,32										
	National Security														
	Scientific														
Sub-total (Canopy Levels)		**590,57**	**77,50**	**63,75**	**106,98**	**0,00**	**0,00**	**0,00**	**0,00**						
Total (Actual Forest/Open Area Type)					**838,80**				**0,00**	**14,07**	**11,57**	**883,28**	**0,73**	**0,89**	**1,37**
Total (Actual Forests/Open Areas)									**838,80**						**911,91**
Grand Total (Section 5)															**1750,71**

SECTION 6										**Unwooded Forest Soil**	**Water Body (Lake, Dam, River)**	**Settlements**	**Agricultural Land**	**Quarry-Mine Pit**	**Facility**	**Highway**	**Graveyard**	**KDA**
Economic	Forest Products Production	421,90	20,97	108,84	18,83													
Ecological	Nature Protection	34,74		1,57	0,03													
	Erosion Protection/Soil Conservation																	
	Climate Protection																	
Social and Cultural	Hydrological	12,58			0,89													
	Public Health																	
	Aesthetics	11,35		3,19	0,55													
	Ecotourism and Recreation	4,36		3,76														
	National Security	1,72																
	Scientific																	
Private Afforestation					8,06													
Sub-total (Canopy Levels)		**486,66**	**20,97**	**117,36**	**28,37**	**0,00**	**0,00**	**0,00**	**0,00**									
Total (Actual Forest/Open Area Type)					**653,36**				**0,00**	**44,83**	**14,89**	**223,17**	**3736,75**	**2,84**	**18,13**	**48,00**	**0,52**	**1,58**
Total (Actual Forests/Open Areas)									**653,36**									**4090,70**
Grand Total (Section 6)																		**4744,06**

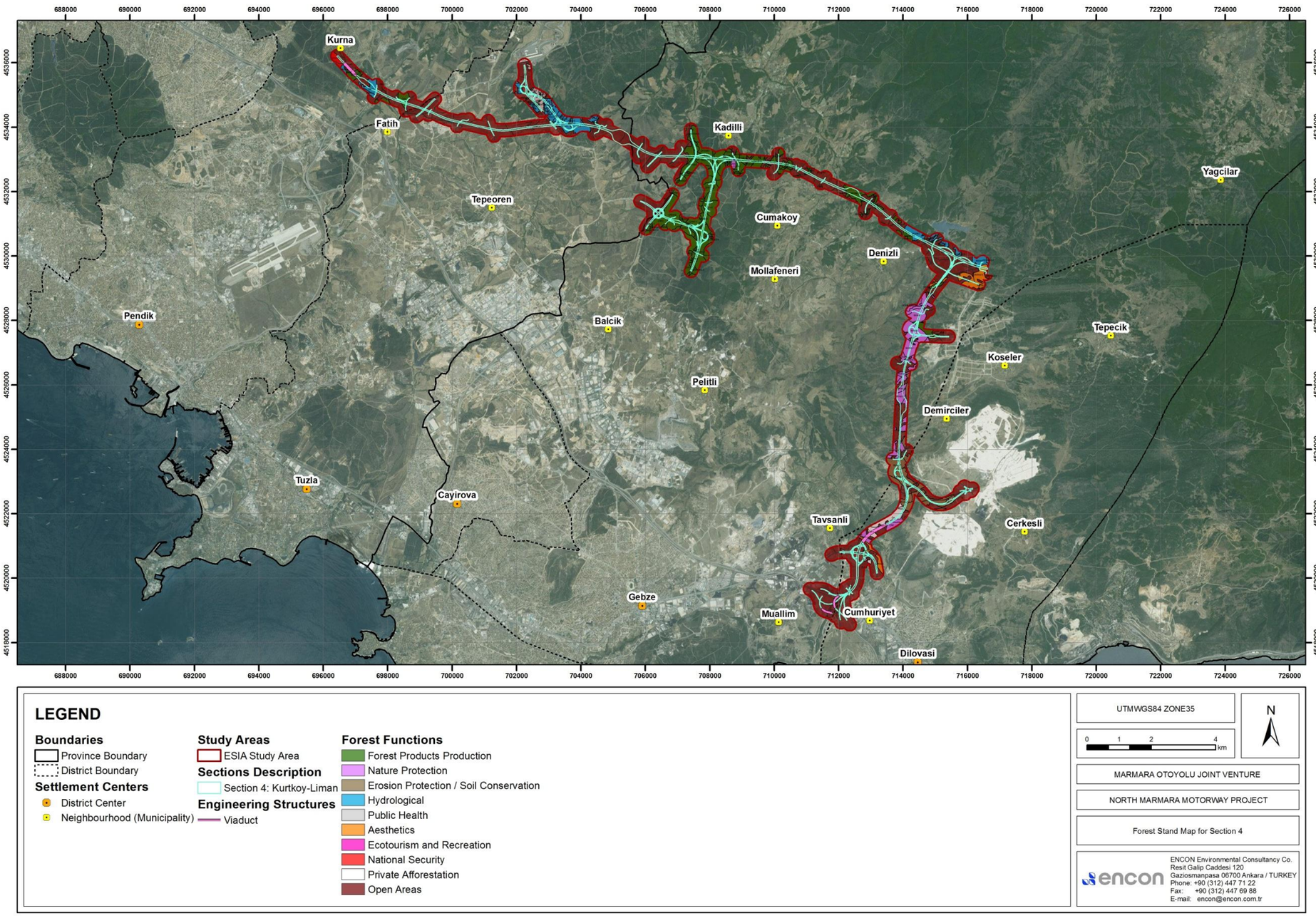


Figure 5.10. Forest Stand Map for Section 4

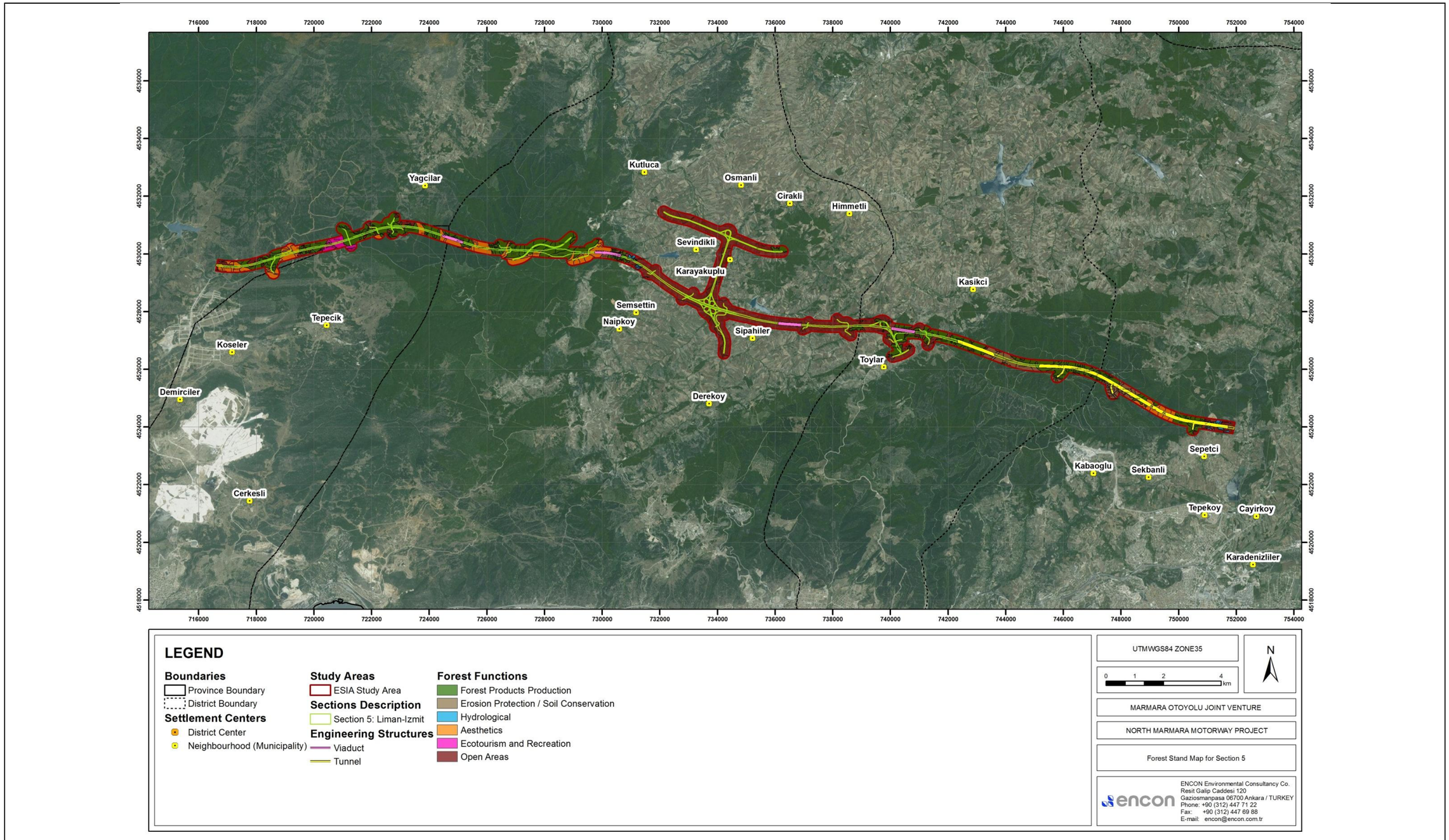
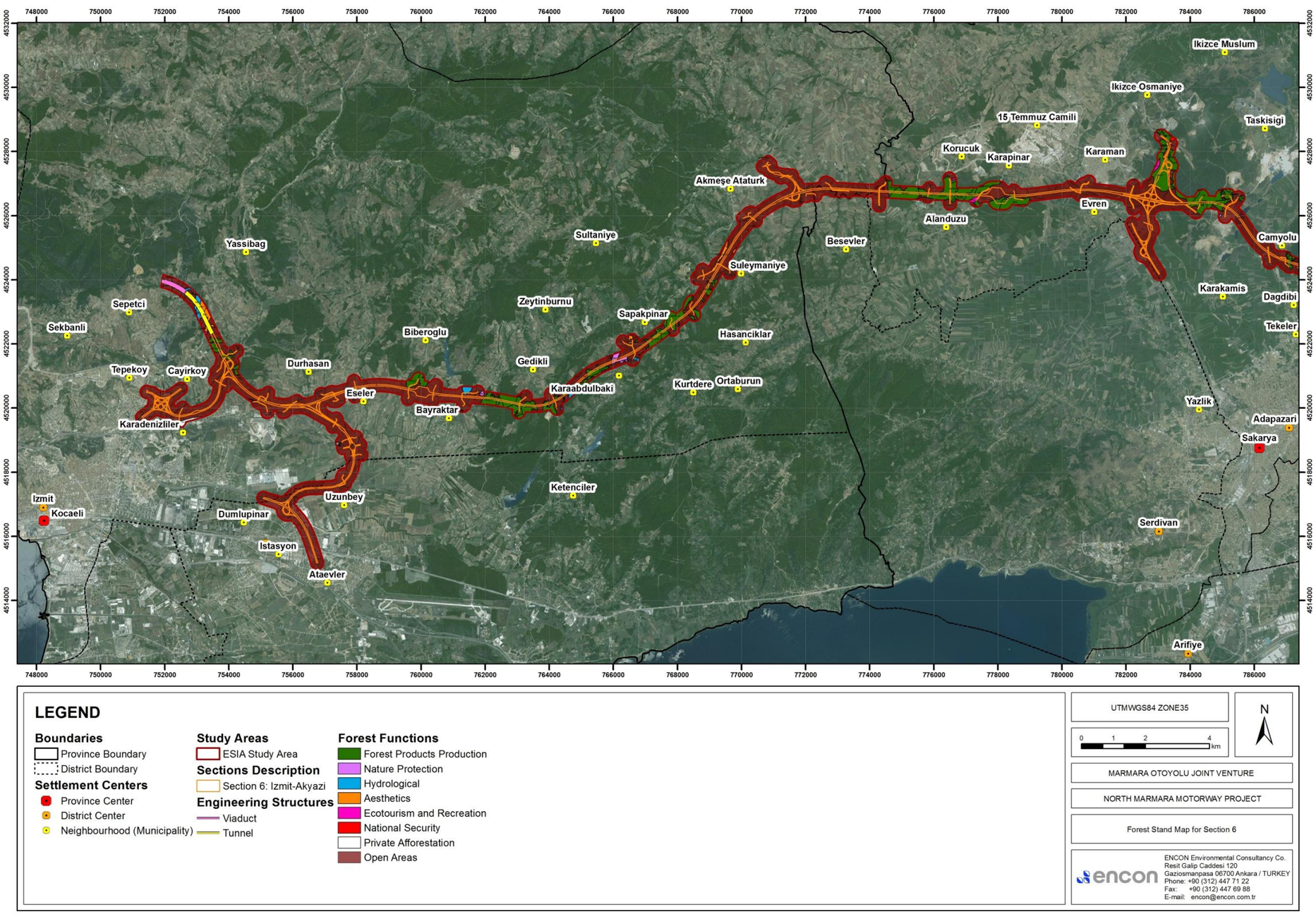


Figure 5.11. Forest Stand Map for Section 5



LEGEND

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- Section 6: Izmit-Akyazi

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- Tunnel

Forest Functions
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- Nature Protection
- Hydrological
- Aesthetics
- Ecotourism and Recreation
- National Security
- Private Afforestation
- Open Areas

UTMWGS84 ZONE35

N

0 1 2 4 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Forest Stand Map for Section 6

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Figure 5.12.a. Forest Stand Map for Section 6

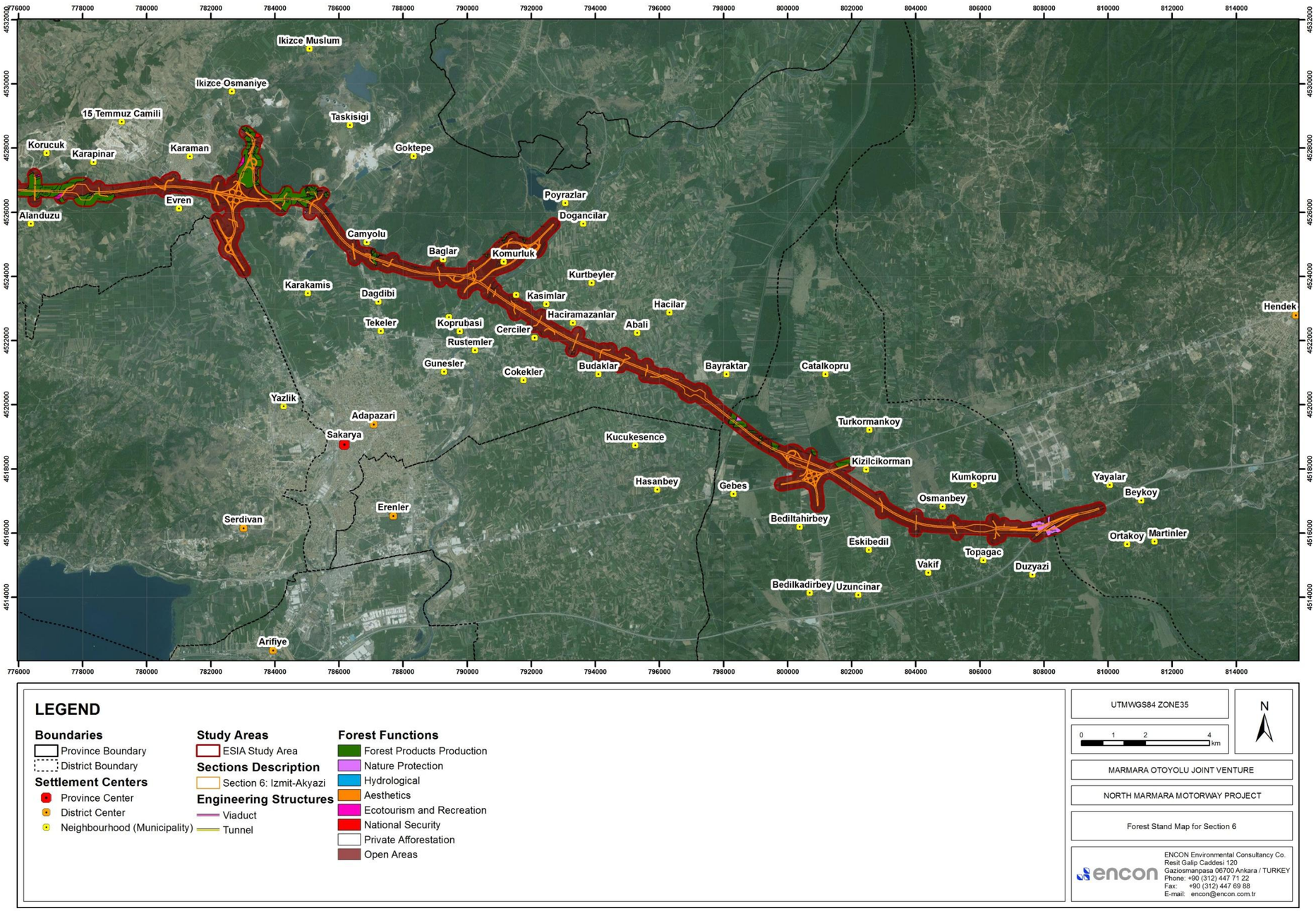


Figure 5.12.b. Forest Stand Map for Section 6

As known, the study area for the assessment of Project impacts on the land use is 9.068,8 ha for the 400 meters study corridor. Within the study corridor, there is no forest specified as “coppice forest”, and thus all of the actual forests are categorized as high forests having different canopy covers. The key findings of the analyses done based on the relevant Forest Management Plans of the study area are summarized below:

- According to the Forest Management Plans, 28,1% (2.552,1 ha) of the entire study corridor is covered by actual forests. Almost 80% of the actual forests are productive, where the canopy cover level changes between 10-100%, while the remainder 20% (539,8 ha) correspond to degraded forests where the canopy cover level is less than 10%.

- Regarding the forest functions, 64,3% (1.641,4 ha) of the all actual forests serve for social and cultural function, while the remaining 20,3% (518,4 ha) serves for ecological and 14,2% (362 ha) serves for economic functions. Private afforestation cover 1,2% (30,3 ha) of actual forests, which correspond to Section 4 and Section 6.

- In Section 4, actual forests (productive and degraded) cover an area of 1.060 ha. Half of the actual forests (50%; 530 ha) in Section 4 serves for economic function. 25,7% of the actual forests in this section serve for ecological function.

- In Section 5, actual forests (productive and degraded) cover an area of 838,8 ha. A considerable portion of the actual forests (64,5%; 540,7 ha) in Section 5 serves for economic function. Only 5,6% of the actual forests in this section serve for ecological function.

- In Section 6, actual forests (productive and degraded) cover an area of 653,4 ha. A considerable portion of the actual forests (87,3%; 570,5 ha) in Section 6 serves for economic function. Only 5,6% of the actual forests in this section serve for ecological function.

In addition to information presented above, forests corresponding to the study area (as discussed previously, the length of the tunnels and viaducts are excluded) according to their stand types have been analyzed by using the Forest Management Plans and the relevant database. The results of the analysis are presented in Table 5.12. Maps showing stand types of forests are presented in Figure 5.13, Figure 5.14 and Figure 5.15 for each section.

As it can be observed from the table forest 14,85 % of forest areas in Section 4 constitute of degraded forest area types. The second dominant stand type is dense oak forest. In Section 5 and Section 6 forests constitute of dense oak forests (19,73 % in Section 5 and 7,77% in Section 6). It should be noted that open areas (especially agricultural lands) are dominant in all three sections.

Table 5.12. Land Use Properties and Forestlands according to Stand Types for Asian Sections within the Study Area

Forest Stand Types	Section 4			Section 5			Section 6		
	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)
Degraded Forest Area	3821311,63	382,13	14,85	1069779,45	106,98	6,11	203035,93	20,30	0,43
Walnut	156800,05	15,68	0,61	-	-	-	-	-	-
Ash	-	-	-	-	-	-	306028,76	30,60	0,65
Dense Ash Forest	-	-	-	-	-	-	291708,90	29,17	0,61
Stone Pine	335667,06	33,57	1,30	-	-	-	33999,08	3,40	0,07
Dense Stone Pine Forest	436664,28	43,67	1,70	-	-	-	-	-	-
Calabrian Pine	-	-	-	-	-	-	32716,70	3,27	0,07
Black Pine	156851,56	15,69	0,61	514783,60	51,48	2,94	26421,08	2,64	0,06
Dense Black Pine Forest	925169,35	92,52	3,59	987664,18	98,77	5,64	-	-	-
Maritime Pine	1235318,96	123,53	4,80	510266,01	51,03	2,91	1060322,20	106,03	2,24
Dense Maritime Pine Forest	463872,00	46,39	1,80	-	-	-	42330,54	4,23	0,09
Oak	1268206,09	126,82	4,93	103942,59	10,39	0,59	740901,61	74,09	1,56
Dense Oak Forest	1576823,45	157,68	6,13	3454983,61	345,50	19,73	3687742,75	368,77	7,77
Dense Hornbeam Forest	-	-	-	113106,76	11,31	0,65	9158,29	0,92	0,02
Beech	-	-	-	37755,74	3,78	0,22	-	-	-
Dense Beech Forest	-	-	-	1562487,60	156,25	8,92	-	-	-
Radiata	-	-	-	33219,04	3,32	0,19	-	-	-
Hazelwood	-	-	-	-	-	-	18589,09	1,86	0,04
Private Afforestation	222812,83	22,28	0,87	-	-	-	80625,26	8,06	0,17
Unwooded Forest Soil	624515,86	62,45	2,43	140727,56	14,07	0,80	448294,57	44,83	0,94
Water Body (Lake, Dam, River)	-	-	-	-	-	-	148856,74	14,89	0,31
Agricultural Land	11003359,87	1100,34	42,75	8832844,19	883,28	50,45	37367519,82	3736,75	78,77
Settlements	2543798,40	254,38	9,88	115692,88	11,57	0,66	2231654,89	223,17	4,70
Quarry-Mine Pit	38478,10	3,85	0,15	7257,07	0,73	0,04	28398,26	2,84	0,06
Facility	833496,78	83,35	3,24	-	-	-	181317,86	18,13	0,38
Highway	8929,11	0,89	0,03	-	-	-	480039,41	48,00	1,01
Energy Transmission Line	14220,88	1,42	0,06	8877,04	0,89	0,05	-	-	-
Graveyard	24397,64	2,44	0,09	-	-	-	5175,42	0,52	0,01
Plantation Area out of Forest Cadastre	29981,64	3,00	0,12	13690,79	1,37	0,08	15787,93	1,58	0,03
Green Field	19666,43	1,97	0,08	-	-	-	-	-	-
TOTAL	**25740341,98**	**2574,03**	**100,00**	**17507078,09**	**1750,71**	**100,00**	**47440625,08**	**4744,06**	**100,00**

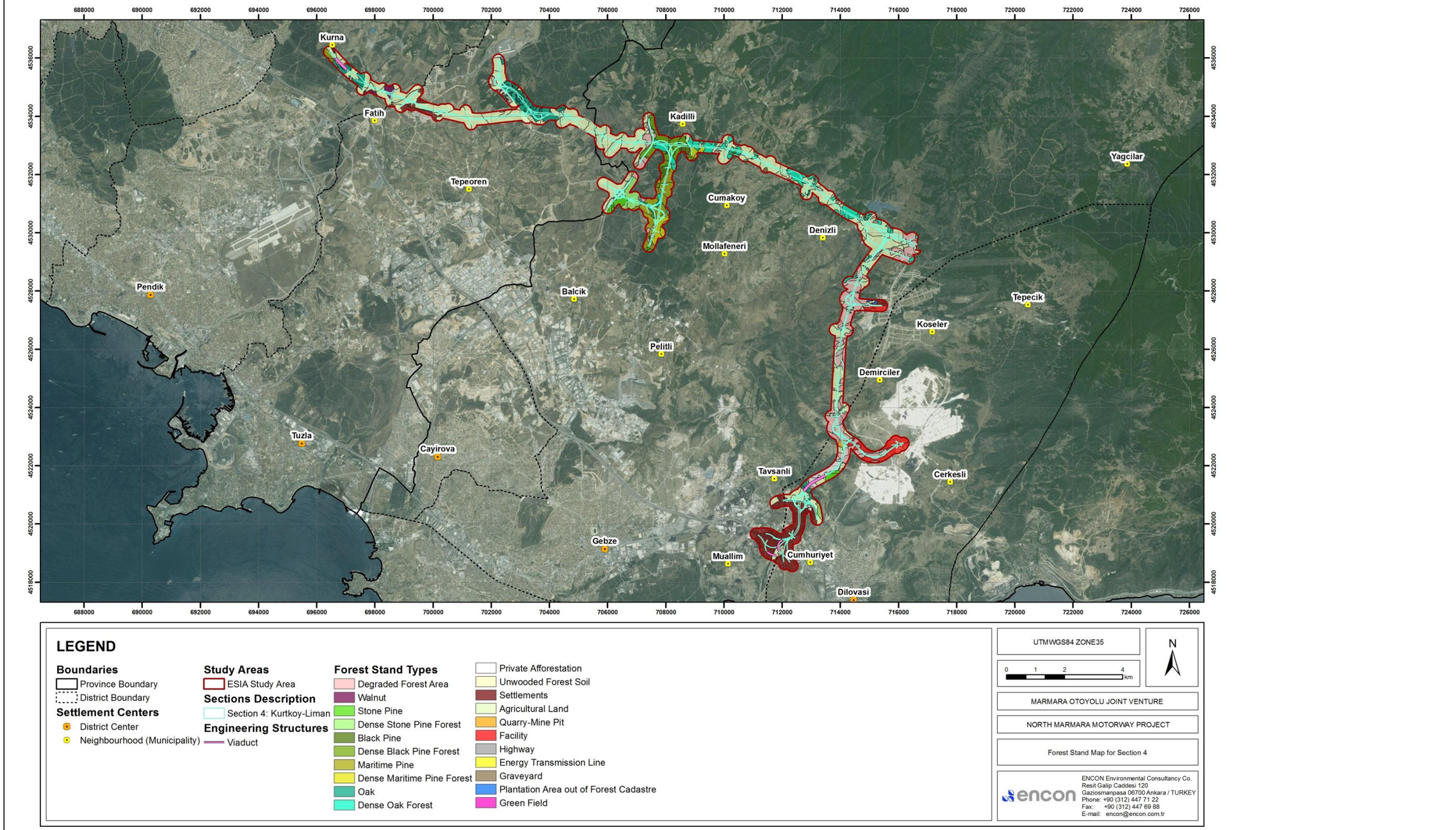


Figure 5.13. Forestlands according to Stand Types for Section 4

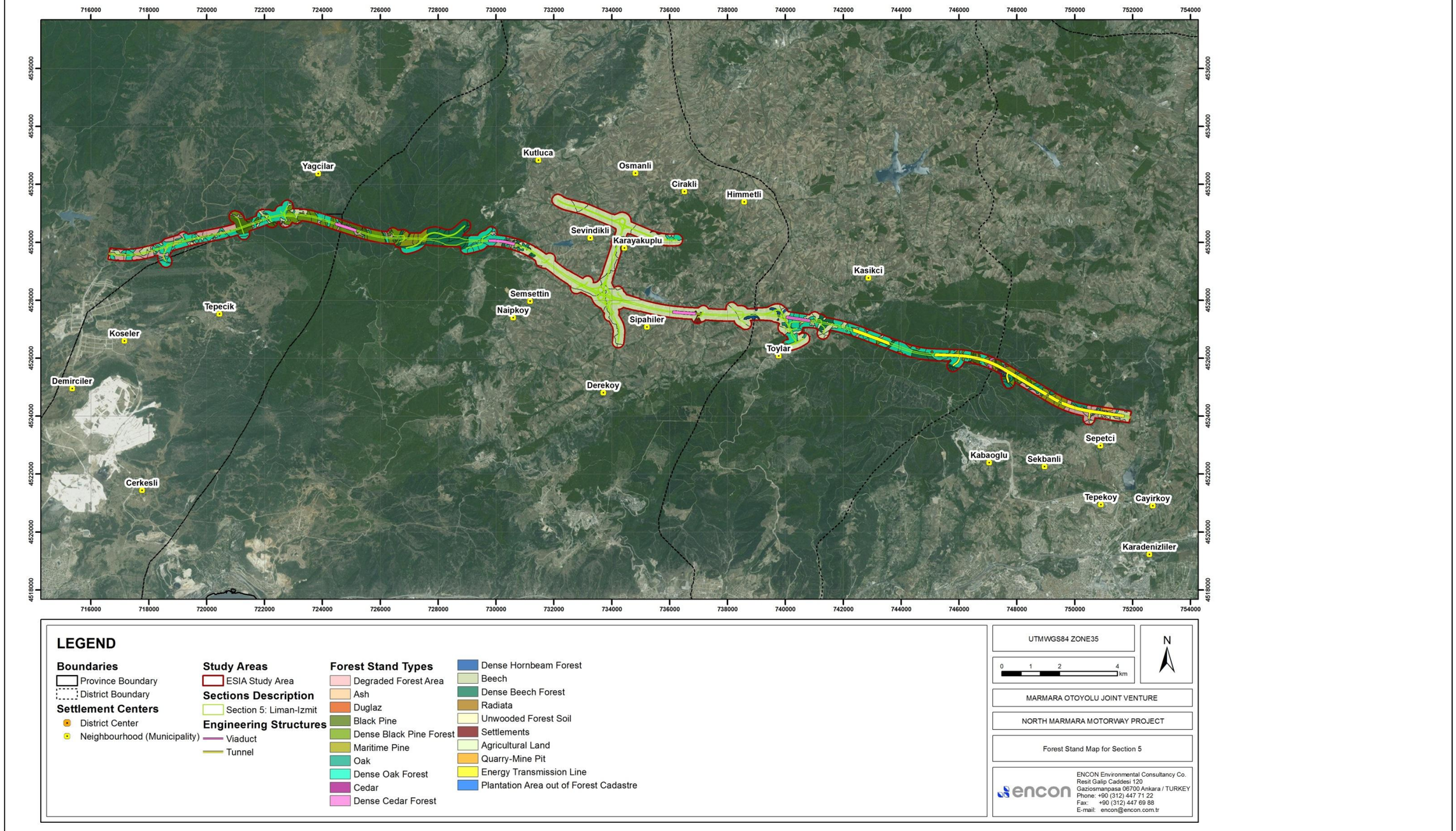
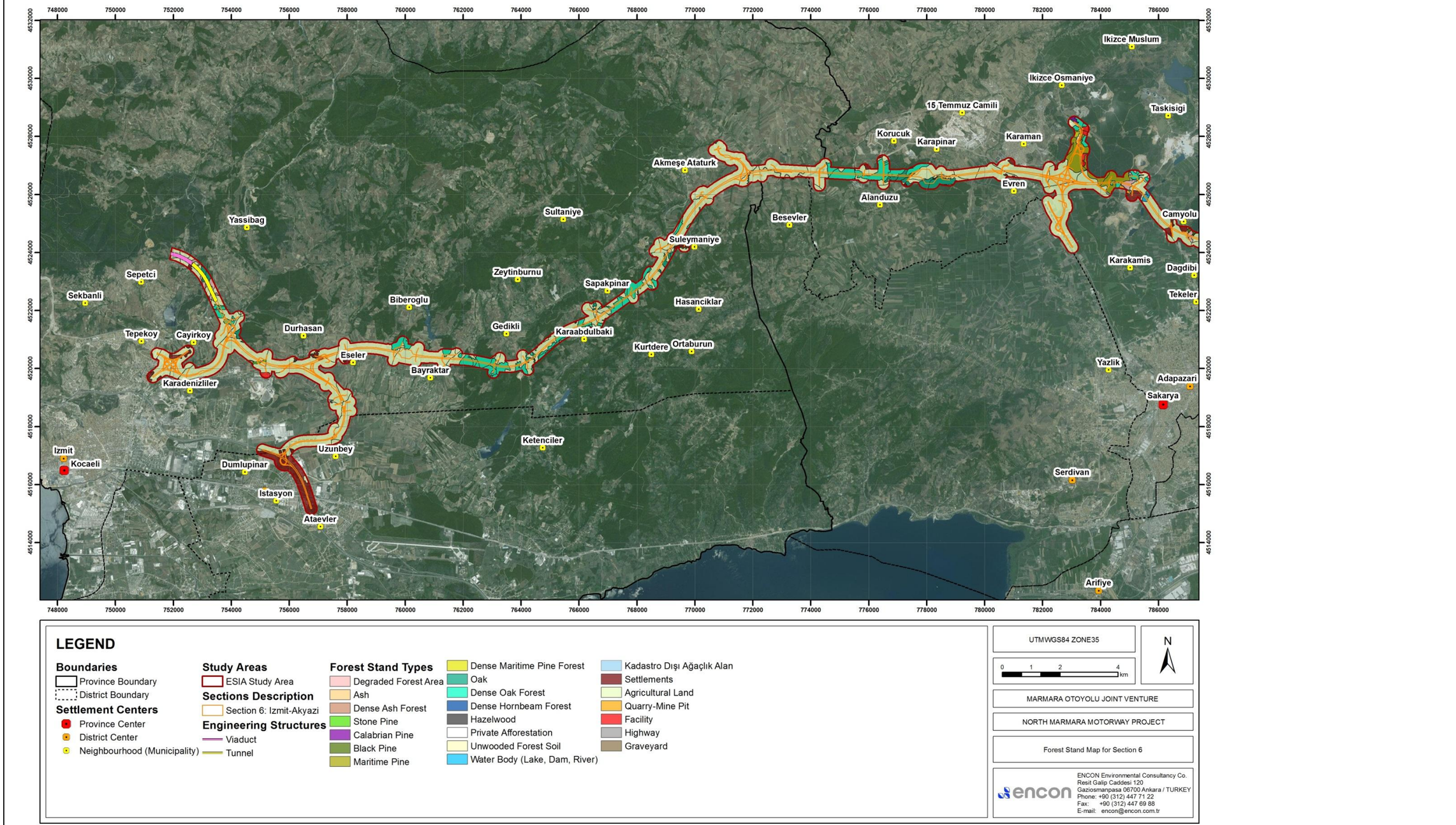


Figure 5.14. Forestlands according to Stand Types for Section 5



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 6: Izmit-Akyazi

Engineering Structures
- Viaduct
- Tunnel

Forest Stand Types
- Degraded Forest Area
- Ash
- Dense Ash Forest
- Stone Pine
- Calabrian Pine
- Black Pine
- Maritime Pine
- Dense Maritime Pine Forest
- Oak
- Dense Oak Forest
- Dense Hornbeam Forest
- Hazelwood
- Private Afforestation
- Unwooded Forest Soil
- Water Body (Lake, Dam, River)
- Kadastro Dışı Ağaçlık Alan
- Settlements
- Agricultural Land
- Quarry-Mine Pit
- Facility
- Highway
- Graveyard

UTMWGS84 ZONE35

N

0 1 2 4 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Forest Stand Map for Section 6

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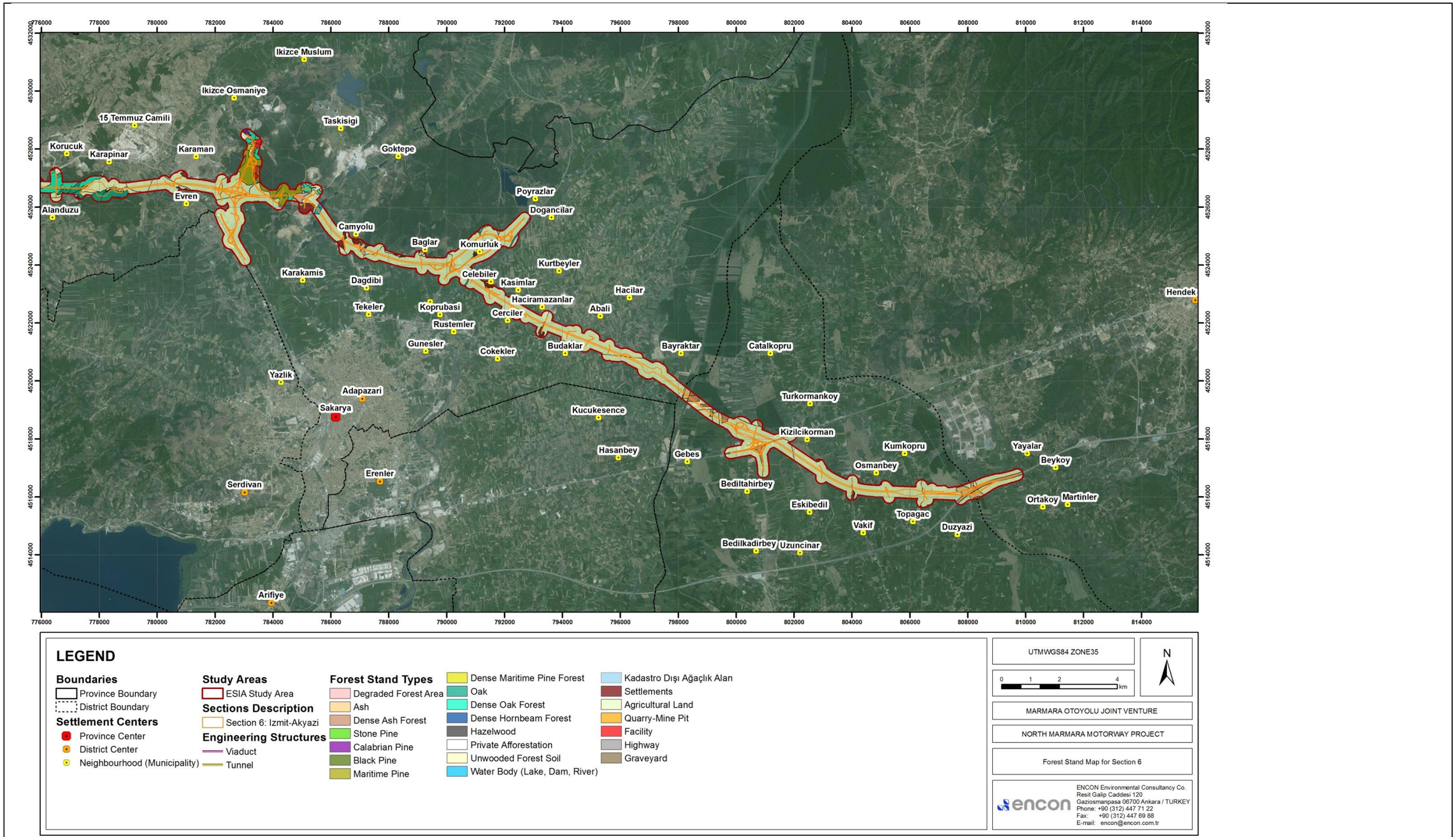
Figure 5.15.a. Forestlands according to Stand Types for Section 6



LEGEND

Boundaries
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UTMWGS84 ZONE35

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0 1 2 4 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Forest Stand Map for Section 6

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Figure 5.15.b. Forestlands according to Stand Types for Section 6

5.2.1.4. Agricultural Lands

According to CORINE (2006) database, agricultural areas (including the arable lands and heterogeneous agricultural areas, excluding pasturelands) cover 59,1 % (5.361 ha) of the entire study corridor (9.068,8 ha) for the Asian sections. Of all agricultural areas, 3.653 ha correspond to Section 6 (68% of all agricultural lands); 868 ha correspond to Section 5 (16% of all agricultural lands); and 840 ha correspond to Section 4 (16% of all agricultural lands).

Assuming that the land use capabilities given for each section according to GDRS database previously in Table 5.4 are applicable to the current situation, Table 5.13 provides an overview of the land use capabilities of the agricultural areas within the study corridor. As can be seen, in Section 4, a major part (77,4%) of the agricultural lands consist of soils having Class VI land use capability, which represent agricultural lands that are not suitable for soil cultivation. Similarly, in Section 5, almost half of the agricultural lands (47,9%) consist of soils having Class VI, while the remaining is mainly composed of Class I, II and III. In Section 6, 46,4% of the agricultural lands consist of Class II soils and 21,4% consist of Class III soils, which represent lands that are suitable for agricultural soil cultivation. The remainder of Section 6 is mainly composed of Class VI and VII soils, which are not suitable for soil cultivation.

Table 5.13. Land Use Capabilities of the Agricultural Areas within the Study Corridor

Land Use Capability Class	Section 4		Section 5		Section 6	
	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
I	0,0	0,0	143,2	16,5	0,0	0,0
II	24,4	2,9	141,5	16,3	1695,0	46,4
III	151,3	18,0	134,5	15,5	781,7	21,4
IV	14,3	1,7	0,0	0,0	65,8	1,8
V	0,0	0,0	0,0	0,0	0,0	0,0
VI	650,8	77,4	415,8	47,9	683,1	18,7
VII	0,0	0,0	33,0	3,8	427,4	11,7
VIII	0,0	0,0	0,0	0,0	0,0	0,0
Total	**840,8**	**0**	**868,0**	**100**	**3653,0**	**100**

Land use capability of soils for the study area on settlement-basis is presented in Table 5.14.

Table 5.14. Land Use Capability of Agricultural Lands in Each Settlement (*GDRS, 1987, 1991 and 1995*)

Section	Location			Main Land Use Capability Class
	Province	District	Neighborhood	
Section 4	Istanbul	Pendik	Kurnakoy	III , VI
	Istanbul	Tuzla	Tepeoren	IV
	Kocaeli	Gebze	Kadilli	VII, IV
	Kocaeli	Gebze	Cumakoy	VI
	Kocaeli	Gebze	Balçık	IV
	Kocaeli	Gebze	Denizli (Liman Access Road)	VI
	Kocaeli	Dilovasi	Koseler (Liman Access Road)	VI
	Kocaeli	Dilovasi	Demirciler (Liman Access Road)	VI, VII
	Kocaeli	Gebze	Tavsanli (Liman Access Road)	VI, VII
Section 5	Kocaeli	Izmit	Tepecik	IV, VI
	Kocaeli	Gebze	Yagcilar	VI, VII
	Kocaeli	Korfez	Kutluca	VII
	Kocaeli	Korfez	Sevindikli	I, II
	Kocaeli	Korfez	Semsettin	III,IV
	Kocaeli	Korfez	Karayakuplu	I, VI
	Kocaeli	Korfez	Sipahiler	III, VI
	Kocaeli	Korfez	Himmetli	VI
	Kocaeli	Derince	Kasikci	VI
	Kocaeli	Korfez	Toylar	VI
Section 6	Kocaeli	Izmit	Cayirkoy	II, VI
	Kocaeli	Izmit	Durhasan	VI
	Kocaeli	Izmit	Uzunbey	II
	Kocaeli	Izmit	Eseler	III, VI
	Kocaeli	Izmit	Bayraktar	III, II
	Kocaeli	Izmit	Gedikli	VII, IV
	Kocaeli	Izmit	Karaabdulbaki	VII
	Kocaeli	Izmit	Sapakpinar	VII
	Kocaeli	Izmit	Suleymaniye	VI, VII
	Kocaeli	Izmit	Akmese	IV, VI
	Sakarya	Serdivan	Besevler	VI, III
	Sakarya	Adapazari	Korucuk	II, VI
	Sakarya	Adapazari	Karapinar	II, VI
	Sakarya	Adapazari	Kulaksiz	II
	Sakarya	Adapazari	Karaman	II
	Sakarya	Adapazari	Karakamis	II
	Sakarya	Adapazari	Tekeler	III
	Sakarya	Adapazari	Dagdibi	III
	Sakarya	Adapazari	Camyolu	VII
	Sakarya	Adapazari	Gunesler	III, II
	Sakarya	Adapazari	Suleymanbey	III, II
	Sakarya	Adapazari	Trabzonlar	III, II
	Sakarya	Adapazari	Rustemler	III, II
	Sakarya	Adapazari	Celebiler	III
	Sakarya	Adapazari	Cerciler	III
	Sakarya	Adapazari	Haciramazanlar	II
	Sakarya	Adapazari	Budaklar	II
	Sakarya	Adapazari	Abali	II
	Sakarya	Adapazari	Kucukesence	II
	Sakarya	Akyazi	Bediltahirbey	III
	Sakarya	Akyazi	Kizilcikorman	III
	Sakarya	Akyazi	Eskibedil	III
	Sakarya	Akyazi	Uzuncinar	III
	Sakarya	Akyazi	Vakif	II
	Sakarya	Akyazi	Osmanbey	II
	Sakarya	Akyazi	Ramasli/Topagac	II
	Sakarya	Akyazi	Duzyazi	II
	Sakarya	Akyazi	Ortakoy	II

5.2.1.5. Pasture Lands

According to CORINE (2006) database (see Table 5.3), pasturelands are present only in Section 6, as listed in Table 5.15. Data has been confirmed by analyses done using the database of the General Directorate of Land Registry and Cadastre. Additionally, in the scope of the socio-economic field surveys conducted as a part of the ESIA in January 2017 (see Chapter 14 “Socio-economic Environment”), availability of pasturelands in the neighbourhoods has been identified by means of questionnaires conducted with the headmen. In addition to these areas, based on a review of the expropriation plans prepared for the Project, pasturelands located within the expropriation area have been identified in Karakamis and Celebiler neighborhoodsof Adapazari, Sakarya. Figure 5.16 provides a map of pasturelands located along the route in Section 6.

Table 5.15. Pasturelands Identified by CORINE Database

Province	District	Neighborhood	Corresponding Motorway KM	Main Land Use Capability Class according to GDRS
Section 6				
Kocaeli	Izmit	Akmese	211+300	VII
Sakarya	Adapazari	Karakamis	223+810; 2+031	II
Sakarya	Adapazari	Celebiler	234+000	III
Sakarya	Akyazi	Kizilcikorman	246+000	III
Sakarya	Akyazi	Osmanbey	247+800	II
Sakarya	Akyazi	Ramasli/Topagac	251+000	III

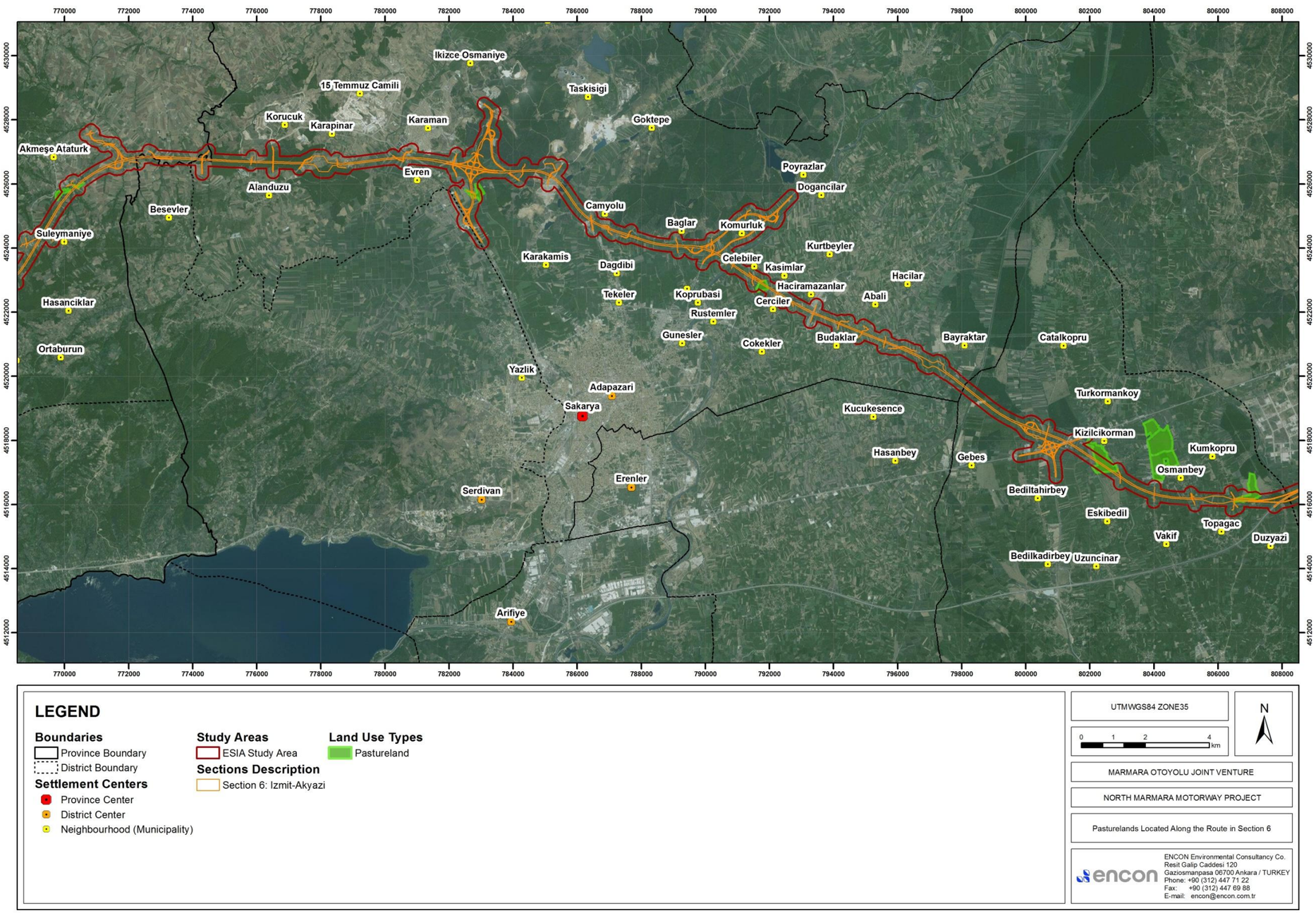


Figure 5.16. Pasturelands Located Along the Route in Section 6

5.2.2. Property and Ownership within the Expropriation Corridor

According to expropriation plans prepared for the Project, the lands corresponding to the Motorway and its components including the Camp Sites, quarries and storage sites are mainly categorized as follows:

- Privately owned lands
- Lands owned by legal entities
- State-owned lands (i.e. treasury lands)
- Lands under the authority of Forestry Directorates
- Lands that are out of registration

Table 5.16 lists the number of parcels and corresponding areas within the expropriation corridor in each section along the Motorway (excluding the Camp Sites, quarries, storage sites, etc. which are separately addressed in the following paragraphs). As can been seen, the lands within the expropriation corridor cover a total area of 3.540,1 ha. Nearly than half (48,7%; 1.723,9 ha) of these lands are under the authority of Forestry Directorates, while a major part of the remaining (42,3%; 1.498,1 ha) are privately owned.

Table 5.16. Distribution of Lands According to Type of Ownership and Number of Corresponding Parcels within the Expropriation Corridor

Type of Ownership	Area (ha)			Total	
	Section 4	Section 5	Section 6	Area (ha)	Percent (%)
(A) Privately owned lands	358,2	321,2	818,7	**1498,1**	**42,3**
(B) Lands owned by legal entities	12,2	1,3	28,6	**42,1**	**1,2**
(C) State-owned lands (Treasury)	90,8	19,2	166,0	**276,0**	**7,8**
(D) Lands under the Authority of Forestry Directorates	681,0	647,4	395,5	**1.723,9**	**48,7**
Total Area (ha)	**1.142,2**	**989,1**	**1.408,8**	**3.540,1**	**100,0**
Total Number of Corresponding Parcels	**717**	**1.707**	**3.551**	**3.540,1**	**100,0**
			5.975		

Regarding the construction compounds, cadastral information obtained from the database of the General Directorate of Land Registry and Cadastre for the registered lands are summarized in Figure 5.17.

Section 4: Demirciler Construction Camp Site		
	Province	Kocaeli
	District	Dilovasi
	Neighborhood	Demirciler
	Location	Garipler Ridge
	Plot no.	0
	Parcel no.	1776
	Title Deed Area	2.006.497,51 m^2
	Type	State Forest
Section 6: Taskisigi Construction Camp Site		
	Province	Sakarya
	District	Adapazari
	Neighborhood	Taskisigi
	Location	İncirlibayir
	Plot no.	0
	Parcel no.	787
	Title Deed Area	407,650.00 m^2
	Type	Quarry
Section 6: Yagbasan Sandstone Borrow Site		
	Province	Sakarya
	District	Hendek
	Neighborhood	Akarca
	Location	Ihlamuryanı
	Plot no.	102
	Parcel no.	19
	Title Deed Area	215,102,14
	Type	Forest

Figure 5.17. Cadastral Information for the Construction Compounds that are Located on Registered Lands

5.3. Potential Impacts

Land use and transportation are intrinsically related. Motorway development projects result in changes in the land use patterns and ownership structure along their route. Depending on the length of the route and the width of the road and expropriation corridor, magnitude of the impacts would change. Similarly, the sensitivity of the lands (i.e. ecological importance, social and economic value to users, etc.) to be crossed by the Motorway changes depending on their value, which in turn, together with the magnitude of the impact, determines the level of impact significance.

Asian sections of the North Marmara Motorway will have a total length of 186,9 km, including the main carriageway and the access roads. The width of the expropriation corridor will be minimum 100 meters, whereas it may expand up to 350 meters depending on the scale of excavation and fill requirements and siting of the road structures such as interchanges, service areas, etc. Lands (within the expropriation corridor) required for the development and operation of the Motorway and its components will be acquired by the KGM prior to the start of construction activities in accordance with the relevant provisions of the national legislation (i.e. Expropriation Law numbered 2942, Forestry Law numbered 6831, Pastures Law numbered 4342, Law on Soil Conservation and Land Use numbered 5403). Total area to be acquired within the expropriation corridor will be 3.540,1 ha, which corresponds to 5.975 parcels.

Following the acquisition of lands, Project activities including vegetation clearing, top soil stripping, cut and fill operations and construction of Motorway components and other buildings/facilities will result in permanent and temporary impacts that need management.

In addition to the direct physical impacts of the activities on the lands and socio-economic dimensions of the land acquisition, transportation projects possibly trigger further land developments in the vicinity of route, especially when the Motorway provide access to lands.

In this context, direct potential impacts of the Motorway development on the land use and property and probable indirect impacts are listed below. Further assessment of the direct impacts for the land preparation and construction and operation phases, in consideration of the baseline conditions, are provided in the following headings, while evaluation of socio-economic impacts associated with land acquisition and changes in the existing land use patterns (e.g. physical or economic displacement) are provided in Chapter 14 (“Socio-economic Environment”).

- Permanent land take resulting in changes in the existing land use characteristics (i.e. agricultural, forest, pasture, etc.),
- Temporary land take for construction facilities resulting in degradation of lands that need rehabilitation;
- Fragmentation of lands and access restrictions to lands;
- Future changes in the regional land use character that would be triggered by a potential expansion of the cities in the northern direction as a result of increased access to be provided by the Motorway;
- Planned and unplanned urban development in the expansion areas;

- Increased demand in residential and commercial properties resulting in a trend in increase in the property values;
- Increased demand in infrastructural services (i.e. transportation, electricity, water, wastewater, etc.).

5.3.1. Land Preparation and Construction Phase

Construction of the Motorway and its components will result in the changes in the existing land use. Accordingly, forest lands, agricultural areas, pastures, etc. corresponding to the expropriation corridor will be permanently lost when the components correspond to such uses. In addition, land use characteristics corresponding to temporary construction compounds such as Camp Sites and quarries as well as permanent storage sites will also change temporarily or permanently depending on the nature of the activity. On the other hand, as a result of Motorway construction, the Motorway will cause permanent fragmentation of agricultural areas, pastures, forests and other lands at a number of locations, making the associated land less viable for existing owners and users through access restriction. These impacts will start to occur in the construction phase and continue during the operation phase of the Project as well. Several culverts, underpasses and overpasses have been included in the design. Quantified assessment on each type of land use is provided below.

5.3.1.1. Temporary Impacts at the Construction Sites

Road construction sites and Construction Camp Sites are the locations where temporary impacts of the construction activities may be encountered. In the scope of road construction works, construction activities are to be normally conducted within the expropriation corridor. For the privately-owned lands, construction activities have to start following the completion of expropriation process (in case of agreement, after payments are done; otherwise in accordance with Article 27 (“Urgent Expropriation”) of the Expropriation Law. Since the expropriation corridor is specified wide enough (minimum 100 meters and maximum 350 meters) to allow sufficient space for the works to be conducted by construction machinery and vehicle, intrusion of construction activities onto adjacent lands are normally avoided. On the other hand, there may be exceptional cases when the construction crew may cross the borders of the expropriation corridor (may be unintentionally or with informed decision) and pose risk of damage on the adjacent lands. Similarly, on very rare cases, drilling, land preparation or construction activities may be initiated by construction contractors before the expropriation or court decisions are finalized. To avoid such cases and associated risks or damages on lands and their owner/users, good management of construction crew and strict adherence to the borders of expropriation corridor is essential. If occurs, the impact would most likely be reversible by corrective measures to be taken.

The area to be covered by known construction components such as Camp Sites, quarries, storage sites, etc. and the corresponding land uses are summarized in Table 5.17. As can be seen from the table, most of the compounds are located on forest lands. These lands correspond to registered or unregistered areas. The lands on which the Camp Sites have been established will be temporarily affected due to use of land throughout the construction period, which will be maximum 3 years according to BOT Contract. Quarries will be operated through the construction period but the impacts on the land-use will only be reversed in the long-term if rehabilitation activities are conducted effectively. Land use at the storage sites will change permanently as these sites will serve the storage of materials in the long run.

Table 5.17. Areas and Land Use Information for the Construction Compounds for Asian Sections

Location	Location			Description of the Site/Plant	Area (ha)	Type of Land Use	Lot/ Parcel No.
	Province	District	Nearest Neighborhood				
Section 4							
146+500	Kocaeli	Gebze	Cumakoy	Cumakoy Construction Camp Site	14,4	Forest	Out of registration
150+500; 4+750	Kocaeli	Dilovasi	Demirciler	Demirciler Construction Camp Site	44,1	Forest	0/1776
150+500; 1+000	Kocaeli	Dilovasi	Demirciler	Storage Site-401 and 402	1,0	Forest	Out of registration
150+500; 4+000	Kocaeli	Dilovasi	Demirciler	Storage Site-403	5,5	Forest	Out of registration
150+500; 7+000	Kocaeli	Dilovasi	Demirciler	Storage Site-404	22,8	Forest	Out of registration
Sub-total (Section 4)					**87,8**	**Forest**	
Section 5							
164+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Limestone Quarry	28,9	Forest	Out of registration
165+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Construction Camp Site	6,0	Forest	Out of registration
162+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Storage Site-501	14,04	Forest	Out of registration
Sub-total (Section 5)					**48,9**	**Forest**	
Section 6*							
188+500	Kocaeli	Izmit	Cayirkoy Hacioglu	Cayirkoy Construction Camp Site	41,4	Forest	Out of registration
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Construction Camp Site	40,8	Quarry	0/787
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Limestone Quarry 1-2	16,8	Quarry (former), Forest	Out of registration
				Taskisigi Limestone Quarry-4	39,1	Forest	Out of registration
250+000	Sakarya	Yagbasan	Hendek	Yagbasan Sandstone Borrow Site	42,9	Forest	102/19; Out of registration
Sub-total (Section 6)					**181,0**	**Forest, Former quarry**	

**Locations for the storage sites in Section 6 are yet to be identified. It is likely that these areas would be located on forest lands.*

5.3.1.2. Impacts on Forestlands

Impacts of the North Marmara Motorway Project on the forestlands have been assessed based on the area to be affected and number of trees to be lost in economic, ecological and social/cultural forests.

Loss of Forestlands

Areas of forests corresponding to the corridor to be acquired in the scope of the Project in each Section of Asian part are listed in Table 5.18. A major part of the forest area to be affected by the Project corresponds to Section 5, which are mainly located near Kasikci, Kutluca and Yagcilar. In Section 4, loss of forestlands will mainly occur near Kadilli and Demirciler (on the Liman Access Road) neighborhoods. In Section 5, forests are located mainly in the first 40 km of Section 6, and forests are not affected in the remainder of this Section. In Section 6, forestlands to be affected are generally homogenously distributed, with the exception of Karakamis, which is the neighborhood, where the impacts will be more prominent when compared to other areas. A total of 1.465,1 ha of forest land will be affected from the Motorway.

Table 5.18. Forest Areas to be Acquired in the Scope of the Project (Asian Part)

Section	Regional Directorate	Forestry Management Directorate	Management Sub-directorate	Forest Area Corresponding to the Land Acquistion Corridor	
				(m2)	(ha)
Section 4	Istanbul Directorate of Forestry	Kanlica Forestry Management Directorate	Kartal	796.279,03	79,63
			Sultanbeyli	107.702,85	10,77
	Sakarya Regional Directorate of Forestry	İzmit Forestry Management Directorate	Derince	1.058.757,80	105,87
			Dilovasi	4.574.149,03	457,41
			Gebze	2.633.802,43	266,38
			Hereke	940.342,20	94,03
			Izmit	776.690,81	77,67
			Kargali	23.493,05	2,35
			Korfez	332.877,53	33,29
			Taskopru	722.396,34	72,24
			Uzuntarla	874.018,61	87,40
Section 5	Sakarya Regional Directorate of Forestry	Adapazari Forestry Management Directorate	Adapazari	1.459.733,01	149,57
Section 6	Sakarya Regional Directorate of Forestry	Akyazi Forestry Management Directorate	Akyazi	284.897,94	28,49
Total				**14.651.140,6**	**1465,1**

In addition to Motorway construction, most of the construction compounds including camp sites and quarries and storage sites are located on forest lands as summarized previously in Section 5.2.2. The forest area to be affected by these construction compounds and storage sites in each Section is listed in Table 5.19. It should be noted that locations for the storage sites in Section 6 are yet to be identified and it is likely that these areas would be located on forest lands causing corresponding forest areas to be affected depending on the footprint of the storage sites.

Table 5.19. Areas and Land Use Information for the Construction Compounds for Asian Sections

Location	Location			Description of the Site/Plant	Area (ha)	Corresponding Main Forest Functions in the Relevant Forest Management Plan
	Province	District	Nearest Neighborhood			
Section 4						
146+500	Kocaeli	Gebze	Cumakoy	Cumakoy Construction Camp Site	14,4	Economic
150+500; 4+750	Kocaeli	Dilovasi	Demirciler	Demirciler Construction Camp Site	44,1	Ecological
150+500; 1+000	Kocaeli	Dilovasi	Demirciler	Storage Site-401-402	1,0	Ecological
150+500; 4+000	Kocaeli	Dilovasi	Demirciler	Storage Site-403	5,5	Ecological
150+500; 7+000	Kocaeli	Dilovasi	Demirciler	Storage Site-404	22,8	Ecological
Sub-total (Section 4)					**87,8**	
Section 5						
164+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Limestone Quarry	28,9	Economic
165+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Construction Camp Site	6,0	Economic
162+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Storage Site-501	14,04	Economic
Sub-total (Section 5)					**48,94**	
Section 6*						
188+500	Kocaeli	Izmit	Cayirkoy Hacioglu	Cayirkoy Construction Camp Site	41,4	Economic, SC
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Limestone Quarry-4	39,1	Economic
250+000	Sakarya	Hendek	Yagbasan	Yagbasan Sandstone Borrow Site	42,9	Economic
Sub-total (Section 6)					**123,4**	
Grand Total					**260,1**	

In conclusion, total forest area to be affected by the Motorway, construction compounds and storage sites (in Section 4 and Section 5) will be 1465,1 ha, which corresponds to high forests with varying canopy levels. Of the total forest area, around 14% correspond to degraded forestlands where the canopy level is classified as absent to sparse (0-10%).

Loss of Trees

Trees corresponding to the permitted road construction areas (road footprint and embankment and fill zones) will be removed and appraised by the relevant Regional Directorate of Forestry in coordination with the KGM and Project Sponsors. In this scope, exact number of trees to be removed is determined by the Regional Directorate after examination of current management plans and field studies. Accordingly, number of trees to be removed in the scope of the Project has been estimated by relevant forestry

directorates for each section of the Project and is summarized in Table 5.20. The figures given in this table has been calculated to cover the trees to be removed from the footprint of the Motorway construction areas including the embankment and fill zone. As can be seen from Table 5.20, total forest area corresponding to the area to be acquired for Motorway route is 1.465,1 ha, 197,18 ha (around 14%) is formed of degraded forests where the canopy cover rate is lower than 10% that is represented by absent to sparse vegetation cover.

Table 5.20. Estimated Number of Trees to be Removed in Each Section of the Motorway

District/Sub-District Directorates of Forestry	Number of Trees Removed
Kanlıca District Directorate of Forestry	
Kartal Sub-District Directorate of Forestry	11.919
Sultanbeyli Sub-District Directorate of Forestry	5.408
İzmit District Directorate of Forestry	
Derince Sub-District Directorate of Forestry	62.493
Dilovasi Sub-District Directorate of Forestry	346.018
Gebze Sub-District Directorate of Forestry	139.246
Hereke Sub-District Directorate of Forestry	95.091
Izmit Sub-District Directorate of Forestry	40.367
Kargali Sub-District Directorate of Forestry	2.165
Korfez Sub-District Directorate of Forestry	31.377
Taskopru Sub-District Directorate of Forestry	19.348
Uzuntarla Sub-District Directorate of Forestry	49.233
Adapazari District Directorate of Forestry	
Adapazari Sub-District Directorate of Forestry	52.536
Akyazi District Directorate of Forestry	
Akyazi Sub-District Directorate of Forestry	8.895
Total	**864.099**

When the forest stand types are considered (based on the findings of the ecological surveys conducted); *Pyrus elaeagnifolia* Pallas subsp. *Elaeagnifolia, Salix alba L., Quercus frainetto Ten., Quercus cerris L. var. cerris, and Quercus petraea (Mattuschka) Liebl. Var. iberica (Steven ex Bieb.) Krassiln* stand out the common types that will be affected in each section. None of the species identified has is classified as Vulnerable (VU) or Endangered (EN) by the International Union for Conservation of Nature (IUCN). On the other hand, it has been understood during the Public Consultation Meetings, poplar trees (*Populus*) are attached with particular importance by the local people because of their economic activities. Ficus carica L. and Juglans regia L. would also of economic importance. Tree species to be removed are given in Table 5.21. Detailed ecological assessments on the species-level (e.g. sensitivities, conservation status, endemism, etc.) are provided in Chapter 9 (“Ecology”).

Table 5.21. Trees to be Removed according their Types

Species Name	Turkish Name	Presence			Ecological/ Socio-economic Value
		Section 4	Section 5	Section 6	
Pinus pinaster Ait.	Sahil çamı	x	x		
Cupressus sempervirens L.	Servi	x			
Juniperus oxycedrus L. subsp. *oxycedrus*	Ardıç	x	x		
Papaver rhoeas L.	Gelincik	x			
Robinia pseudoacacia L.	Akasya	x	x		
Pyrus elaeagnifolia Pallas subsp. *elaeagnifolia*	Ahlat	x	x	x	
Malus sylvestris Mill. subsp. *orientalis* (Uglitzk.) Browicz var. *orientalis*	Elma	x			
Arbutus unedo L.	Kocayemiş	x		x	
Salix alba L.	Ak söğüt	x	x	x	
Quercus frainetto Ten.	Macar meşesi	x	x	x	
Quercus cerris L. var. *cerris*	Saçlımeşe	x	x	x	
Quercus petraea (Mattuschka) Liebl. Var. *iberica* (Steven ex Bieb.) Krassiln	Sapsız meşe	x	x	x	
Pinus nigra J.F. Arnold	Karaçam		x		
Tilia argentea Desf. ex DC	Gümüşi ıhlamur		x		
Acer campestre L.			x		
Crataegus monogyna Jacq. Subsp. *monogyna*	Alıç		x		
Prunus spinosa L. subsp. *dasyphylla* (Schur) Domin	Erik		x		
Cornus mas L.	Kızılcık		x	x	
Fraxinus angustifolia Vahl subsp. oxycarpa (Bieb. ex Willd.) Franco & Rocha Afonso	_		x		
Carpinus betulus L.	Gürgen		x	x	
Ulmus minor Miller. subsp. *minor*	Karaağaç		x	x	
Quercus infectoria Olivier			x	x	
Quercus coccifera L.			x	x	
Fagus orientalis Lipsky	Kayın ağacı		x	x	
Cornus sanguinea L. *subsp. sanguinea*				x	
Fraxinus angustifolia Vahl subsp. oxycarpa (Bieb. ex Willd.) Franco & Rocha Afonso	_			x	
Corylus avellana L. var. *avellana*	Fındık			x	
Populus alba L.	Ak kavak			x	Economic
Populus canadensis Moench	Kavak			x	Economic
Ficus carica L.	İncir			x	
Juglans regia L.	Ceviz			x	Economic

Secondary Impacts associated with Loss of Forestlands

Besides direct loss of forestlands, as secondary impacts, increased human activity at the construction sites may increase the potential for the start of forest fires. Loss of carbon capture capacity in association with the number of trees lost will be discussed in Chapter 10 ("Air Quality"). Socio-economic impacts of the loss of forestlands on local communities will be covered in Chapter 14 ("Socio-economic Environment").

5.3.1.3. Impacts on Agricultural Lands

To meet Project's land take requirements, agricultural lands located within the expropriation corridor will be expropriated by the responsible agency (KGM). One of the main direct results of the permanent land take to be done in the scope of the Project will be the conversion of productive agricultural lands to built-up lands. Consequently, these lands will be permanently lost for agricultural activities of the local people. Besides the direct loss of lands, following impact types are likely to be encountered by local people on a case-by-case basis:

- Difficulties for local people to ensure access to agricultural lands in cases when the settlement center and the agricultural parcels are separated;
- Difficulties for local people to ensure access between severed parts of an agricultural plot;
- Difficulties for local people in accessing agricultural lands from the locations of the passages (e.g. underpasses, culverts);
- Economic losses of local people due to partial expropriation of parcels (e.g. loss of viability for use of the remaining part of the parcel to be expropriated);
- Loss of growing crops and trees as a result of the expropriation of agricultural lands;
- Economic impacts on people, who are not legal owners but rent or use the affected lands.

Assuming all of the privately-owned lands to be acquired in the scope of the Project are agricultural lands, total amount of agricultural land to be permanently lost in the scope of the Project is estimated to be 1.498,1 ha along the entire Motorway in the Asian part of the Motorway. Table 5.22 summarizes the extent of impacts on the agricultural areas located within the expropriation corridor.

Table 5.22. Agricultural Areas to be Affected by the Project

Section	Area of Agricultural Lands (ha)	Percent (%)
Section 4	358,2	23,9
Section 5	321,2	21,4
Section 6	818,7	54,6
Total	**1.498,1**	**100,0**

In addition to loss of lands available for agricultural activities, the Project will results in the severance and fragmentation of the agricultural lands resulting in restrictions in the access to lands by their owners and/or users. An example to the fragmentation of agricultural lands by existing Anatolian Motorway (E-80 section near Akyazi district is shown in Figure 5.18.

Figure 5.18. Example to Fragmentation of Agricultural Lands by Motorways

5.3.1.4. Impacts on Pasture Lands

Motorway crosses or passes close to pasturelands in some of the neighborhoods. For the determination of pasturelands located within the expropriation area, expropriation plans (as of the date of the analysis) have been reviewed. In addition, questionnaires done in January 2017 with the neighborhood headmen at selected settlements in the scope of the socio-economic field surveys conducted as a part of the ESIA have been resorted (see Chapter 14 “Socio-economic Environment”). In this context, pasturelands identified to be crossed or passed close by the Motorway are listed Table 5.23. Figure 5.19 and Figure 5.23 shows the pasturelands to be affected.

The Motorway sections that pass through the pasture lands will result in fragmentation of land and restriction of access between separated parts of the land. In this case, significance of impacts will depend on either the availability of passage structures such as culverts, etc. to ensure access of local people and animals between the severed lands; or the area that will remain to be available for public users. In Celebiler, a considerable amount of (30%) the pastureland will be lost within the expropriation corridor of the Project.

In cases, when the Motorway does not directly cross the pastureland, but some part (e.g. one corner) of the pastureland corresponds to the expropriation corridor, the area that will be available to public will be restricted. In this case, significance of impacts will depend on the area that will remain to be available for public users.

Table 5.23. Pasturelands to be Affected by the Project

Province	District	Neighbo rhood	Corres ponding Motorway KM	Parcel No	Area (m^2)			Description of Impact
					Title Deed Area	Approxi mate Area to be Acquired	Percent of Area to be Acquired (%)	
Section 6								
Kocaeli	Izmit	Akmese	210+900	1337	5,7	0,8	24,7	Slight restriction of available pastureland
Kocaeli	Izmit	Akmese	211+200	1265	1,1	0,9		Fragmentation of pasture due to Motorway crossing
Kocaeli	Izmit	Akmese	211+300	1264	0,5	0,1		Slight restriction of available pastureland
Sakarya	Adapazari	Karakamis	223+810; 2+031	167	11,6	1,6	13,8	Fragmentation of pasture due to Motorway crossing
Sakarya	Adapazari	Celebiler	234+000	512	8,4	2,5	29,8	Fragmentation of pasture due to Motorway crossing; loss of considerable amount of pasture
Sakarya	Akyazi	Kizilcik orman	246+000	103/ 102	42,5	6,0	14,1	Fragmentation of pasture due to Motorway crossing; loss of some part of pasture
Sakarya	Akyazi	Ramasli/ Topagac	250+800	102/53	24,0	3,0	12,5	Slight restriction of available pastureland; loss of some part of pasture
Total					**93,8**	**14,9**		

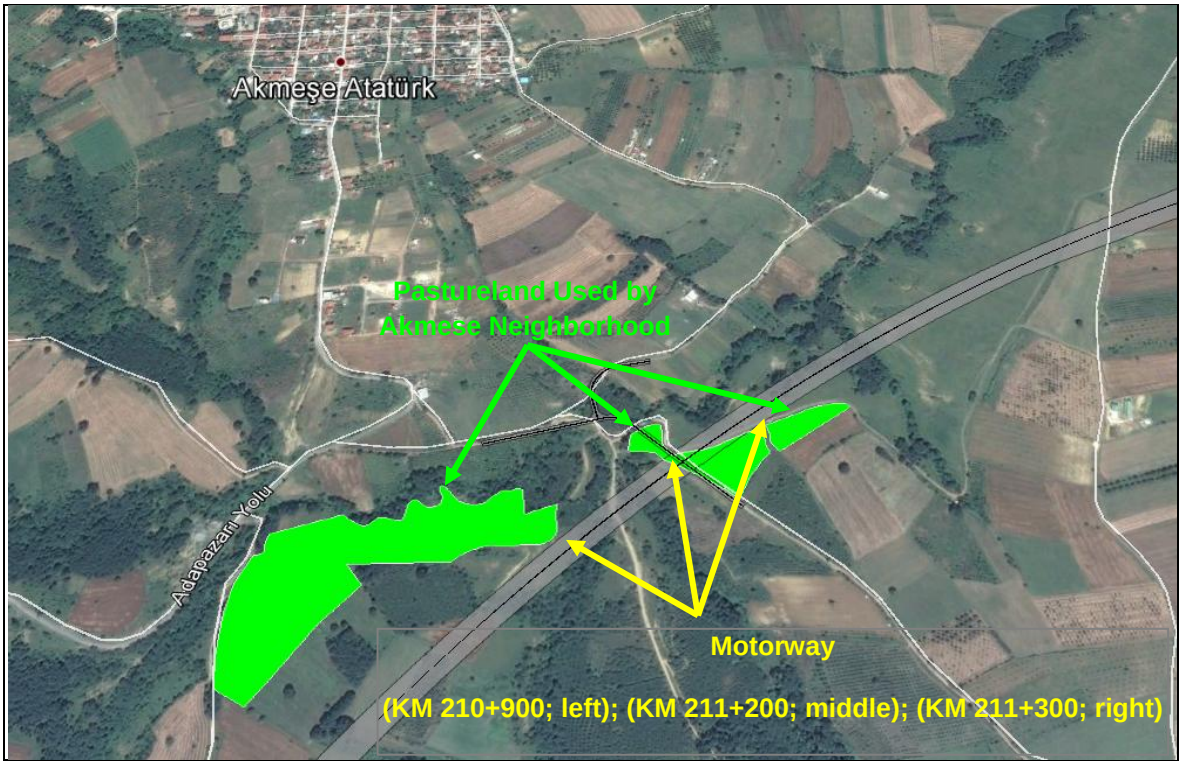


Figure 5.19. Pasturelands in Akmese Ataturk Neighborhood Adjacent to or Crossed by the Motorway (Section 6; KM 210+900; 211+200 and 211+300)

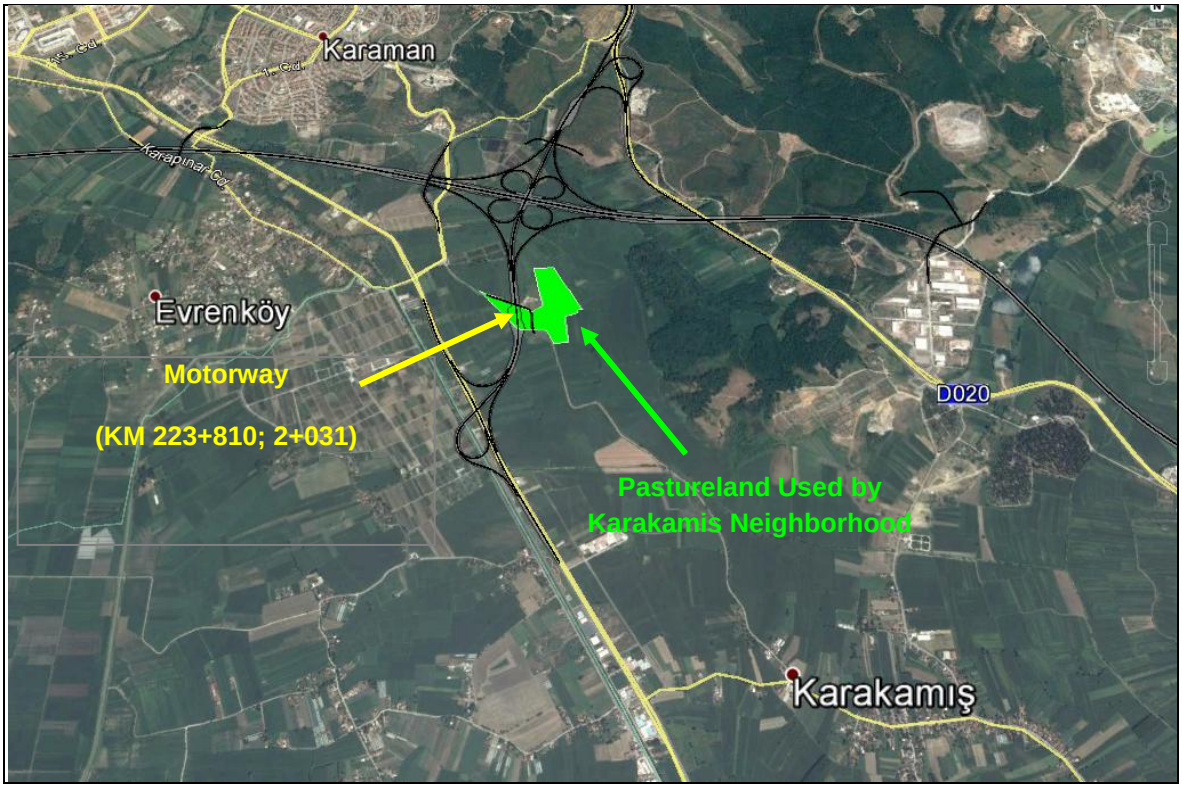


Figure 5.20. Pastureland in Karakamis Neighborhood Crossed by the Motorway (Section 6; KM 223+810; 2+031)

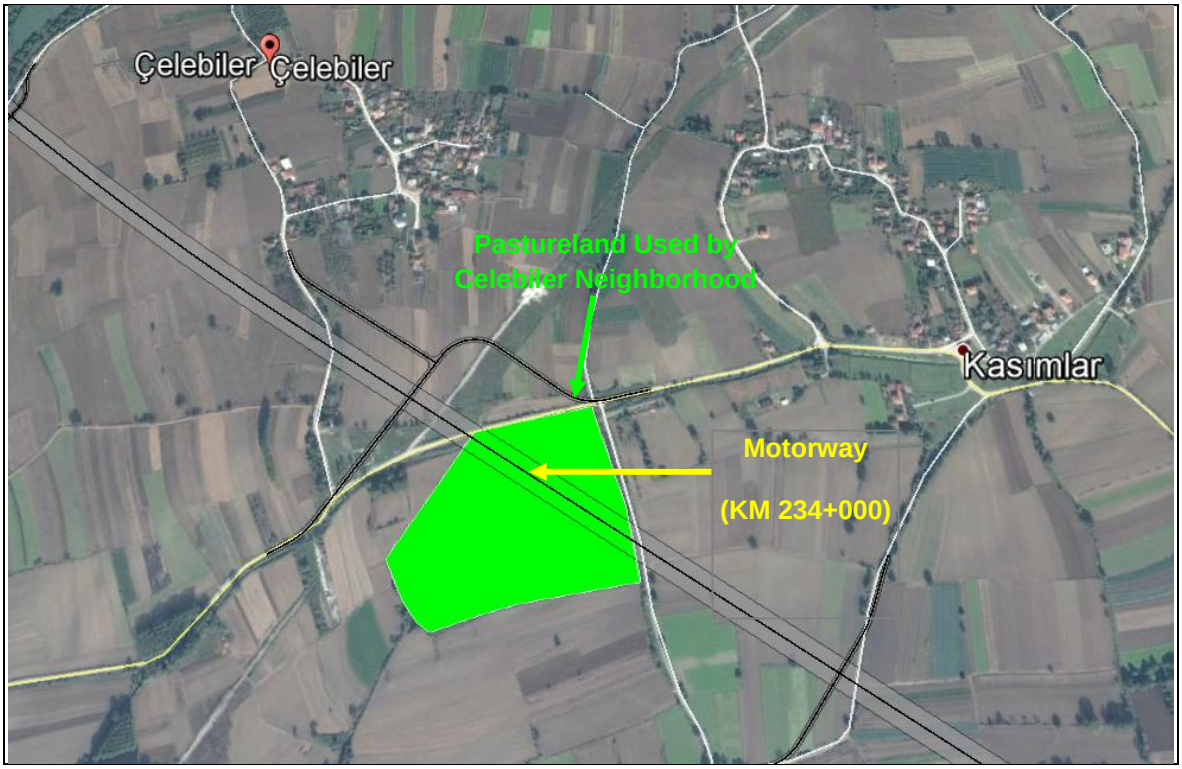


Figure 5.21. Pastureland in Celebiler Neighborhood Crossed by the Motorway (Section 6; KM 234+000)

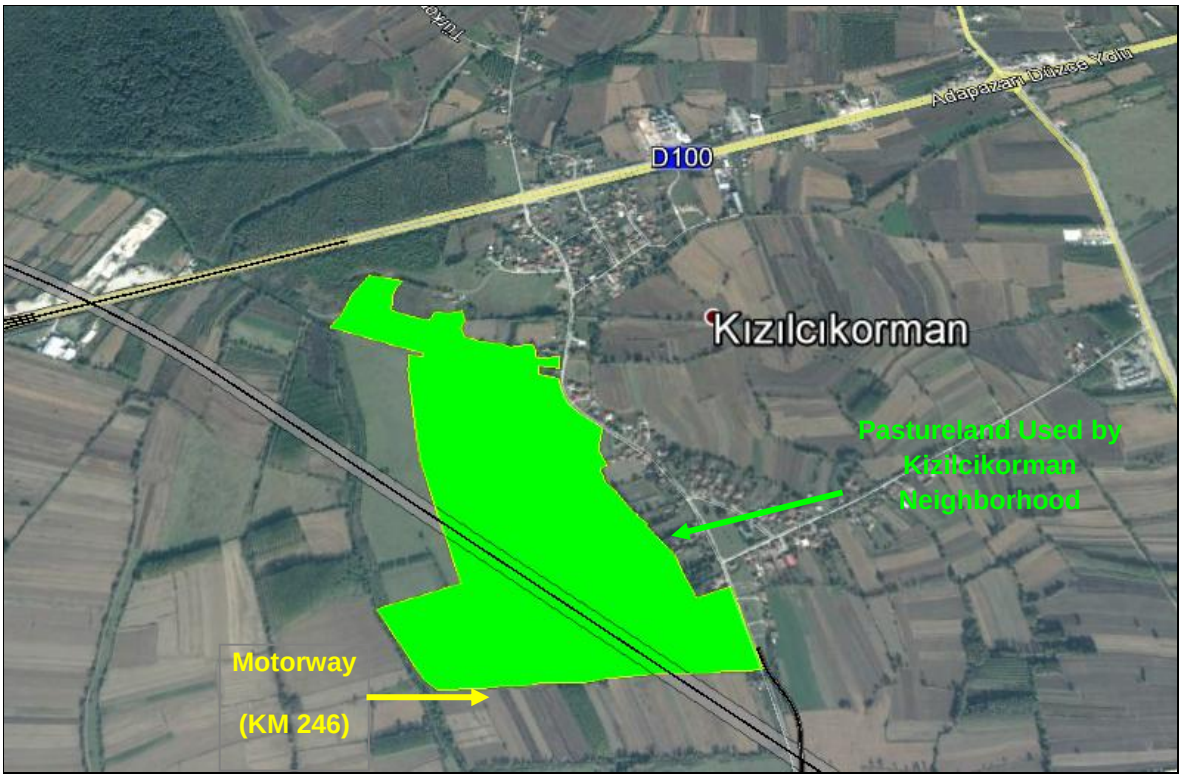


Figure 5.22. Pastureland in Kizilcikorman Neighborhood Crossed by the Motorway (Section 6; KM 246+000)

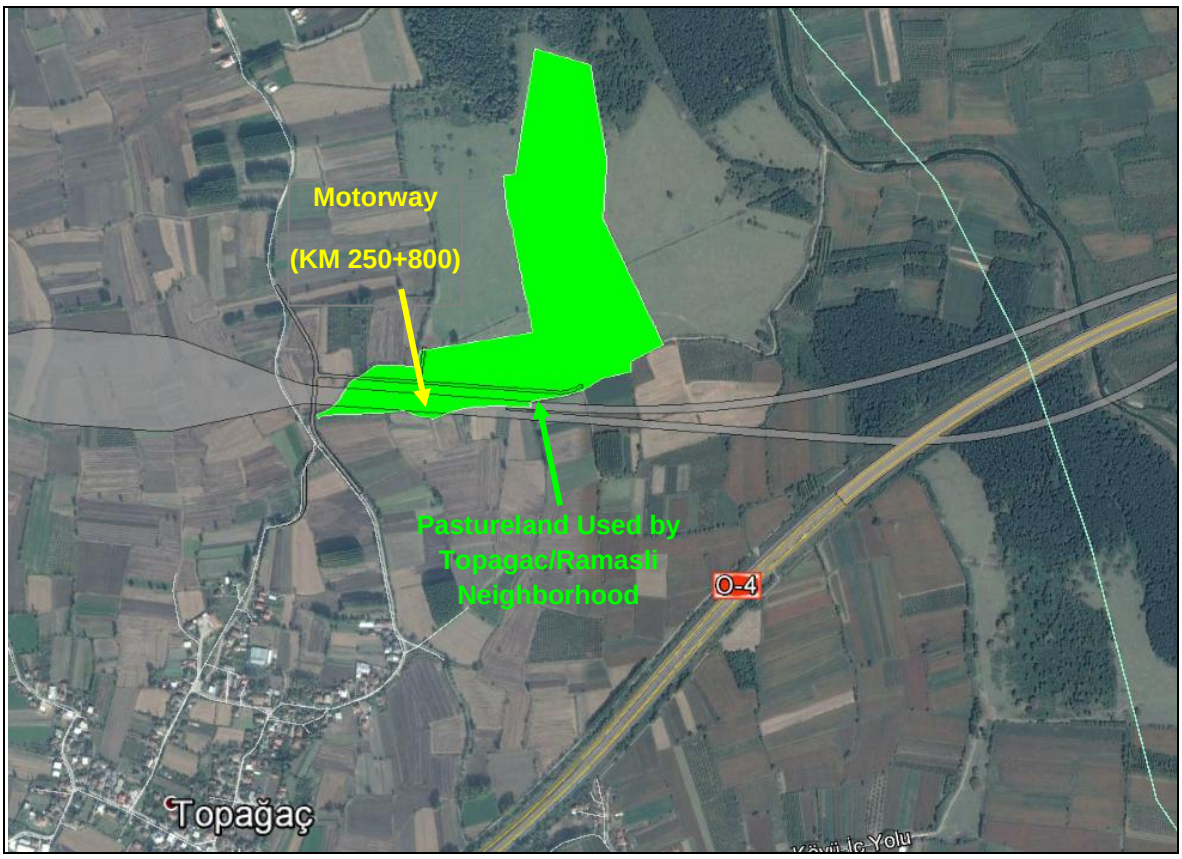


Figure 5.23. Pastureland in Topagac/Ramasli Neighborhood Crossed by the Motorway (Section 6; KM 250+800)

5.3.1.5. Impacts at Quarry and Material Borrow Sites

Land preparation (i.e. vegetation and top-soil clearing) and excavation activities to be conducted at the quarries and material borrow sites will also result in local changes in the land use patterns. Except some part of Taskisigi 1-2 Quarry, as new quarries will be used for construction material extraction, quarry operation in the scope of the Project will result in permanent changes in the lands use patters corresponding to the quarry sites, which are located on forest lands. Table 5.24 summarizes the area to be affected by each quarry/material borrow site.

Table 5.24. Area to be Affected by Quarry/Material Borrow Site Operations

Location	Location			Description of the Site/Plant	Area (ha)	Type of Land Use	Corresponding Forest Function in the Relevant Forest Management Plan
	Province	District	Nearest Neighborhood				
Section 5							
164+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Kutluca Limestone Quarry	28,9	Forest	Economic
Sub-total (Section 5)					**28,9**		
Section 6							
226+400	Sakarya	Adapazari	Taskisigi	Taskisigi Limestone Quarry 1-2	16,8	Partly Former Quarry, Forest	Economic
				Taskisigi Limestone Quarry-4	39,1	Forest	Economic
250+000	Sakarya	Yagbasan	Hendek	Yagbasan Sandstone Borrow Site	42,9	Forest	Economic
Sub-total (Section 6)					**98,8**	Forest, Former Quarry	
Grand Total					**127,7**	**Mainly Forest**	

5.3.1.6. Impacts at Excavated Material Storage Sites

As the excavated material disposal sites will be permanent Project components, land use corresponding to these sites will change permanently as a result of the Project. Table 5.25 summarizes the area to be affected by excavated material storage site. As can be seen, all the storage sites will be located on forest lands.

Table 5.25. Area to be Affected by Excavated Material Storage Sites

Location	Location			Description of the Site/Plant	Area (ha)	Type of Land Use	Lot/ Parcel No.
	Province	District	Nearest Neighborhood				
Section 4							
150+500; 1+000	Kocaeli	Dilovasi	Demirciler	Storage Site-401, 402	1,0	Forest	Out of registration
150+500; 4+000	Kocaeli	Dilovasi	Demirciler	Storage Site-403	5,5	Forest	Out of registration
150+500; 7+000	Kocaeli	Dilovasi	Demirciler	Storage Site-404	22,8	Forest	Out of registration
Sub-total (Section 4)					**29,3**	**Forest**	
Section 5							
162+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Storage Site-501	14,04	Forest	Out of registration
Sub-total (Section 5)					**14,04**	**Forest**	

5.3.2. Operation Phase

In the operation phase, the activities will not involve any additional physical interaction thus no additional direct impact on land use is foreseen. The impacts related with habitat fragmentation/alteration and socio-economic impacts due to land acquisition will be permanent thus this may result in changes (positive or beneficial) in the existing socio-economic conditions of some of the potentially affected households in the long term.

5.3.2.1. Future Urban Development Potential

In addition to the direct physical impacts of the activities on the lands and socio-economic dimensions of the land acquisition, transportation projects possibly trigger further land developments in the vicinity of route, especially when the Motorway provide access to lands. Increased access to land raises its potential for development (e.g. residential, industrial, tourism) and need for additional transportation services. This in turn, results in changes of the land use patterns over a period of time (*Oruonye, E.D., June 2014*). In the case of the North Marmara Motorway Project, the northern parts of the cities of Kocaeli and Sakarya has a rather rural character when compared to the city centers located in the south of North Marmara Motorway route. The North Marmara Motorway Project may contribute Kocaeli and Sakarya cities' potential for expanding in the northern direction. There are other infrastructure projects (railway and divide road) planned in this region, thus the infrastructural development to be provided by the North Marmara Motorway and other projects is likely to attract industrial investments first and then the industrial development would result in residential development. Consequently, development and operation of the Motorway is anticipated to result in changes in the existing land use patterns, increased population growth and increased demand for residential and commercial properties and infrastructural requirements in the region. On the other hand, increased overall accessibility in the region would also improve accessibility of cultural sites and tourism areas that may bring social, cultural and economic benefits to the region.

Accordingly, future development potential of the Istanbul (eastern border), Kocaeli and Sakarya cities has been analyzed based on the Environmental Master Plans of Istanbul, Kocaeli and Sakarya. In the beginning of Section 4, settlement areas are planned for Tepeoren and Akfirat neighborhoods of Tuzla district. Thus, Motorway is likely to support the development foreseen in this area. Industrial areas and settlement expansion areas planned on the area where Liman Access Road passes would be developed following the construction and operation of the Motorway and these developments may put stress on the Ballikayalar Nature Park, which would then be surrounded by industry and residential areas. In Section 5, low density settlement development is likely to be observed in the area where dispersed settlements are present in the south of Sevindikli, Karayakuplu, Semsettin and Sipahiler. Izmit district of Kocaeli and the industries in this area may continue to expand in the northern and eastern directions as a result of the Motorway, suppressing the agricultural areas and local forests present. Together with the potential development of industry in the area, rural areas would also start to urbanize. The settlement area planned in the surroundings of Korucuk, Karaman and Karapinar would experience urbanization.

Adapazari district of Sakarya is likely to grow in the direction of north and east, towards the route of North Marmara Motorway. This development may result in a depression of existing agricultural areas. The ending point of the Motorway (KM 250) is close to industrial zones of Hendek districts. This may result in the attracting of industrial investments, which would in return result in residential development. Akyazi district may also continue to grow in the northern direction.

5.4. Mitigation Measures

The route selection process for the North Marmara Motorway Project has considered sensitivities related with the land use patterns and their socio-economic dimensions. As explained in details in Chapter 18 ("Analysis of Alternatives"), the Project has aimed to establish a balance between the crossing of sensitive forest areas and impact on agricultural lands to avoid intolerable ecological and socio-economic impacts associated with Project land take. In the following sections, measures to be taken to minimize and/or mitigate direct impacts on the land use are described for the land preparation, construction and operation phases. It should be noted that implementation of the expropriation works and permitting process for the forests and public lands are under the responsibility of KGM as the administrative authority.

Measures to be taken against potential socio-economic impacts that would be associated with land use changes will further be evaluated in Chapter 14 ("Socio-economic Environment"). Measures to be taken to mitigate impacts on habitats and wildlife due to loss of forestlands are covered in Chapter 9 ("Ecology and Biodiversity").

5.4.1. Land Preparation and Construction Phase

Land use rights for the lands/parcels corresponding to Project components, including the Motorway route, tunnel portals, construction camp sites, excavated material storage sites and quarries will be acquired either permanently or temporarily. Acquisition of land use rights for those lands/parcels located within Project's expropriation corridor has been/will be done by the KGM in accordance with the national legislation. Following the acquisition of land use rights, these lands will be allocated to the Project In this respect;

- Privately-owned lands have been/will be acquired in line with the relevant provisions of the Turkish Expropriation Law;
- Forestry permits have been/will be obtained from the Forestry authorities in line with the Forestry Law;
- For the state owned lands including treasury lands, pasture lands, closed roads and lands out of registration, applications will be done to acquire easement rights.

KGM will complete the process for the allocation of the private lands under the property of Treasury and the state-owned lands that are required for the Project and allocate those lands to the Project Sponsors for their use during the Contract Duration. In this respect, free of any charge, easement rights for the benefit of Project Sponsors will be constituted for the private lands under the property of Treasury and usage rights for the use of state-owned lands will be provided for the duration of the Contract. At the end of the Contract Duration, lands under the property of Treasury and the state-owned lands will be transferred to KGM free from any debt or commitment and in a well-maintained, operating, in-service condition, without any charge.

5.4.1.1. Construction Sites

In the scope of road construction works, the following measures will be taken to avoid and/or minimize the cases of unauthorized intrusion of construction machinery onto adjacent privately-owned lands that are out of the expropriation corridor:

- Borders of the construction areas and expropriation corridor will be identified by suitable markings.
- Construction crew will be trained to stay within the border of the construction areas and expropriation corridor.
- For exceptional cases when the privately-owned land has to be used but the expropriation or court processes have not been finalized yet, no work will be started until bilateral agreements are settled and official consent letters are taken from the legal owners. In such cases, official commitment letters will be provided to legal owners by the Project Sponsors regarding the scope of works and compensation of probable damages and the works will be conducted in accordance with those consent and commitment letters.
- A Grievance and Comment Mechanism has been established and activated for the Project in March 2017 (see Chapter 19 “Public Consultation and Stakeholder Engagement” for further details of the mechanism). If complaints related with unauthorized use of privately-owned lands, damages on adjacent lands, etc. are received through Project’s Grievance and Comment Mechanism, evaluation/inquiry will be conducted on a case-by-case and where necessary, corrective actions will be planned and implemented.
- In accordance with KGM’s technical specifications, in case of any direct or indirect damage on state or personal property as a result of the activities of the Project contractors or sub-contractors, Project Sponsors will ensure that relevant corrective measures (e.g. repair, maintenance, rebuilding, restoration, etc.) are implemented at its own cost in line with the instructions of the KGM or other related governmental agencies.

Construction Camp Sites will be used for a temporary period throughout the construction phase. Once the construction activities are completed, following measures will be taken for the rehabilitation of sites:

- Initially above-ground construction compounds including the plants/facilities, prefabricated buildings/houses, relevant infrastructure and installations, etc. of no beneficial use will be dismantled and removed in accordance with the national legislation.

- Any storage tank and pipes will be taken out of operation and fully emptied. Liquid wastes will be removed in accordance with the national legislation
- Affected lands at the Construction Camp Sites and service roads will be graded and appropriately rehabilitated to acceptable uses.
- Any void area formed as a result of demolition works will be filled with suitable soil or other materials that are compatible with the natural topography and local ground conditions.
- Topsoil stripped prior to the installation of construction compounds will be reapplied and landscaping activities will be conducted in conformity with the surrounding land uses. Lands that will not be restored for a specific community use will be seeded and revegetated with native species.

5.4.1.2. Forestlands

The legislation related to forest areas, their protection and utilization for public benefit is composed of laws and regulations that are based on the constitution of Turkey. The central administrative authority is the Ministry of Forestry and Water Affairs. The relevant agency within Ministry of Forestry and Water Affairs is the General Directorate of Forestry, which itself has regional directorates (including Istanbul Regional Directorate) in the country and operational directorates and sections in those regions. These directorates are responsible for protecting forestry and forestry resources against negative impacts, and developing and managing forestry and forestry resources in a sustainable way.

Within this framework, forestlands corresponding to the North Marmara Motorway Project's components are under the authority of the Ministry of Forestry and Water Affairs. In accordance with the Forest Law and associated regulations, relevant forestry permits have to be obtained by the KGM from the Ministry of Forestry and Water Affairs, for the construction of Project components on forestlands.

Once the forestry permits are obtained, all the works including tree marking, felling, logging, chipping, removal and appraisal (selling, etc.) is performed by the General Directorate of Forestry and its Regional Directorates during the period between permit issuance and delivery of the land to the KGM.

For the forest lands to be used in the scope of the Project, forestry permit applications have been/are being submitted by KGM to related Forestry authorities in accordance with the Forest Law. Measures that have been taken to minimize the impact on forests and that will be taken in the course of the Project to compensate unavoidable impacts are described in the following paragraphs.

Minimization of the Loss of Forestlands

The primary aim of the Project is to protect the existing forests to the extent possible. In this respect, protection of forestlands was one of the main criteria considered in the route selection process.

In Section 4, the initial route at the feasibility stage was crossing the Ballikayalar Nature Park. Then at the tender stage, route change has been done and a new route not crossing the Nature Park has been selected (see Chapter 18 “Analysis of Alternatives” for further details). This change has resulted in the conservation of forests located within the Nature Park, which consist of mainly cyprus oak, hungarian oak, cermes oak and the other small trees and shrubberies and include 9 endemic flora species (*Governership of Kocaeli, 2013)*.

In Section 5 and Section 6, where changing the route had not been a feasible alternative, impacts on forestlands have been minimized with the addition of several tunnels and viaducts into the design (see Table 5.26). Figure 5.24 and Figure 5.25 show the locations of viaducts and tunnels in Section 5 and Section 6.

Table 5.26. Tunnels and Viaducts that will Provide Conservation of Forests and/or Minimization of Impacts on Forests

Code	Length (m)	Location on the Route (Motorway KM)		Explanation
		Start Location	End Location	
Section 5				
Tunnels				
T-01	1.292	178+150	179+475	Passage through forestry
T-02	4.155	183+200	185+275	Passage through forestry
T-03	345	185+500	185+880	Passage through forestry
T-04	2.190	185+898	188+070	Passage through forestry
Viaducts				
V-02	716,5	159+554	160+270	Passage through forestry (ecological passage function)
V-03	876	164+932	165+808	Passage through forestry (ecological passage function)
V-04	756	171+863	172+619	Passage through valley
V-05	790	175+800	176+590	Passage through forestry (ecological passage function)
Section 6				
Tunnels				
T-01	2.720	189+060	190+420	Topographical conditions, passage through forestry
Viaducts				
V-06	1.560	188+200	189+980	Topographical conditions, passage of greenhouses
V-10	680	191+300	191+980	Topographical conditions
V-11	420	198+720	199+140	Topographical conditions

In addition, an ecological At KM 161+870 will be constructed in line with the requirements of related forestry directorates. Location of the ecological bridge is shown in Figure 5.26.

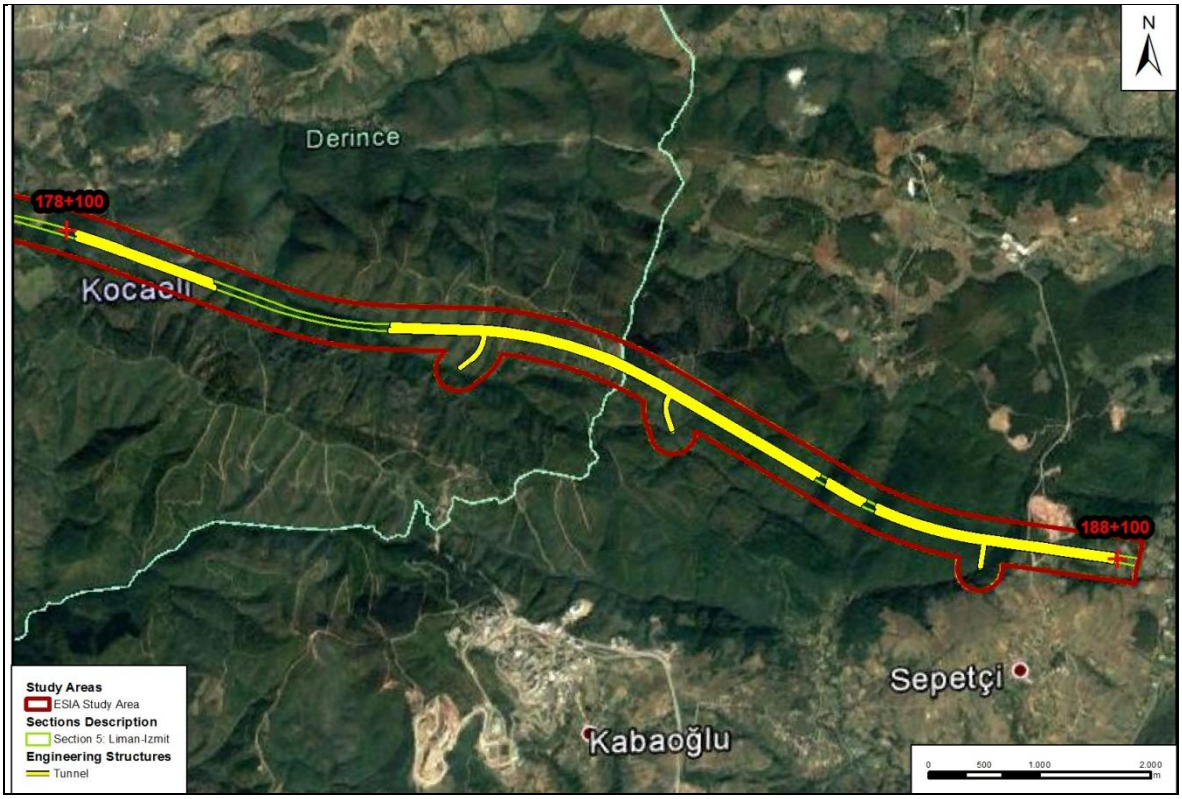


Figure 5.24. Passage of Forest by means of Tunnels in Section 5

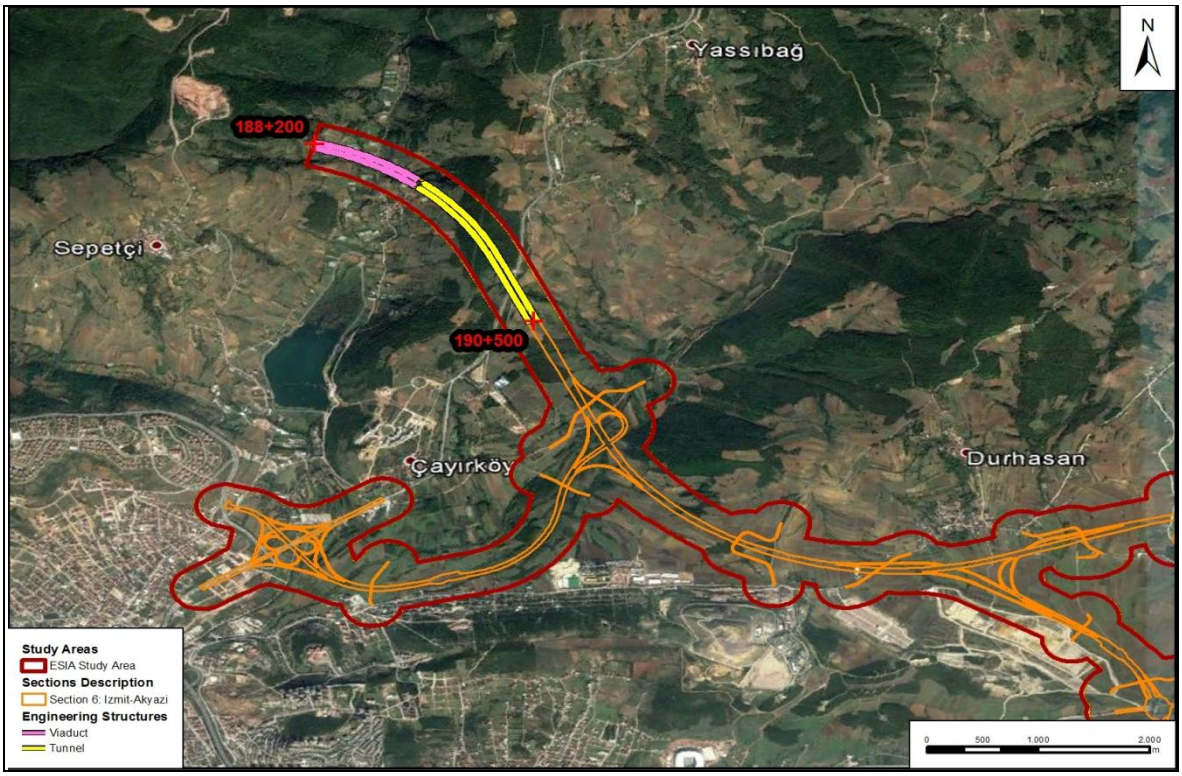


Figure 5.25. Passage of Forest by means of Tunnels and Viaducts in Section 6

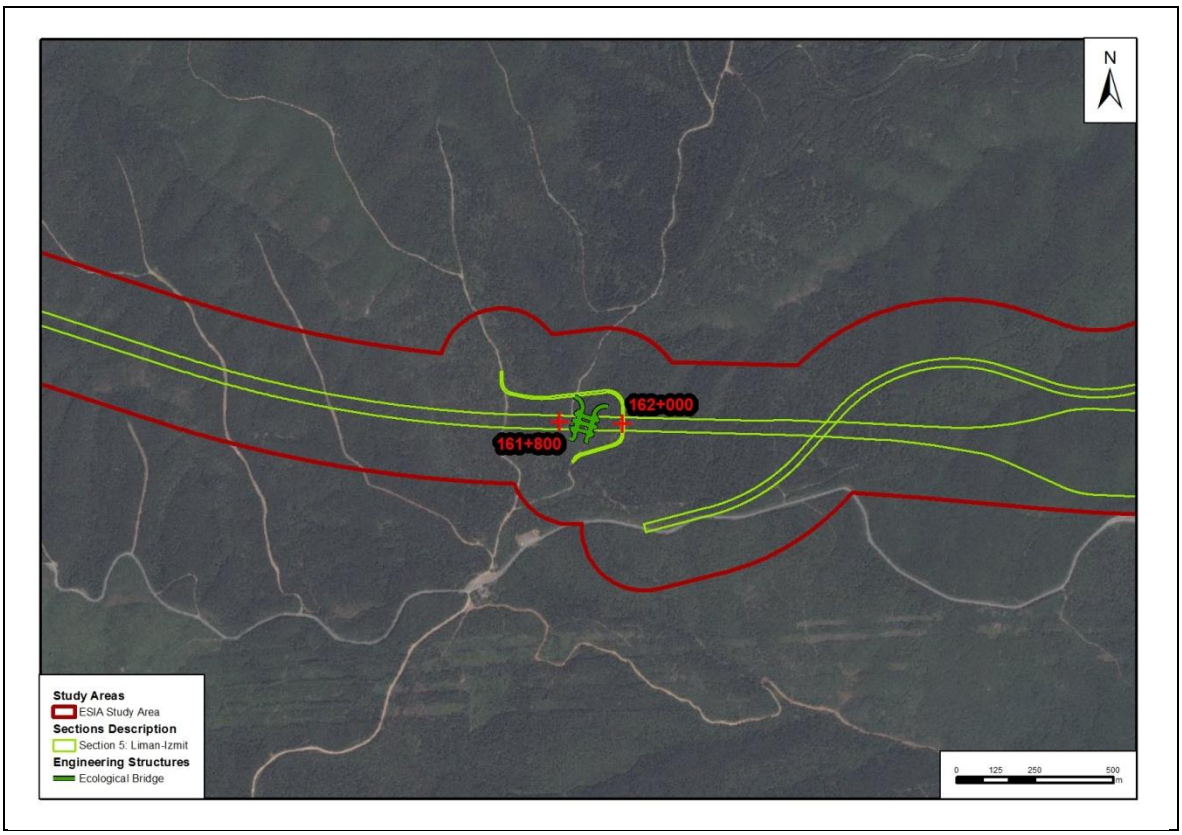


Figure 5.26. Location of Ecological Bridge in Section 5

Similarly, to minimize additional impact on forest lands, sites for Construction Camps have been selected either on the route of Motorway or on formerly degraded or bare areas, wherever possible. In this respect, Demirciler Camp Site in Section 4 has been established on the location of one of the planned service areas. In Section 5, storage site for excavated materials is located on forest regeneration/plantation area (economic function) where the plantations have already been removed and the Camp Site has been established on a bare forest area where the vegetative cover was absent. In Section 6, Taskisigi Camp Site is located on an area already degraded by former mining/quarry activities.

Afforestation

Following the completion of construction activities, measures will be taken to compensate (afforestation/reforestation) the lost forest assets at alternative locations to be determined by the Forestry authorities. In this scope, Project Sponsors will aim to compensate the loss of forest lands by planting trees at alternative areas on a voluntary basis. In the case of voluntary afforestation applications, afforestation is carried out in any region of Turkey in line with the directions of the Forestry authorities. Project Sponsors will make the reasonable efforts to cooperate with the Forestry authorities and if approved by the Forestry authorities, afforestation activities in the scope of the North Marmara Motorway Project will be conducted primarily at suitable locations in the region to adequately compensate the lost forest functions. Afforestation areas will be under the authority of relevant Forestry authorities, which decides for the specific tree species to be planted in each region, depending on the forest habitats and specific requirements of that region. These requirements are determined yearly and are specified on that year's afforestation plans of the Regional Directorate. The relevant Forestry authorities will be informed about the outcomes of the ecology studies done in the scope of the ESIA studies and the proposals for the plant species in consideration of the local ecological sensitivities.

The Afforestation Plan developed for the Project is presented in Annex-4 ("Afforestation Plan") of this ESIA Report. Implementation of the Afforestation Plan will be initiated in the construction phase and may continue through the initial phases of the operation period. The afforestation ratio will be 4 for every tree lost due to the construction of the Motorway.

Response to Forest Fires

Regarding potential forest fires, the following measures will be taken in accordance with good site practices and KGM's technical specifications:

- Project Sponsors will require all contractor and sub-contractor personnel to take necessary measures to avoid forest fires and immediately respond to any fire event that could not be avoided by measures taken.
- Project Sponsors will cooperate with relevant governmental agencies to make all the reasonable effort in responding forest fires.
- Project personnel will be trained to immediately inform forestry authorities about the location and scale of any fire incident.
- Adequate number and amount of fire fighting equipments will be provided at construction sites. Fire-fighting equipment will not be obstructed. On the field, there will be always proper trained personnel and units who can use fire-fight equipments efficiently.
- Proper fire extinguishers will be kept ready at site where hot/welding works will be performed.
- The operability's of fire-fight equipments will check regularly.

- Construction sites and work areas, which are prone to fire incidents, will be determined and accordingly, locations where smoking is not dangerous will be specified and smoking will only be allowed at these locations. Throwing cigarette butts on the floor will be prevented by means of relevant applications/sanctions (i.e. trainings, placing ashtrays to the locations where smoking is allowed within the construction site, etc.)
- Within the scope of the training program to be given to the personnel, basic field rules for fire protection will be explained, awareness on fire hazard will be raised and personal responsibilities will be defined. Against fire incidents that cannot be prevented by taking relevant measures, personnel will be trained on emergency procedures and use of emergency response equipments.
- Not all fires (e.g. forest fires caused by energy transmission line) will be responded with water. To stop a fire caused by electric current, sufficient amount of dry-type extinguishers will also be kept available at the site. Electric current may be cut off before responding to fire, if deemed necessary.

5.4.1.3. Agricultural Lands

Expropriation of privately-owned agricultural lands will be done by KGM in accordance with the relevant provisions of the Expropriation Law. In the accordance with Turkish Expropriation Law, if the land portion remaining from expropriation would not be viable anymore, eligible persons have the right to request the expropriation of the entire parcel (application has to be in line with the requirements of the Law) including the remaining portion, even if this portion is out of the expropriation corridor. Relevant article of the Law is provided below:

> Article 12: Partial Expropriation
>
> Where only part of a property is to be expropriated its value is estimated in accordance with Article 12 of the Expropriation Law as follows:
>
> a. In cases where no change occurs in the value of the non-expropriated part due to the expropriation, the value of the expropriated part shall be determined in proportion to the total value of the whole property in accordance with Article 11 of the Expropriation Law.
>
> b. If a decrease in the value of the non-expropriated part occurs as a result of expropriation, this loss is estimated and added to the expropriation value of the expropriated part as defined in the relevant paragraph of the Law.
>
> c. If an increase in the value of the non-expropriated part occurs as a result of expropriation, this increase is estimated and subtracted from the value of the expropriated part as defined in the relevant paragraph of the Law.
>
> d. The decreased and increased amounts stated in relevant paragraphs of the Law are determined according to the valuation method under Article 11 of the Expropriation Law.
>
> e. When the remaining part of the property after expropriation remains suitable for use in accordance with the zoning legislation, the expenses and costs for reinstatement of any buildings, surrounding walls, sewerage, water, electricity and gas lines that are damaged shall be determined and added to the expropriation value.
>
> f. When the remaining part of the property is no longer suitable for use, and the expropriation decision is not challenged in the courts, the owner may apply in writing within 30 days of the date of notification of the expropriation decision, for the remaining part also to be expropriated.

In accordance with Expropriation Law, standing crops, trees, irrigation structures, walls, fences, etc. will be considered in the valuation process and the compensations will be provided by responsible agency (in this case KGM) to cover the associated losses.

- Several underpasses and culverts have been included in the design to ensure access of local people to agricultural lands. These underpasses and culverts will ensure sufficient dimensions for the passage of harvesters, vehicles, etc. where required. Detailed lists of underpasses and culverts planned in the Asian sections of the Project are provided in Chapter 3 ("Project Description").

- Access roads will be constructed in parallel to the Motorway near agricultural areas/zones to provide access to agricultural lands, where necessary.

- Legitimate requests of local people regarding the avoidance and/or minimization of the restriction of access between their settlement areas and agricultural lands will be considered by the Project Sponsors' design team and feasible solutions will be developed and implemented, where possible.

5.4.1.4. Pasture Lands

For the pasturelands that will be separated by the Motorway (fragmentation of land), impacts on the public users of the pasturelands will be mitigated by ensuring access between severed lands. In this scope, culverts have already been included in the design as explained in Table 5.27. For the pasturelands in Karakamis and Celebiler neighborhoods, additional culverts are needed to be added to design at the immediate locations of the pastures. In addition, as the amount of pasture that will remain available after acquisition will be relatively low in Celebiler, collaboration will be made with the headman of the Celebiler to mitigate the impact on public users.

Table 5.27. Pasturelands to be Affected by the Project

Province	District	Neighborhood	Corresponding Motorway KM	Parcel No	Availability of Culvert
Section 6					
Kocaeli	İzmit	Akmese	210+900	1337	Culvert is available at KM 210+902
Kocaeli	İzmit	Akmese	211+200	1265	Culverts are available at KM 211+057 and KM 211+525
Kocaeli	İzmit	Akmese	211+300	1264	
Sakarya	Adapazari	Karakamis	223+810; 2+031	167	Not available at the immediate location of the pastureland; Closest culvert is available at KM 223+132 and KM 223+351.
Sakarya	Adapazari	Celebiler	234+000	512	Not available at the immediate location of the pastureland; Closest culvert is available at KM 233+160.
Sakarya	Akyazi	Kizilcik orman	246+000	103/ 102	Culvert is available at KM 246+420 (Corresponds to the western border of the pastureland)
Sakarya	Akyazi	Ramasli/ Topagac	250+800	102/53	Culverts are available at KM 250+738 and KM 250+953

5.4.1.5. Quarries and Material Borrow Sites

Where it is planned that construction raw materials will be obtained by state institutions and organizations from forest areas, a raw material production license is required. Based on this permit, permission for all operations and construction associated with this activity is regulated by Implementing Regulation of the 16th Article of the Forest Law. Raw material production license have been obtained for the quarries to be used. Measures to be taken at the quarry site are described below:

- Borders of the quarry and material borrow sites will be identified by using proper methods (i.e. fencing, etc.) and material extraction activities will be conducted within these borders.
- Topsoil management measures (see Chapter 6 “Topography, Soils and Geology”) to be taken at Motorway construction sites will be applied at the quarry and material borrow sites.
- Appropriate low-impact extraction methods that would result in final site contours supportive of habitat restoration principles and final land use will be selected wherever feasible.
- Preference for extraction will be given to thicker deposits as far as possible and as reasonable to land use changes and consequent loss of soil.
- Open pit mining method will be used at quarries and tunneling will not be applied. Open pits will be developed in benches.
- Quarry and material borrow sites will be reclaimed immediately after the completion of extraction activities. Rehabilitated lands will conform with acceptable uses consistent with local and regional land use plans.
- During reinstatement, affected land will be graded and appropriately prepared prior to the reapplication of soil layers that would sustain vegetative regrowth.

5.4.2. Operation Phase

As no additional direct physical impact on land use is not anticipated in the operation phase, mitigation measures to be taken in this phase will be mainly limited with the afforestation activities that would continue in line with the commitments of the Project Sponsors and guidance of the relevant Forestry authorities. On the other hand, in order to minimize the unplanned development potential and meet the infrastructural needs of the potentially growing populations adequately, regional and local planning authorities and administrations should duly assess the future development potential of the region where North Marmara Motorway and other large-scale infrastructure projects are to be implemented and develop relevant measures.

5.5. Summary of Assessment and Residual Impacts

Table 5.28 provides a summary on the land use assessments. Significance of the identified impacts before and after the implementation of mitigation measures are summarized in this table. As can be seen from the Table, in general, potential impacts on the forestland, agricultural lands, etc. are anticipated to be reduced to low levels in the long-run with effective implementation of mitigation measures, with the exceptions of (i) forests having ecological functions for which the residual impacts have been evaluated as medium due to their importance; (ii) agricultural lands that are suitable for soil cultivation for which the residual impacts have been evaluated as high or medium depending on the land use capability class of the soils to be affected; (iii) pasturelands with Class I-V land use capability class for which the residual impacts have been evaluated as medium. Regional land use character would also change significantly (may be beneficial or adverse depending on the planning measures to be taken by the authorities) in the long-run.

It should be also noted that a certain period of time (from months to years) will be needed to ensure that the residual impacts are adequately mitigated to acceptable levels as measures such as rehabilitation of temporary Project sites or afforestation take time to show their effectiveness. Additionally, the Motorway Project may trigger future urban and industrial development in certain locations along the route. The residual impact of the development may be beneficial or adverse for different receptors, in any case being of high significance. It should be noted that the control of the development is under the authority and responsibility of the local and regional administrations and the stress to be put on the forests and agricultural areas surrounding the settlements has to be well balanced to avoid further significant losses of these land uses.

Table 5.28. Summary of the Land Use Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Forests	Land preparation and construction	Loss of forestland within the Motorway's expropriation corridor and at Camp Sites, storage sites, quarries	Adverse	Restricted	Long	High (>100 ha) • Kadilli (Section 4); • Kutluca (Section 5)	Long term reversible	One-off	Major (A)	Low (1) (Economic forest function)	Medium (A1)	• In accordance with the Forest Law and associated regulations, forestry permits will be obtained by the KGM from the Ministry of Forestry and Water Affairs for all construction sites located at forestlands. • Loss of forest lands will be minimized by taking relevant design measures (i.e. construction of tunnels, viaducts). • An ecological bridge will be constructed at KM 161+870 in line with the requirements of related forestry directorates. • Afforestation Plan will be implemented.	Low
						High (>100 ha) •Demirciler (Section 4) • Kasikci (Section 5)			Major (A)	High (3) (Ecological forest function)	High (A3)		Medium
						Medium (50-100 ha) • Karakamis (Section 6)			Moderate (B)	Low (1) (Economic forest function)	Low (B1)		Low
						Low (5-50 ha) • Cumakoy, Balcik (Section 4) • Yagcilar, Sevindikli, Sipahiler, Himmetli (Section 5) • Gedikli, Sapakpinar, Suleymaniye, Besevler, Korucuk, Karapinar, Kulaksiz, Tekeler, Bediltahirbey (Section 6) •Taskisigi (Quarry), Yagbasan (Borrow Site) (Section 6)			Moderate (B)	Low (1) (Economic forest function)	Low (B1)		Low
						Low (5-50 ha) • Koseler, Tavsanli (Section 4) • Tepecik (Section 5) • Cayirkoy (Camp Site) (Section 6) • Karaabdulbaki (Section 6) Cayirkoy (Camp Site) (Section 6)			Moderate (B)	Medium (2) (Socio-cultural forest function)	Medium (B2)		Low
						Low (5-50 ha) •Duzyazi (Section 6)			Moderate (B)	High (3) (Ecological forest function)	High (B3)		Medium
		Loss of trees	Adverse	Restricted	Long	Medium *Populus alba L., Populus canadensis Moench, Ficus carica L., Juglans regia L.*	Long term reversible	One-off	Moderate (B)	Medium (2) (Socio-economic value)	Medium (B2)		Low
						High Other forest stand types			Major (A)	Low (1) (No specified value)	Medium (A1)		Low
		Forest fires initiate within the Motorway corridor and escalate beyond the initial source affecting surrounding forests/shrubberies	Adverse	Wide	Short	Medium (assumed that any fire initiated within the Motorway corridor can be intervened before a large scale effect occurs as the fire fighting capacity of the region is adequate)	Long-term reversible	One-off	Moderate (B)	High (3) (Ecological forest function) • Forests near Demirciler, Kasikci (Section 4) • Forests near Duzyazi (Section 6)	High (B3)	• Project Sponsors will require all contractor and sub-contractor personnel to take necessary measures to avoid forest fires and immediately respond to any fire event that could not be avoided by measures taken. • Project Sponsors will cooperate with relevant governmental agencies to make all the reasonable effort in responding forest fires. • Project personnel will be trained to immediately inform forestry authorities about the location and scale of any fire incident. • Adequate number and amount of fire fighting equipments will be provided at construction sites. Fire-fighting equipment will not be obstructed. On the field, there will be always proper trained personnel and units who can use fire-fight equipments efficiently. • Proper fire extinguishers will be kept ready at site where hot/welding works will be performed. • The operability's of fire-fight equipments will check regularly. • Construction sites and work areas, which are prone to fire	Low
										Medium (2) (Socio-cultural forest function) • Forests near Koseler, Tavsanli (Section 4) • Forests near Tepecik	Medium (B2)		

Affected	Project	Definition of Potential	Type of	Impact Magnitude						Sensitivity/ Value of	Impact	Measures to be Taken	Significance
										(Section 5) • Forests near Cayirkoy, Karaabdulbaki (Section 6)		incidents, will be determined and accordingly, locations where smoking is not dangerous will be specified and smoking will only be allowed at these locations. Throwing cigarette butts on the floor will be prevented by means of relevant applications/sanctions (i.e. trainings, placing ashtrays to the locations where smoking is allowed within the construction site, etc.) • Within the scope of the training program to be given to the personnel, basic field rules for fire protection will be explained, awareness on fire hazard will be raised and personal responsibilities will be defined. Against fire incidents that cannot be prevented by taking relevant measures, personnel will be trained on emergency procedures and use of emergency response equipments. • Not all fires (e.g. forest fires caused by energy transmission line) will be responded with water. To stop a fire caused by electric current, sufficient amount of dry-type extinguishers will also be kept available at the site. Electric current may be cut off before responding to fire, if deemed necessary.	
										Low (1) (Economic forest function) • Forests near Kadilli, Cumakoy, Balcik (Section 4) • Forests near Kutluca, Yagcilar, Sevindikli, Sipahiler, Himmetli (Section 5) • Forests near Karakamis, Gedikli, Sapakpinar, Suleymaniye, Besevler, Korucuk, Karapinar, Kulaksiz, Tekeler, Bediltahirbey, Taskisigi (Section 6)	Low (B1)		
Agricultural lands	Land preparation and construction	Loss of agricultural lands suitable for soil cultivation	Adverse	Restricted	Long	Low •Sevindikli, Karayakuplu (Section 5) •Cayirkoy, Uzunbey, Bayraktar, Kourucuk, Karapinar, Kulaksiz, Karaman, Karkamis, Gunesler, Suleymanbey, Trabzonlar, Rustemler, Haciramazanlar, Budaklar, Abali, Kucukesence, Vakif, Osmanbey, Topagac, Duzyazi, Ortakoy (Section 6)	Irreversible	One-off	Moderate (B)	High (3) (Class I-II soils)	High (B3)	• Expropriation of privately-owned agricultural lands will be done by KGM in accordance with the relevant provisions of the Expropriation Law. In the accordance with Turkish Expropriation Law, if the land portion remaining from expropriation would not be viable anymore, eligible persons have the right to request the expropriation of the entire parcel (application has to be in line with the requirements of the Law) including the remaining portion, even if this portion is out of the expropriation corridor. • Several underpasses and culverts have been included in the design to ensure access of local people to agricultural lands. These underpasses and culverts will ensure sufficient dimensions for the passage of harvesters, vehicles, etc. where required. • Access roads will be constructed in parallel to the Motorway near agricultural areas/zones to provide access to agricultural lands, where necessarry. • Legitimate requests of local people regarding the avoidance and/or minimization of the restriction of access between their settlement areas and agricultural lands will be considered by the Project Sponsors' design team and feasible solutions will be developed and implemented, where possible.	High
						Low •Kurnakoy, Tepeoren,Balcik (Section 4) • Tepecik, Semsettin, Sipahiler (Section 5) • Eseler, Gedikli, Akmese, Tekeler, Dagdibi, Celebiler, Cerciler, Bediltahirbey, Kizilcikorman,Eskibedil, Uzuncinar (Section 6)			Moderate (B)	Moderate (2) (Class III-IV soils)	Medium (B2)		Medium
		Loss of non-arable lands that are not suitable for soil cultivation				Low •Kadilli, Cumakoy, Denizli, Koseler, Demirciler, Tavsanli (Section 4) •Yagcilar, Kutluca, Himmetli, Kasikci, Toylar (Section 5) Durhasan, Karaabdulbaki, Sapakpinar, Suleymaniye, Besevler, Camyolu (Section 6)			Moderate (B)	Low (1) (Class V-VIII soils)	Low (B1)		Low
Pasturelands	Land preparation and construction	Loss of pasturelands available for public use	Adverse	Restricted	Long	High (Celebiler; affected area of the pasture parcel is more than 25% of the entire parcel area)	Irreversible	One-off	Major (A)	High (3) (Class I-V soils)	High (A3)	• Planning and construction of additional culverts at the immediate locations of the pastures (if not already planned) will be done. • Collaboration with the neighborhood headmen in selecting the exact locations and dimensions of culverts will be made.	Medium
						Medium (Kizilcikorman, Ramasli/Topagac; 10-25% of the entire parcel area)			Moderate (B)	High (3) (Class I-V soils)	Medium (B2)		Low
						Medium (Akmese; 10-25% of the entire parcel area)			Moderate (B)	Low (1) Class (VII-VIII soils)	Low (B1)		Low

Affected	Project	Definition of Potential	Type of	Impact Magnitude						Sensitivity/ Value of	Impact	Measures to be Taken	Significance
						Low (Karakamis; affected area of the pasture parcel is less than 10% of the entire parcel area)			Moderate (B)	High (3) (Class I-V soils)	High (B3)		Low
Local Communities	Land preparation and construction	- Crossing of the borders of expropriation corridor resulting in damage of adjacent lands due to unlawful intrusion - Start of activities on privately owned lands for which expropriation or court processes have not be finalized	Adverse	Local	Short	Low (cannot be quantified but the risk is likely to be associated with a very local land plot)	Short term reversible	One-off	Minor (C)	High (3) (can ne medium or low depending on the quality and socio-economic value of the land plot; assumed as high for the worst case)	Medium (C3) (worst case)	• Borders of the construction areas and expropriation corridor will be identified by suitable markings. • Construction crew will be trained to stay within the border of the construction areas and expropriation corridor. • For exceptional cases when the privately-owned land has to be used but the expropriation or court processes have not been finalized yet, no work will be started until bilateral agreements are settled and official consent letters are taken from the legal owners. In such cases, official commitment letters will be provided to legal owners by the Project Sponsors regarding the scope of works and compensation of probable damages and the works will be conducted in accordance with those consent and commitment letters. • If complaints related with unauthorized use of privately-owned lands, damages on adjacent lands, etc. are received through Project's Grievance and Comment Mechanism, evaluation/inquiry will be conducted on a case-by-case and where necessary, corrective actions will be planned and implemented. • In accordance with KGM's technical specifications, in case of any direct or indirect damage on state or personal property as a result of the activities of the Project contractors or sub-contractors, Project Sponsors will ensure that relevant corrective measures (e.g. repair, maintenance, rebuilding, restoration, etc.) are implemented at its own cost in line with the instructions of the KGM or other related governmental agencies.	Low
Regional Land Use Character	Operation	Future urban development potential	Adverse or Beneficial	Wide	Long	High	Irreversible	Continuous	Major (A)	High (3)	High (A3)	• Good planning by local and regional authorities/ administrations in consideration of other regional/local large-scale infrastructure development is essential (not under the control of Project).	High

CHAPTER 6

TOPOGRAPHY, SOILS AND GEOLOGY

CHAPTER 6. TOPOGRAPGHY, SOILS AND GEOLOGY

This Chapter identifies existing topographical, soil and geological conditions along the Asian sections of the Motorway route and assesses the potential impacts of the North Marmara Motorway Project on these aspects. Measures proposed for the mitigation of the potential impacts and the residual impacts are also described in this Chapter for the following main types of impacts:

- Permanent changes in the existing topographical features;
- Soil disturbance due to earthworks, construction activities and materials extraction;
- Acceleration of soil erosion process;
- Risk of soil contamination due to accidental spills or leakage;
- Risks associated with the handling of existing contaminated lands;
- Geological and geotechnical risks.

6.1. Assessment Methodology and Data Sources

Soil characteristics along the Motorway route will be identified for the 400 meters study corridor (9.068,8 ha). In this scope, great soil groups and erosion levels of the soils will be determined based on the Land Use and Soils Database of the former Turkish General Directorate for Rural Services prepared for Istanbul (in 1987), Kocaeli (in 1991) and Sakarya (1995). A baseline program of soil sampling and analyses was conducted to identify the quality of representative soil samples at selected locations along the Motorway route. Geological-geotechnical survey reports and readily available internet sources have been resorted to characterize the baseline geological and geotechnical conditions at the Project area.

The data sources to be used in this scope are listed below:

- Land Use Database of the former Turkish General Directorate for Rural Services (GDRS; 1987, 1991 and 1995)
- Coordination of Information on the Environment (CORINE) Land Cover (2006)
- Laboratory analysis results for soil samples collected at the Project area
- Geological-geotechnical survey reports

Significance Criteria

The significance criteria for the impacts on topography, soils and geology will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 (“ESIA Methodology”) will be used for the determination of the magnitude of impact on the land use components, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 6.1. Detailed explanation of the sensitivity components for each ecosystem component is provided in the following “Baseline Conditions” section.

Table 6.1. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	**Medium (2)**	**Low (1)**
Topography	Unique topographical structure	Natural topograpghy	Already disturbed topograpghy
Soil (Erosion)	Soil with severe (Level 3) and very severe (Level 4) erosion potential according to GDRS Database	Soil with moderate (Level 2) erosion potential according to GDRS Database	Soils with none or very little (low) erosion potential (Level 1)
Soil (Contamination)	Soils corresponding to lands classified by CORINE Land Cover Database as “Arable Land”, “Permanent Crops”, “Pastures” and Heterogenous Agricultural Areas” (under Agricultural Areas) and Forests (under Forests and Semi-natural Areas)	Soils corresponding to lands classified by CORINE Land Cover Database as “Artifical, Non-agricultural and Vegetated Areas”) (under Artificial Surfaces) and “Shrub and/or Herbaceous Vegetation Associations” (under Forests and Semi-natural Areas)	Soils corresponding to lands classified by CORINE Land Cover Database as “Urban Fabric”, “Industrial, Commericial and Transport”, “Mine, Dump and Construction Sites” (under Artificial Surfaces)
Soil (Top Soil)	Agricultural areas, where top soil thickness is 20-30 cm	Forest areas, where top soil thickness is 10-20 cm	Pastures/Steppe, where top soil thickness is 5-10 cm
Geology (Landslides)	Active landslide areas	Former landslide areas	Areas with no landslide history or risk identified
Geological Features	Sites with unique geological sites and features of scientific or social/cultural importance		Sites with no unique geological sites and features of scientific or social/cultural importance
Seismicity	1st Degree Earthquake Zones according to relevant Earthquake Zoning Maps	2nd Degree Earthquake Zones according to relevant Earthquake Zoning Maps	3rd Degree Earthquake Zones according to relevant Earthquake Zoning Maps

6.2. Baseline Conditions

Similar to land use characteristics, existing topographical, soil and geological conditions along the Asian part of the Motorway route changes from section to section. Further evaluation of the baseline characteristics along the Asian sections of the Motorway is provided below.

6.2.1. Topography and Soils

6.2.1.1. Topographical Conditions

Topographical conditions are a combination of the terrain features, ruggedness**,** slopes and elevation levels along the Motorway route. As described in details in Chapter 5 ("Land Use and Property"), the land use patterns changes from section to section in the Asian part of the Motorway, while a considerable part of the entire study corridor (60,3%; 5.472,8 ha of 9.068,8 ha) is covered by agricultural areas having relatively lower slopes. Along the Liman Access Road part of Section 4, non-flat topography is observed. In Section 5, mainly non-flat topographical conditions and elevation differences prevail along the forest hills The first 10 km of Section 6 (190-200) correspond to lower elevations where slope is low-moderate. Elevations and slopes increase between KM 200-210. After this point, agricultural lands at lower elevations start to dominate the land use character (80%; 3.764,1 ha) resulting in rather flat topography in the last 40 km. Elevation and slope maps for the area where the Project will be implemented are presented between Figure 6.1 and Figure 6.6.

6.2.1.2. Soil Characteristics

Soil conditions along the Motorway route will be described based on the great soil groups, erosion levels and the content of the soils that represent productivity. Slope conditions for the Motorway route. Slope conditions have been provided under the previous "Topographical Conditions" section, while land use capabilities have been described in Chapter 2 ("Land Use and Property").

Great Soil Groups

Great soil groups corresponding to the study corridor have been described based on the land use and soil database of the former Turkish General Directorate for Rural Services (GDRS) published for Istanbul, Kocaeli and Sakarya provinces in 1987, 1991 and 1995, respectively. The results of the analyses done in this scope are provided in Table 6.2. Map of great soil groups within the study corridor is presented in Figure 6.7, Figure 6.8 and Figure 6.9 for each section.

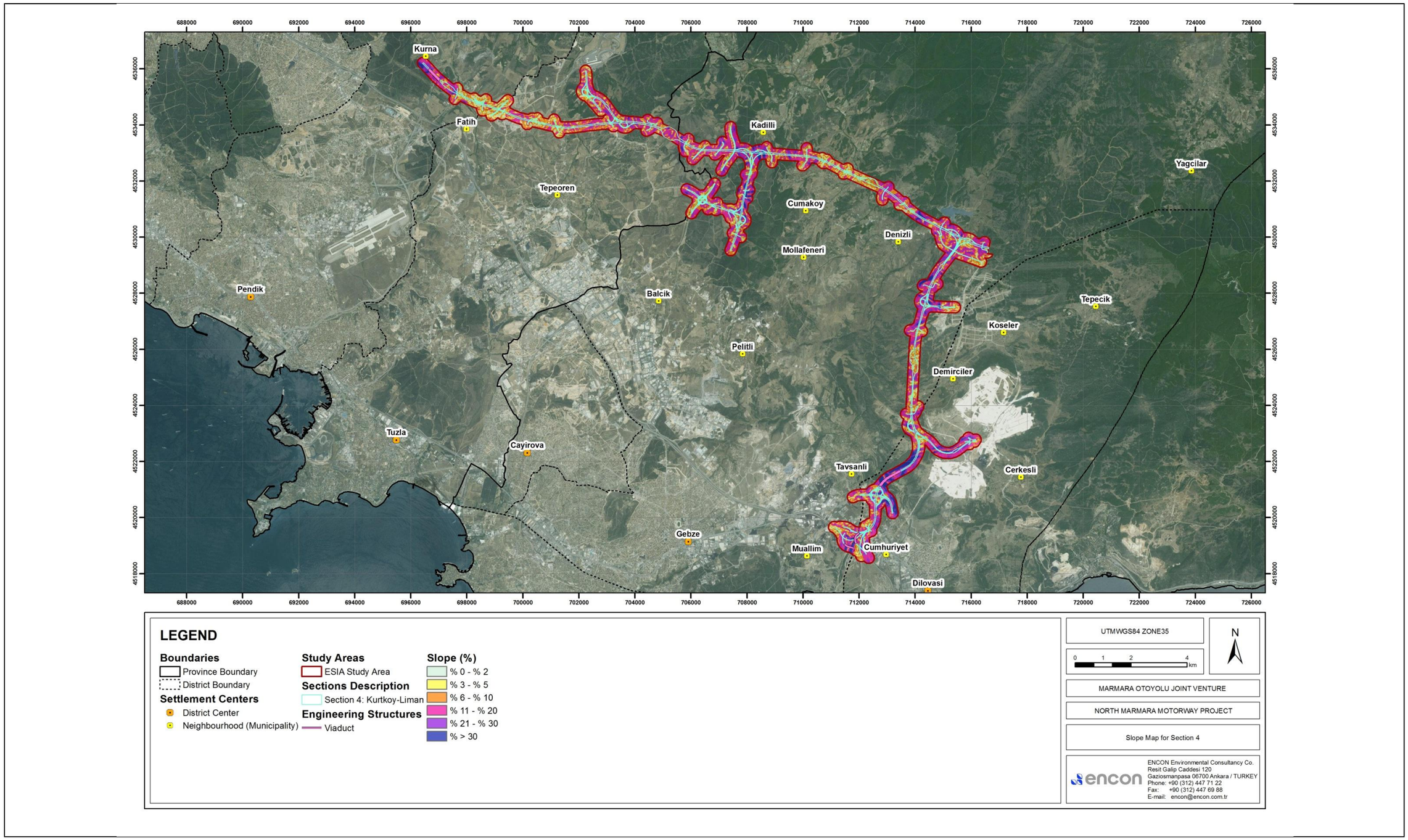


Figure 6.1. Slope Map for Section 4

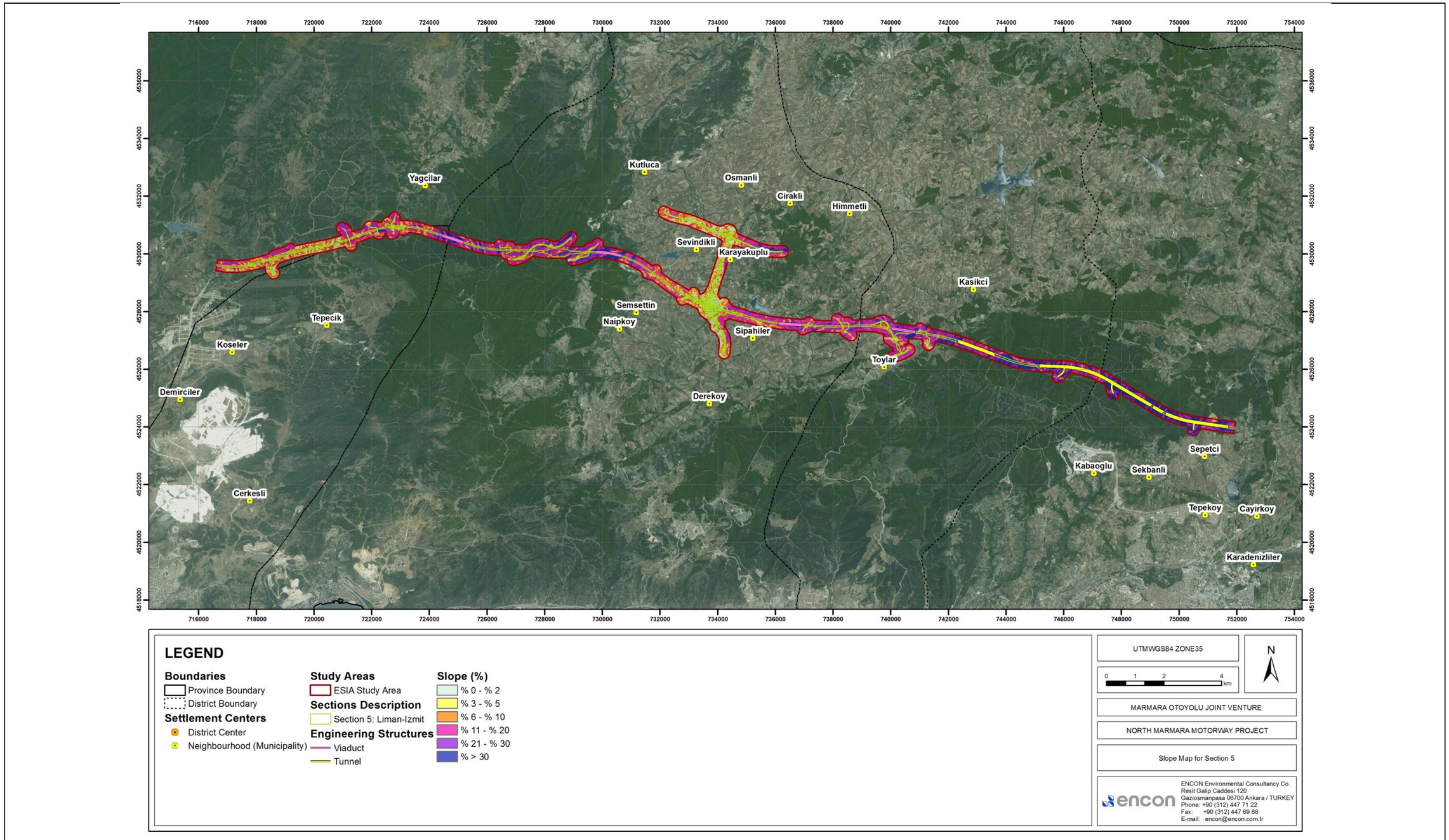


Figure 6.2. Slope Map for Section 5

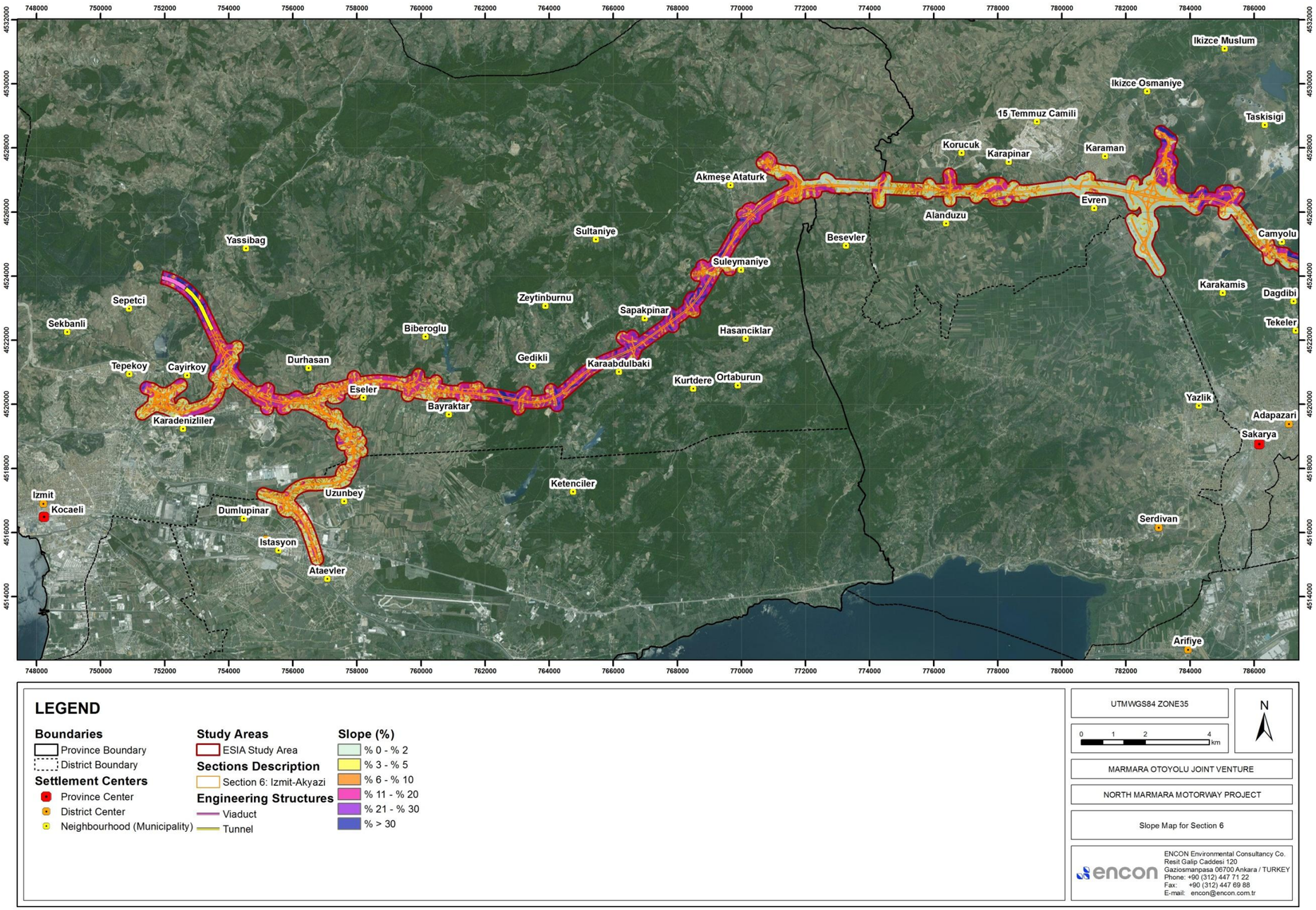


Figure 6.3.a. Slope Map for Section 6

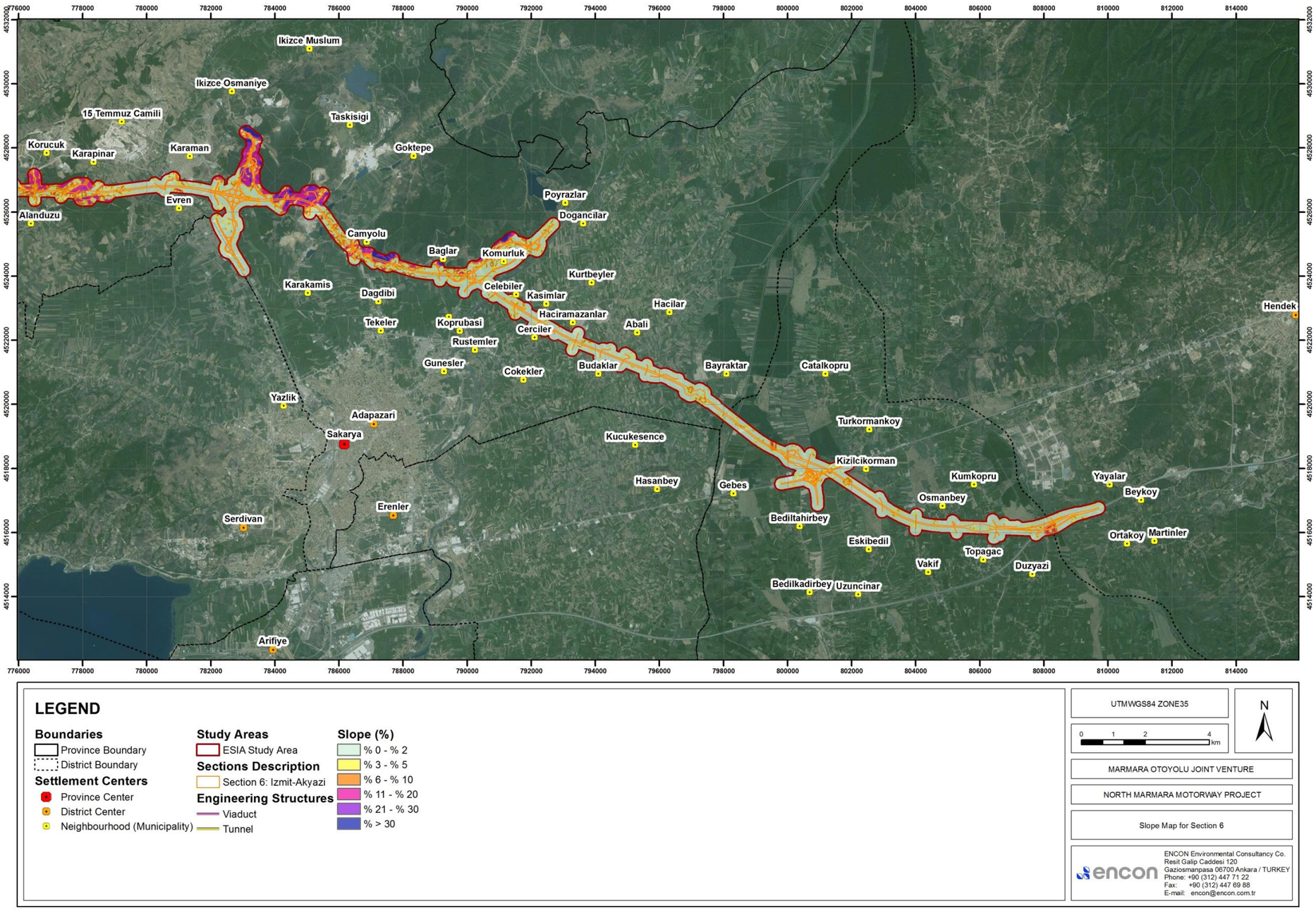


Figure 6.3.b. Slope Map for Section 6

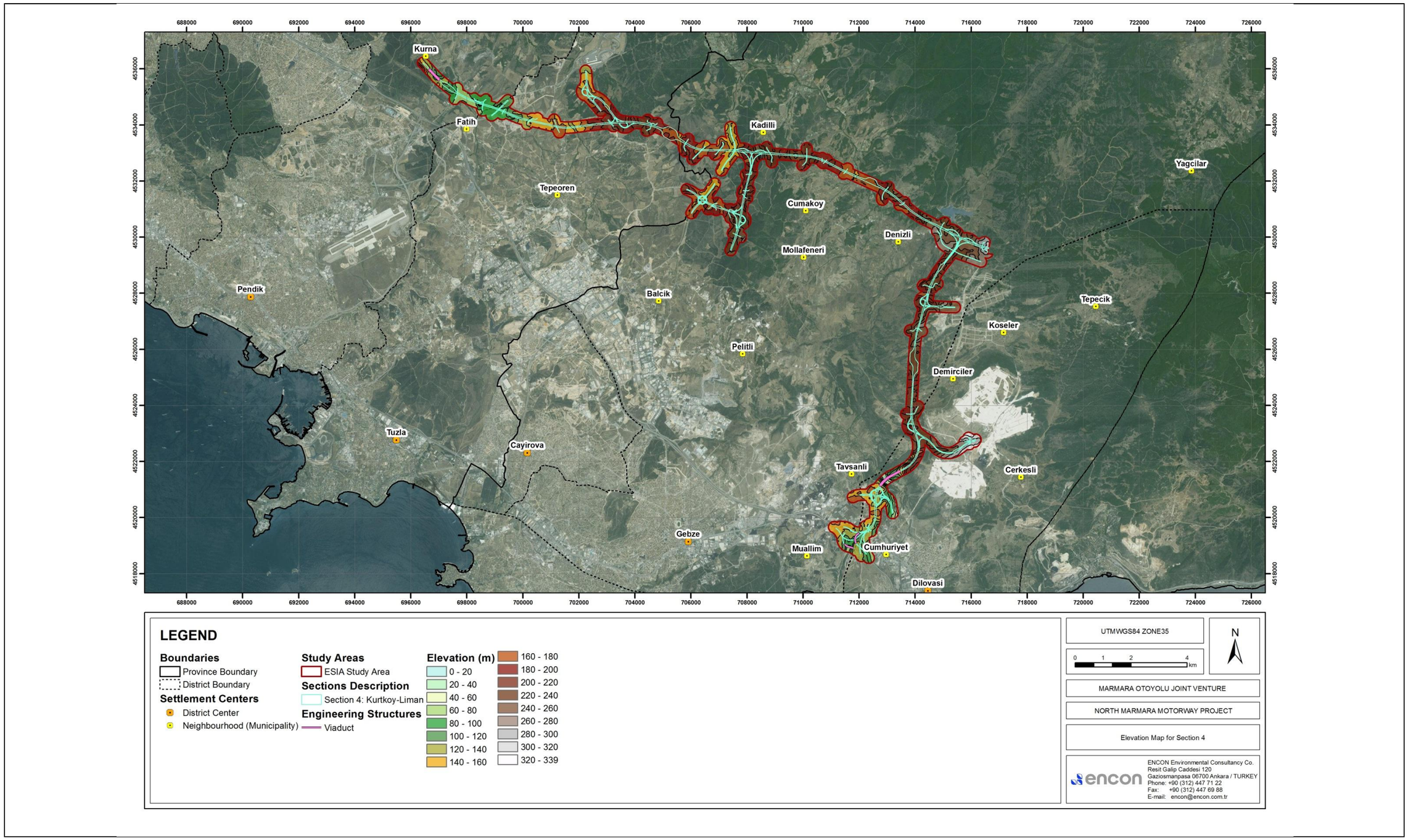


Figure 6.4. Elevation Map for Section 4

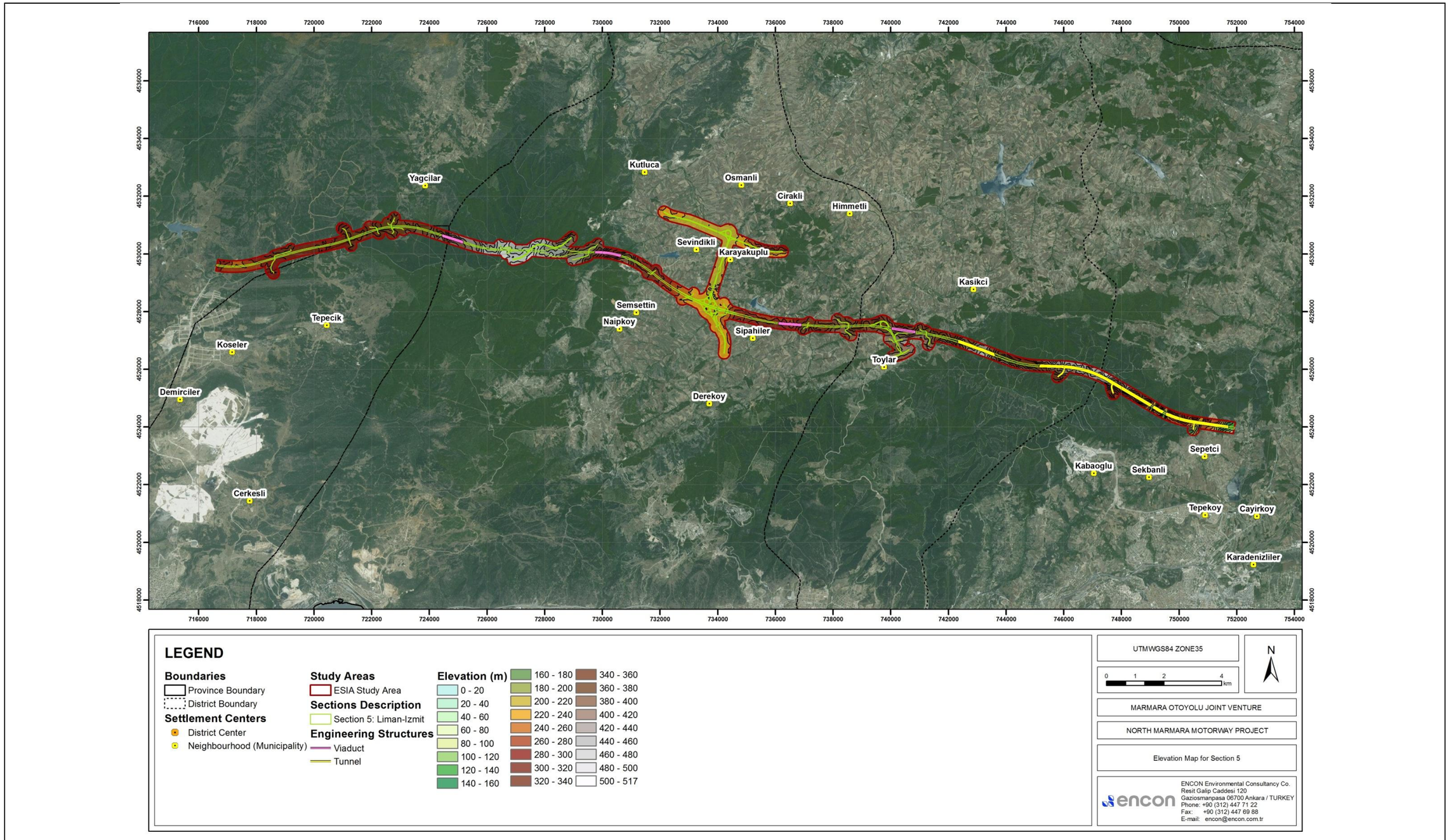


Figure 6.5. Elevation Map for Section 5

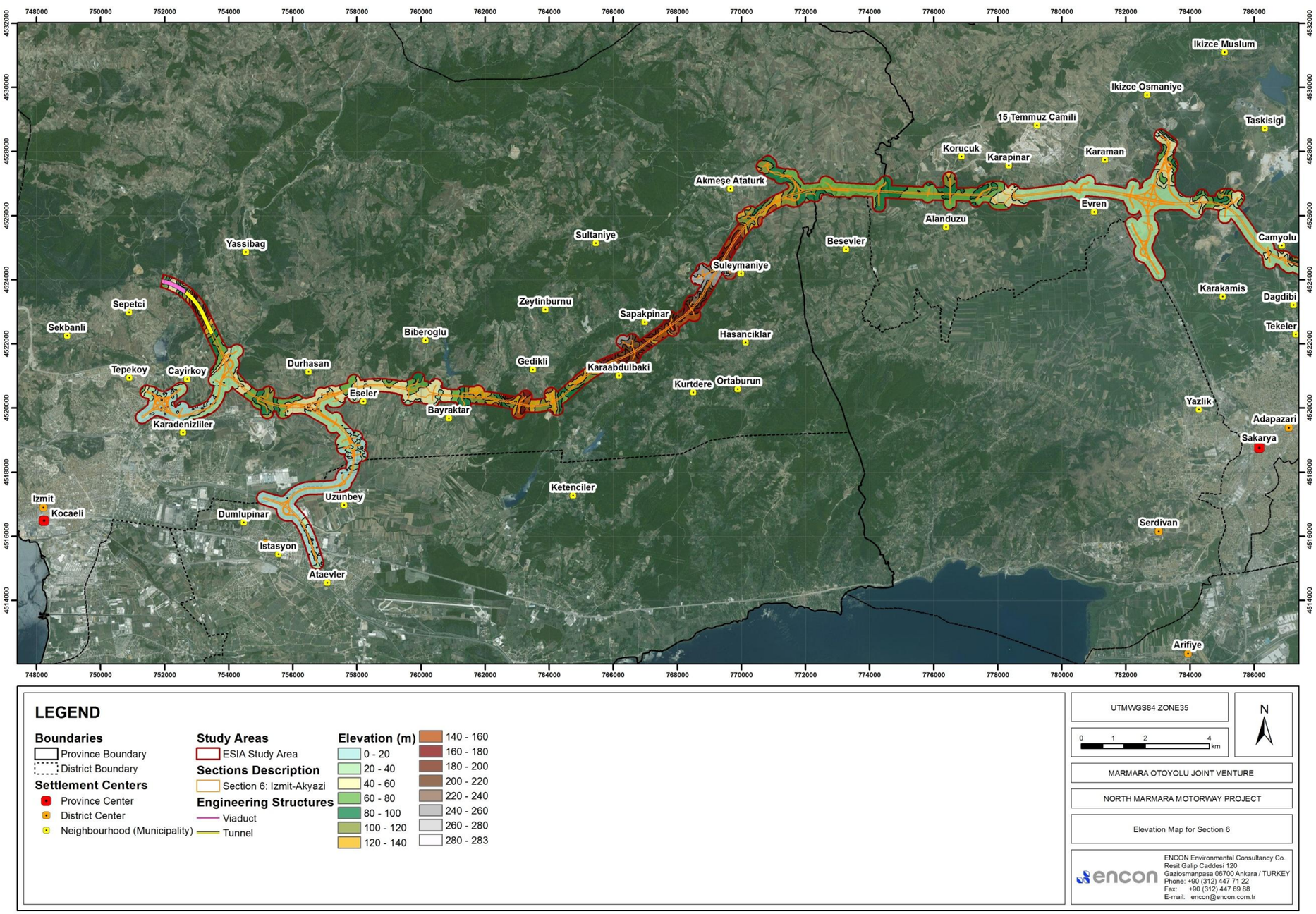


Figure 6.6.a. Elevation Map for Section 6

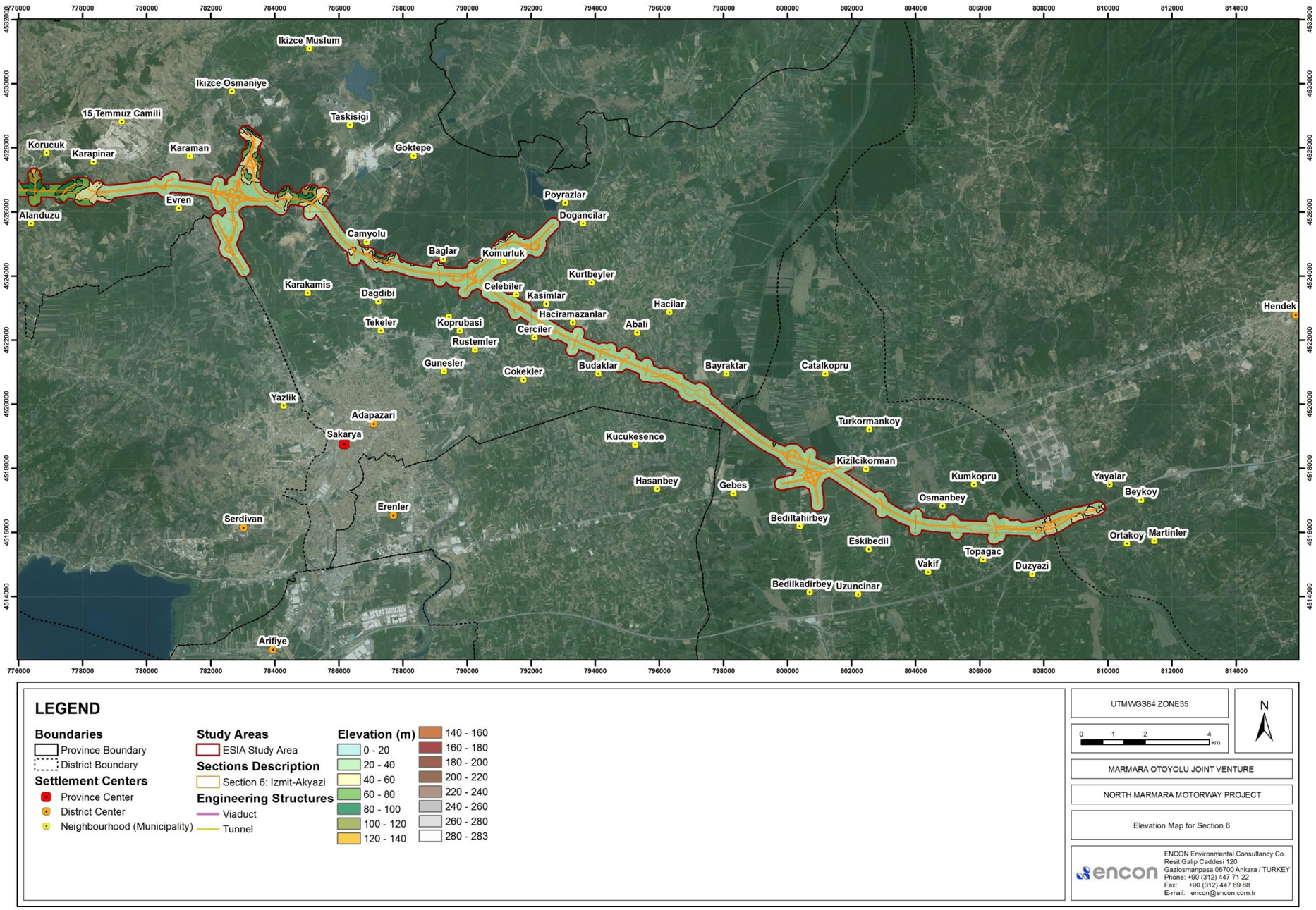


Figure 6.6.b. Elevation Map for Section 6

Table 6.2. Great Soil Groups within the Study Corridor for Asian Sections of the North Marmara Motorway Route (*GDRS, 1987, 1991 and 1995*)

Soil Groups	Section 4			Section 5			Section 6			Total Area	
	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Non-Calcareous Brown Forest Soils	13595540,76	1359,55	52,82	9364237,91	936,42	53,49	14774527,98	1477,45	31,14	3773,43	41,61
Rendzinas	11713155,21	1171,32	45,51	5184062,44	518,41	29,61	4073124,77	407,31	8,59	2097,03	23,12
Alluvial Soil	362760,45	36,28	1,41	1469234,33	146,92	8,39	28108863,34	2810,89	59,25	2994,09	33,02
Colluvial Soil	-	-	-	1450996,53	145,10	8,29	-	-	-	145,10	1,60
Settlements	68885,94	6,89	0,27	38546,83	3,85	0,22	354646,04	35,46	0,75	46,21	0,51
Pond	-	-	-	-	-	-	46820,80	4,68	0,10	4,68	0,05
River	-	-	-	-	-	-	82642,29	8,26	0,17	8,26	0,09
Total	**25740342,35**	**2574,03**	**100,00**	**17507078,04**	**1750,71**	**100,00**	**47440625,21**	**4744,06**	**100,00**	**9068,80**	**100,00**

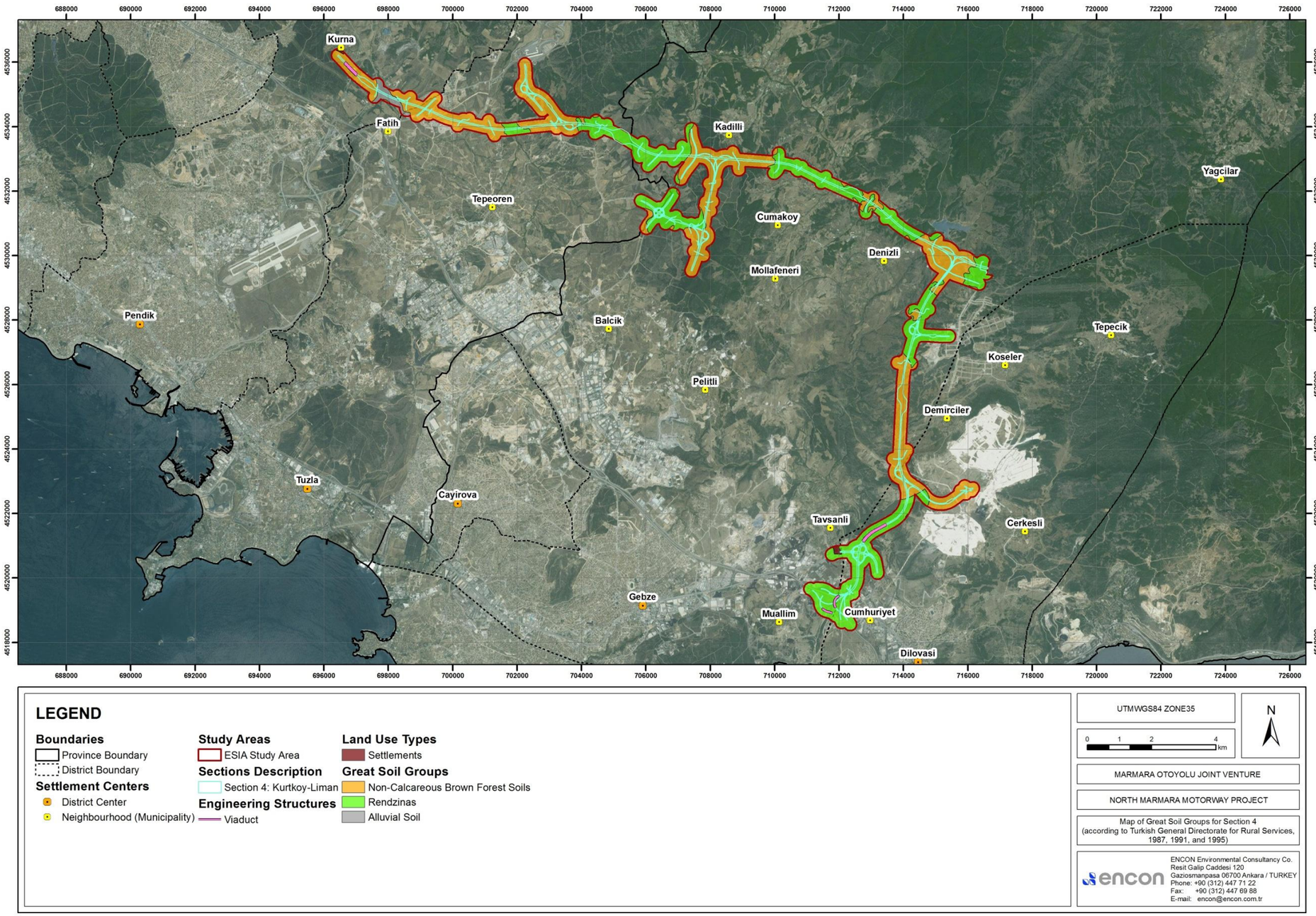


Figure 6.7. Map of Great Soil Groups for Section 4

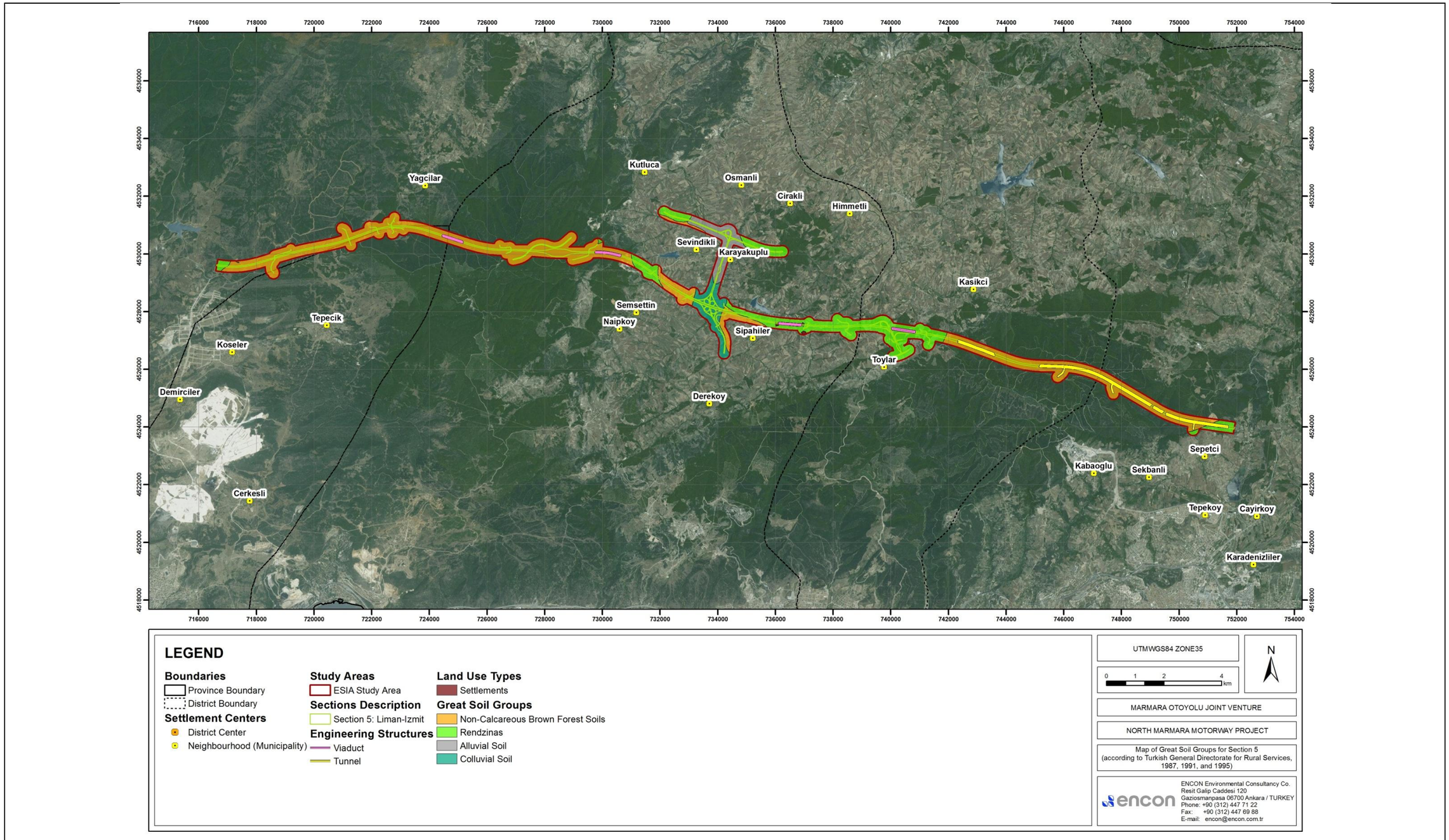


Figure 6.8. Map of Great Soil Groups for Section 5

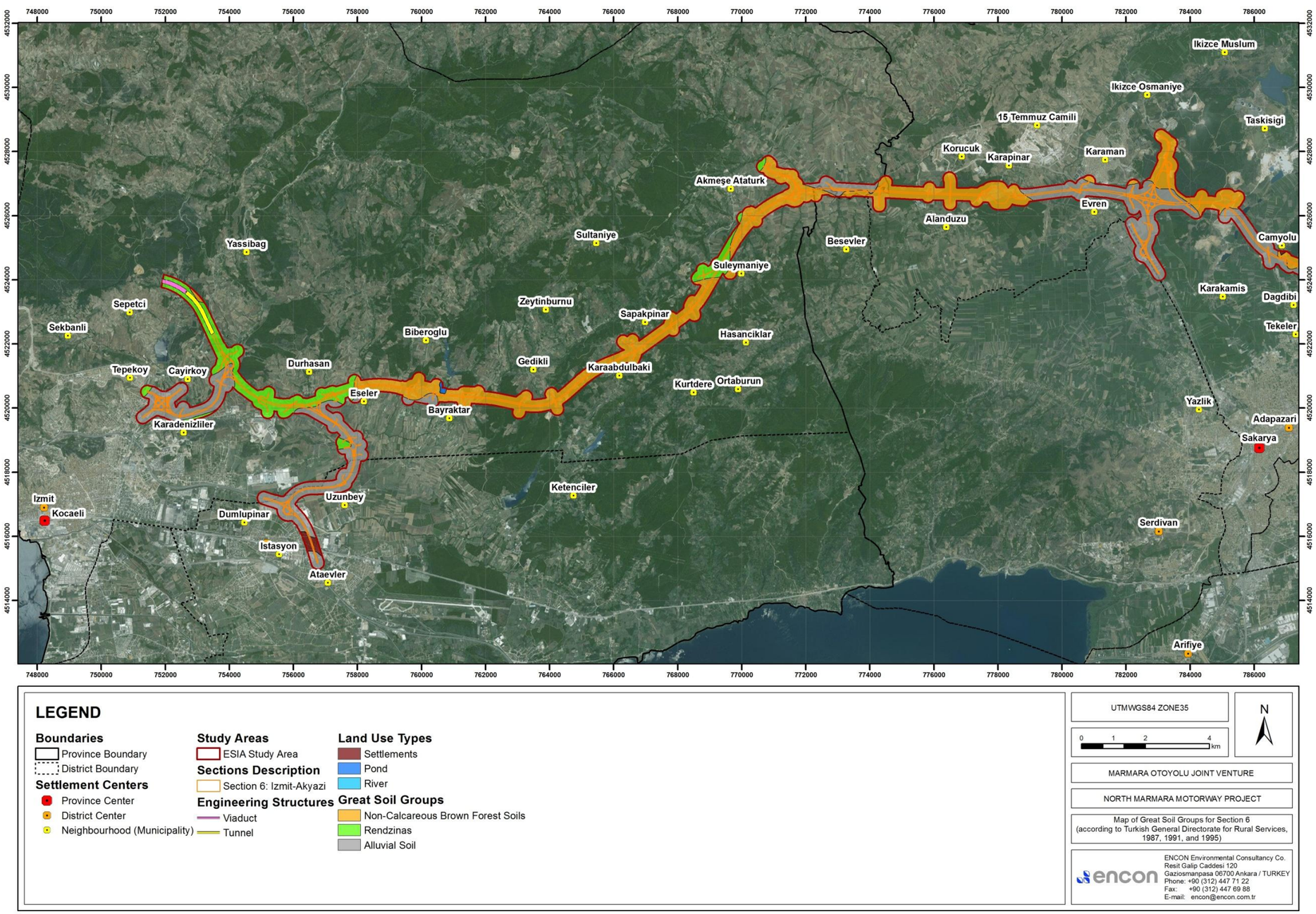


Figure 6.9.a. Map of Great Soil Groups for Section 6

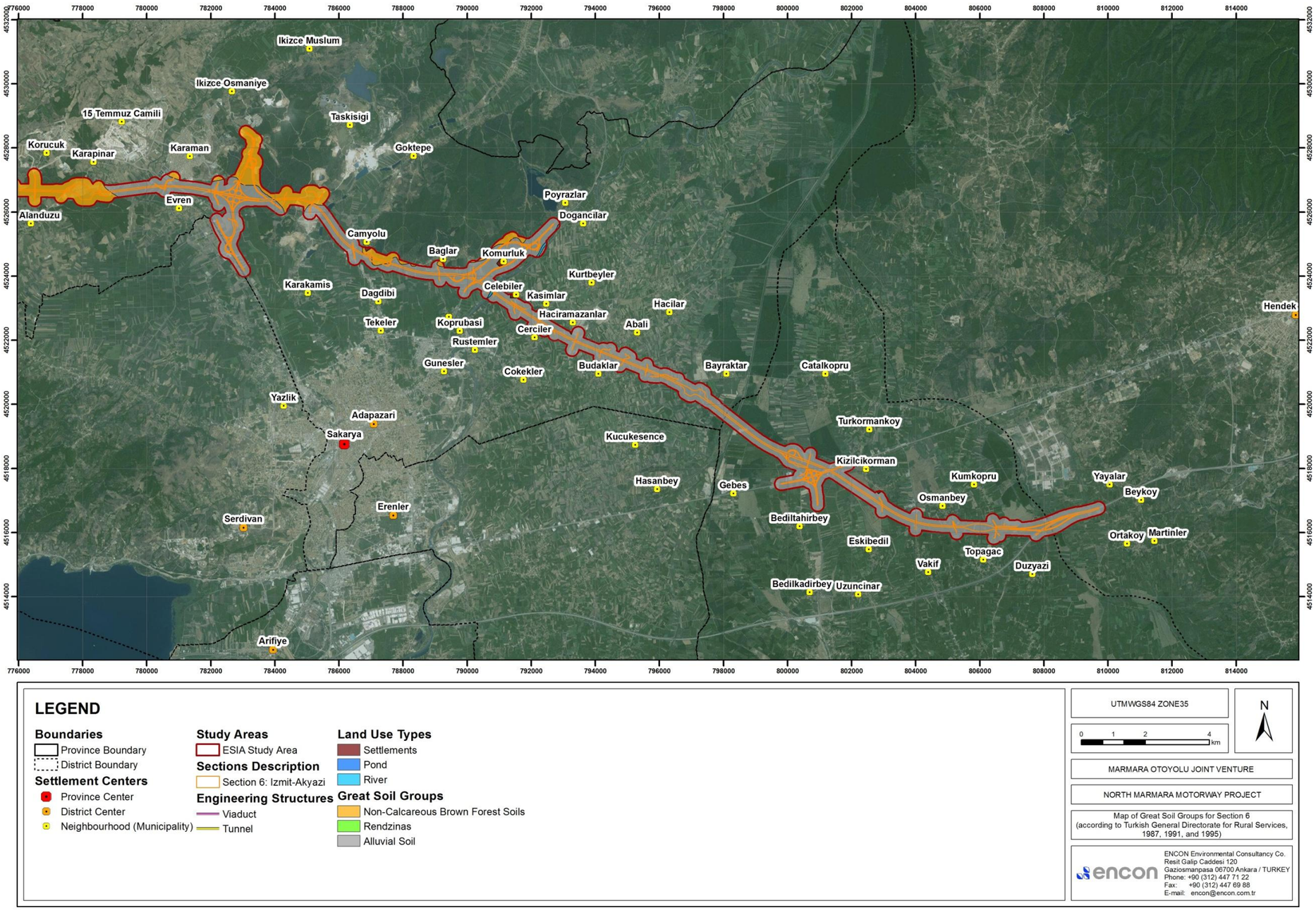


Figure 6.9.b. Map of Great Soil Groups for Section 6

According to the analysis done, the study corridor for the Asian part of the Motorway includes the following great soil groups: non-calcareous brown forest soils, rendzinas, alluvial soils and colluvial soils. Description of each great soil group is provided in Table 6.3.

Table 6.3. Description of Great Soil Groups

Soil Group	Description
Non-Calcareous Brown Forest Soils	These soils consist of a dark-colored top layer and a slightly different layer under the top layer. These do not contain lime and their reactions are acidic, neutral or alkaline. Also, they do not posses much natural yield.
Rendzinas	The top layer in these soils, which consist of bedrocks with plenty of lime, is dark-coloured. These contain plenty of limestone, marn and pieces of chalk in them. The amount of lime could be little or plenty. Below this layer is a light-coloured calcareous transition layer. Below the transition layer is calcareous bedrocks. Natural vegetation cover is generally forests, but a mixture of bushes, forest and grass can also be found. Natural drainage of these soils is good.
Alluvial Soil	In these immature soils, layers are either not present or else very weakly developed even if they are present. On the other hand, various mineral layers with different properties are present. These soils, which are very important for agriculture, are generally under the influence of groundwater and are suitable for growing up all cultivated plants permitted by the climate. The yield could vary between very low and very high.
Colluvial Soil	These groups of soils is accumulated on the foot of step slopes with the effect of gravity, landslide, surface flow or tributaries as a result of transport from short distances and have formed on colluvial material. These young soils rather show the characteristics of the soil materials available in the upper elevations. They contain layers with varying material sizes depending on the level of precipitation and flow rate and the degree of elevation. Those layers are not parallel to each other, as they are with the alluvial soils. The ones that are present at the foot of steep slopes and valleys generally include rough and coarse materials. With decreased rate of flow, material diameters reduce. These well drained soils are occasionally subject to flooding. Natural vegetative structure is dependent on the climate. They are productive under irrigation.

Source: Former Ministry of Agricultural and Rural Services, July 2008.

The key findings of the great soil group analyses done for the study corridor (9.068,8 ha) are summarized below (settlement areas, ponds and rivers that cover %0,7 of the study corridor and not categorized under any of the great soil groups are not taken into consideration in the following figures):

- Non-calcareous brown forest soils are the dominant great soil group along the entire study corridor (41,6%; 3.773,4 ha). Alluvial Soils (33%; 2.994,1) and Rendzinas (23,1%; 2.097 ha) are the most prominent among other great soil groups.

- In parallel to the structure in the entire study corridor, Section 4 and Section 5 are predominantly covered by vertisols (52,8%; 1.359,6 ha in Section 4; 53,5%; 936,4 ha in Section 5).

- Alluvial soils are the most dominant soil group in Section 6 (59,3%; 2.810,9 ha). Non-calcareous brown forest soils are the second important soil group with 31,1% (1.477,5 ha).

Soil Erosion

Soil erosion is described as the transportation of soil material resulting in extensive degradation. The process can either occur naturally within its own balance or be accelerated as a result of human activity. The rate of erosion is increased due to improper agricultural practices such as cultivation on relatively high slope lands, plowing of the fields in the direction of the slope and excessive grazing on pasturelands or deforestation. The agents of soil erosion are water and wind, where the former is more prominent. Water erosion takes place on lands with weak or no vegetative cover where runoff can flow with sufficient energy transporting loosened soil particles down the slope. Consequently, fertile top layer of the soil is lost from the agricultural lands resulting in reduced agricultural productivity and water quality of the surface water resources deteriorates as a result of sedimentation and eutrophication (*Former Ministry of Agricultural and Rural Services, July 2008*).

Evaluation of the erosion level to which soils are exposed is done based on the erosion classification system developed by US Department of Agriculture and adopted by several state authorities including Turkey. Erosion levels specified in this classification system are listed in Table 6.4. Erosion levels corresponding to the Project area are shown on the maps presented between Figure 6.10 and Figure 6.12.

Table 6.4. Erosion Levels according to Technical Procedure on Soil and Land Classification Standards

Erosion Level	Definition
Level 1	Low
Level 2	Moderate
Level 3	Severe
Level 4	Very severe

Source: Former Ministry of Agricultural and Rural Services, July 2008.

In accordance with the erosion level classification, erosion potential of the soils corresponding to the study corridor (9.068 ha; settlement areas, pond and rivers that cover %0,7 of the study corridor and not categorized under any of the great soil groups are not taken into consideration in the following figures) have been described based on the land use and soil databases of the former GDRS published for Istanbul, Kocaeli and Sakarya province in 1987, 1991 and 1995. The results of the analyses done in this scope are provided in Table 6.5. As can be seen from this table, more than half of the study corridor (51%; 4.627,2 ha) corresponds to soils having severe (Level 3) erosion conditions. Soils classified with low (Level 1) erosion level forms 33% (2.994,1 ha) and soils classified with moderate (Level 2) erosion level forms 15,3% (1.388,4 ha) of the remainder. There is no soil within the study corridor classified with very severe (Level 4) erosion level. In Section 4 and Section 5, soils with severe erosion levels are prominent. It should be noted that Marmara Region has experienced a very rapid urbanization rate especially in the last 30 years resulting in significant changes in the land use patterns and increase in the overall area of artificial surfaces including urban areas, industrial sites, transport networks, mine extraction sites, etc. especially in Istanbul and Kocaeli. Consequently, it is likely that the erosion rate has accelerated in Istanbul and Kocaeli and the erosion exposure levels of the soils corresponding to the study corridor have increased. Figure 6.13 present a high-scale map of the status of erosion in Marmara Region extracted from the Erosion Combating Action Plan (2013-2017) prepared by the Ministry of Forestry and Water Affairs. This map mainly supports the analyses done based on the GDRS database.

Table 6.5. Erosion Potential of the Soils within the Study Corridor for Asian Sections of the North Marmara Motorway Route (*GDRS, 1987, 1991 and 1995*)

Erosion Level	Risks	Section 4			Section 5			Section 6			Total Area (Sub-groups)		Total Area (Erosion Levels)	
		Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (m^2)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
None or very low	Drainage problems, oldness, flood damage	362760,45	36,28	1,41	-	-	-	26610212,85	2661,02	56,09	2697,30	29,74	2994,09	33,02
	Soil insufficiency	-	-	-	-	-	-	1498650,49	149,87	3,16	149,87	1,65		
	-	-	-	-	1469234,33	146,92	8,39	-	-	-	146,92	1,62		
Moderate	Slope and erosion damage	2502977,89	250,30	9,72	2002197,51	200,22	11,44	-	-	-	450,52	4,97	1388,38	15,31
	Slope and erosion damage, Soil insufficiency	1534313,49	153,43	5,96	2860112,80	286,01	16,34	4984163,54	498,42	10,51	937,86	10,34		
Severe	Slope and erosion damage	14649,08	1,46	0,06	-	-	-	935698,41	93,57	1,97	95,03	1,05	95,03	1,05
	Slope and erosion damage, Soil insufficiency	21256755,51	2125,68	82,58	11136986,57	1113,70	63,61	12927790,82	1292,78	27,25	4532,15	49,98	4532,15	49,98
Very severe	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Settlements		68885,94	6,89	0,27	38546,83	3,85	0,22	354646,03	35,46	0,75	46,21	0,51	46,21	0,51
Pond		-	-	-	-	-	-	46820,80	4,68	0,10	4,68	0,05	4,68	0,05
River		-	-	-	-	-	-	82642,29	8,26	0,17	8,26	0,09	8,26	0,09
Total		**25740342,35**	**2574,03**	**100,00**	**17507078,04**	**1750,71**	**100,00**	**47440625,21**	**4744,06**	**100,00**	**9068,80**	**100,00**	**9068,80**	**100,00**

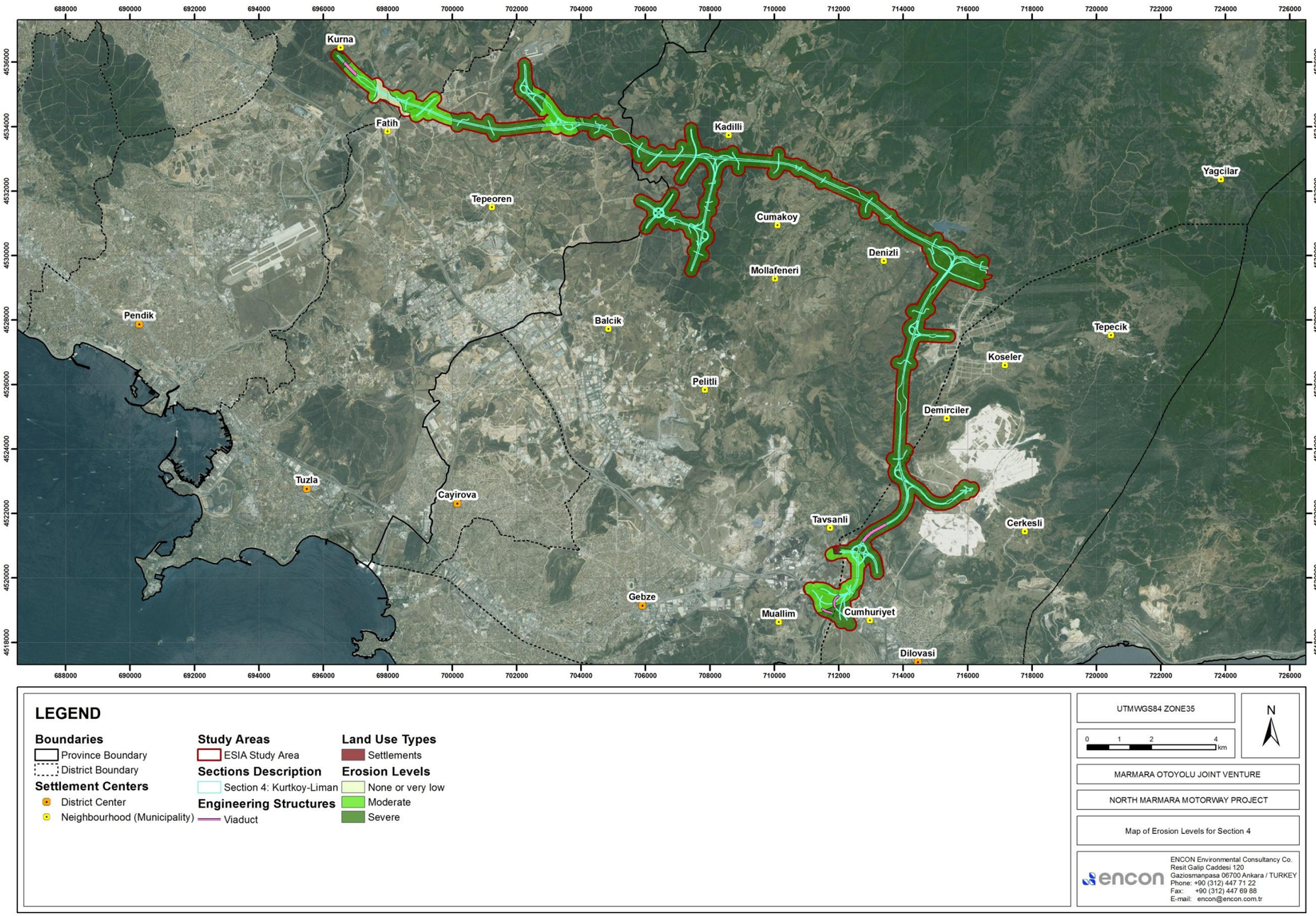


Figure 6.10. Map of Erosion Levels for Section 4

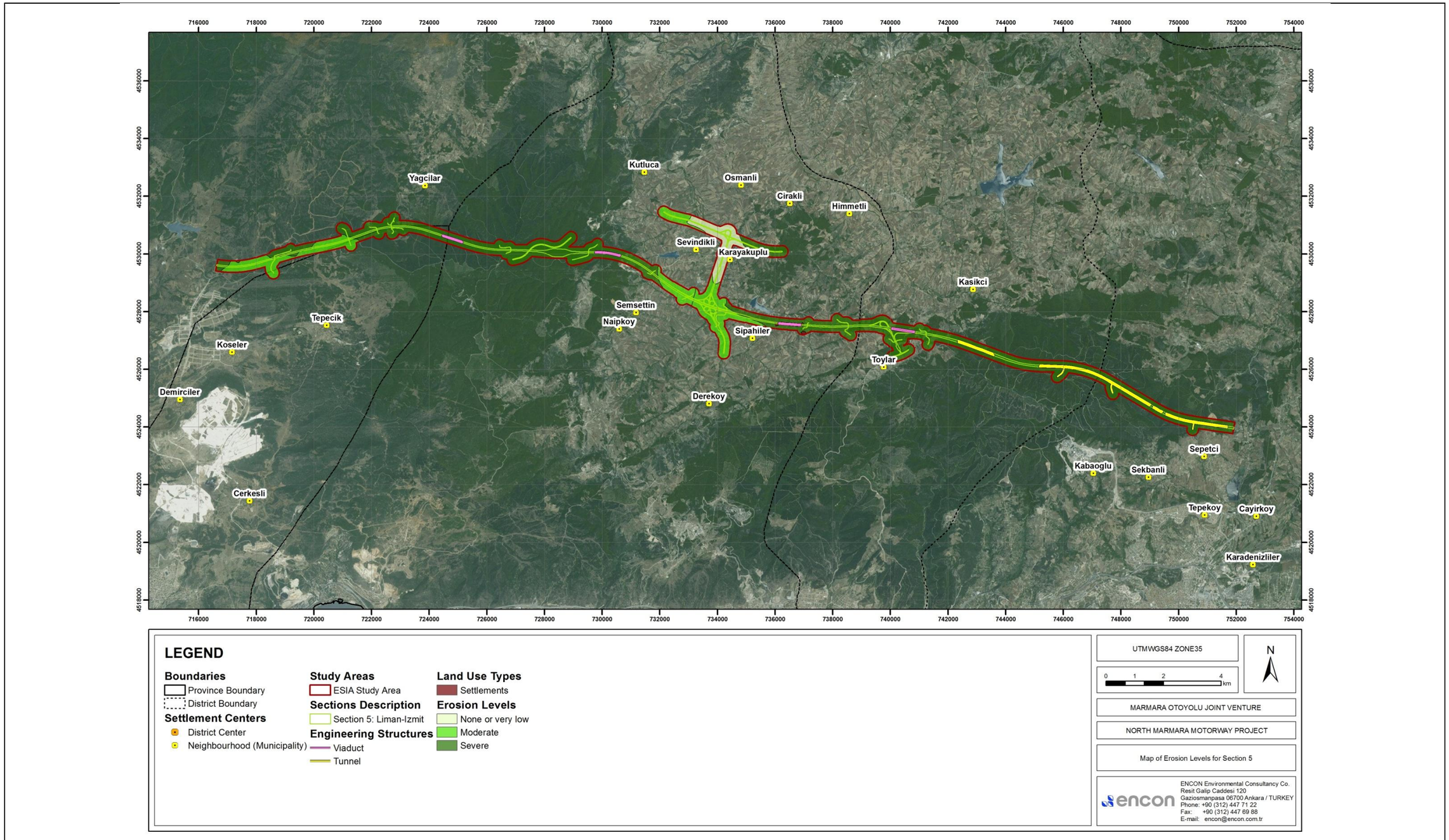
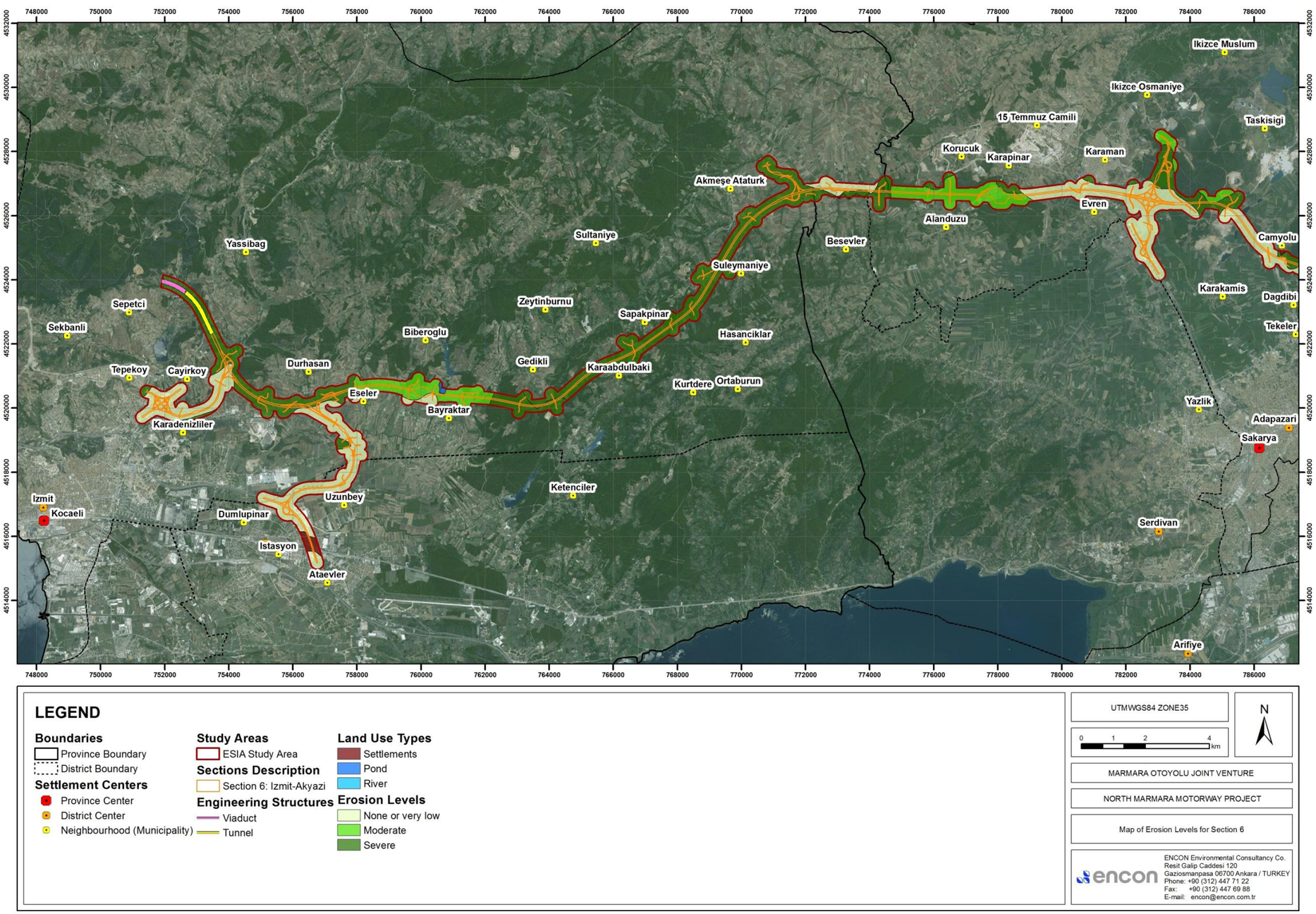


Figure 6.11. Map of Erosion Levels for Section 5



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 6: Izmit-Akyazi

Engineering Structures
- Viaduct
- Tunnel

Land Use Types
- Settlements
- Pond
- River

Erosion Levels
- None or very low
- Moderate
- Severe

UTMWGS84 ZONE35

N

0 1 2 4 km

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Map of Erosion Levels for Section 6

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Figure 6.12.a. Map of Erosion Levels for Section 6

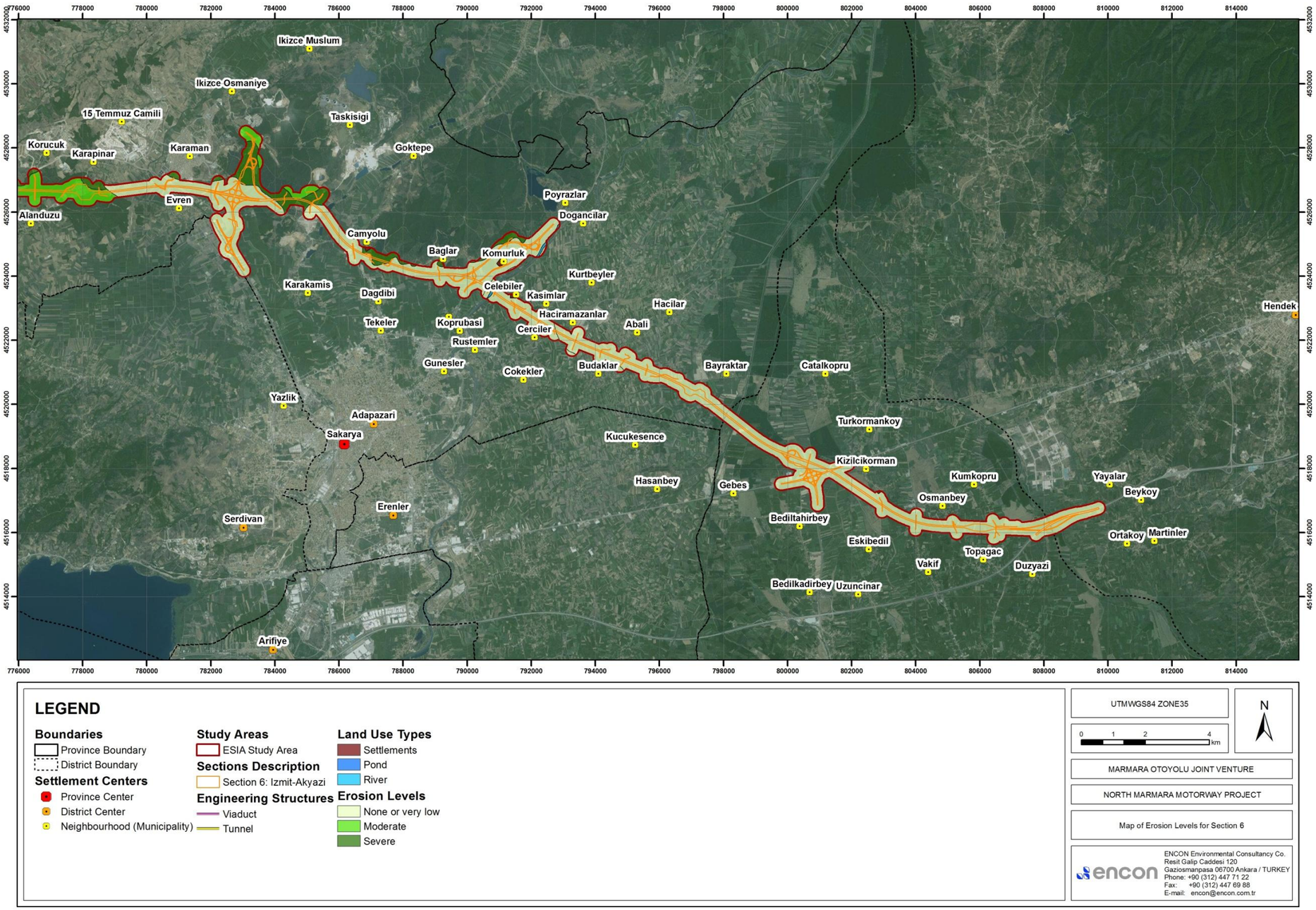


Figure 6.12.b. Map of Erosion Levels for Section 6

Figure 6.13. Status of Erosion in Marmara Region

Erosion levels of soils for the study area on settlement-basis are presented in Table 6.6.

Table 6.6. Erosion Levels of Soils in Each Settlement (*GDRS, 1987, 1991 and 1995*)

Section	Location			Erosion Level
	Province	District	Neighborhood	
Section 4	Istanbul	Pendik	Kurnakoy	Severe, moderate
	Istanbul	Tuzla	Tepeoren	Severe
	Kocaeli	Gebze	Kadilli	Severe
	Kocaeli	Gebze	Cumakoy	Severe
	Kocaeli	Gebze	Balçık	Severe
	Kocaeli	Gebze	Denizli (Liman Access Road)	Severe
	Kocaeli	Dilovasi	Koseler (Liman Access Road)	Severe
	Kocaeli	Dilovasi	Demirciler (Liman Access Road)	Severe
	Kocaeli	Gebze	Tavsanli (Liman Access Road)	Severe, moderate
Section 5	Kocaeli	Izmit	Tepecik	Moderate
	Kocaeli	Gebze	Yagcilar	Severe
	Kocaeli	Korfez	Kutluca	Severe
	Kocaeli	Korfez	Sevindikli	Moderate, Low
	Kocaeli	Korfez	Semsettin	Severe, Low
	Kocaeli	Korfez	Karayakuplu	Low
	Kocaeli	Korfez	Sipahiler	Severe, Moderate
	Kocaeli	Korfez	Himmetli	Severe
	Kocaeli	Derince	Kasikci	Severe
	Kocaeli	Korfez	Toylar	Severe
Section 6	Kocaeli	Izmit	Cayirkoy	Severe, Low
	Kocaeli	Izmit	Durhasan	Severe
	Kocaeli	Izmit	Uzunbey	Low
	Kocaeli	Izmit	Eseler	Moderate
	Kocaeli	Izmit	Bayraktar	Moderate
	Kocaeli	Izmit	Gedikli	Severe
	Kocaeli	Izmit	Karaabdulbaki	Severe
	Kocaeli	Izmit	Sapakpinar	Severe
	Kocaeli	Izmit	Suleymaniye	Severe
	Kocaeli	Izmit	Akmese	Severe
	Sakarya	Serdivan	Besevler	Severe
	Sakarya	Adapazari	Korucuk	Moderate
	Sakarya	Adapazari	Karapinar	Moderate
	Sakarya	Adapazari	Kulaksiz	Moderate
	Sakarya	Adapazari	Karaman	Low
	Sakarya	Adapazari	Karakamis	Low
	Sakarya	Adapazari	Tekeler	Low
	Sakarya	Adapazari	Dagdibi	Low
	Sakarya	Adapazari	Camyolu	and UzunbeyLow
	Sakarya	Adapazari	Gunesler	Low
	Sakarya	Adapazari	Suleymanbey	Low
	Sakarya	Adapazari	Trabzonlar	Low
	Sakarya	Adapazari	Rustemler	Low
	Sakarya	Adapazari	Celebiler	Low
	Sakarya	Adapazari	Cerciler	Low
	Sakarya	Adapazari	Haciramazanlar	Low
	Sakarya	Adapazari	Budaklar	Low
	Sakarya	Adapazari	Abali	Low
	Sakarya	Adapazari	Kucukesence	Low
	Sakarya	Akyazi	Bediltahirbey	Low
	Sakarya	Akyazi	Kizilcikorman	Low
	Sakarya	Akyazi	Eskibedil	Low
	Sakarya	Akyazi	Uzuncinar	Low
	Sakarya	Akyazi	Vakif	Low
	Sakarya	Akyazi	Osmanbey	Low
	Sakarya	Akyazi	Ramasli/Topagac	Low
	Sakarya	Akyazi	Duzyazi	Low
	Sakarya	Akyazi	Ortakoy	Low

Soil Productivity and Quality

Soil productivity, represents the capability of soils to supply primary nutrients in sufficient amounts and ratios proper for sustaining growth of plants. Elements necessary for plant growth includes carbon, hydrogen and oxygen that are supplied from air and water; and nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulphur (S) as well as certain metals including iron (Fe), Manganese (Mn), Boron (B), Molibden (Mo), Copper (Cu), Zinc (Zn) and Chlorine (Cl) that are to be supplied from soil and/or fertilizers.

Top soil is the soil layer between the top 5-40 cm below the ground surface, which is rich in humus (soil organic content) and have high microorganism activity, providing favorable conditions for the growth of plants. Typical composition of top soil that is to be observed homogenously within the soil content is provided in Table 6.7 (*KGM, 2013*).

Table 6.7. Typical Composition of Top Soil

Parameter	Value/Concentration
pH	6,0-7,5
Lime (%)	4,0-9,0
Minimum organic material (%)	2,5-12,0
Salt (%)	0,0-0,15
Nitrate-N (NO_3-N) (ppm)	25
Phosphoric acid (ppm)	15
Potassium oxide (ppm)	150

Average top soil thicknesses identified in the scope of flora studies for main land use types are listed in Table 6.8.

Table 6.8. Average Top Soil Thickness for Different Land Use/Habitat Types

Land Use/Habitat Type	Average Top Soil Thickness	Corresponding Approximate Motorway Chainage
Agricultural	20-30 cm	Section 4 (heterogeneous) KM 165-175 KM 188-200 KM 210-250
Forest	10-20 cm	Section 4 (heterogeneous) KM 141-143 KM 150-165 KM 175-188 KM 200-210
Pasture/Steppe	5-10 cm	KM 211 (Akmese) KM 224 (Karakamis) KM 234 (Celebiler) KM 246 (Kizilcikorman) KM 250 (Ramasli/Topagac)

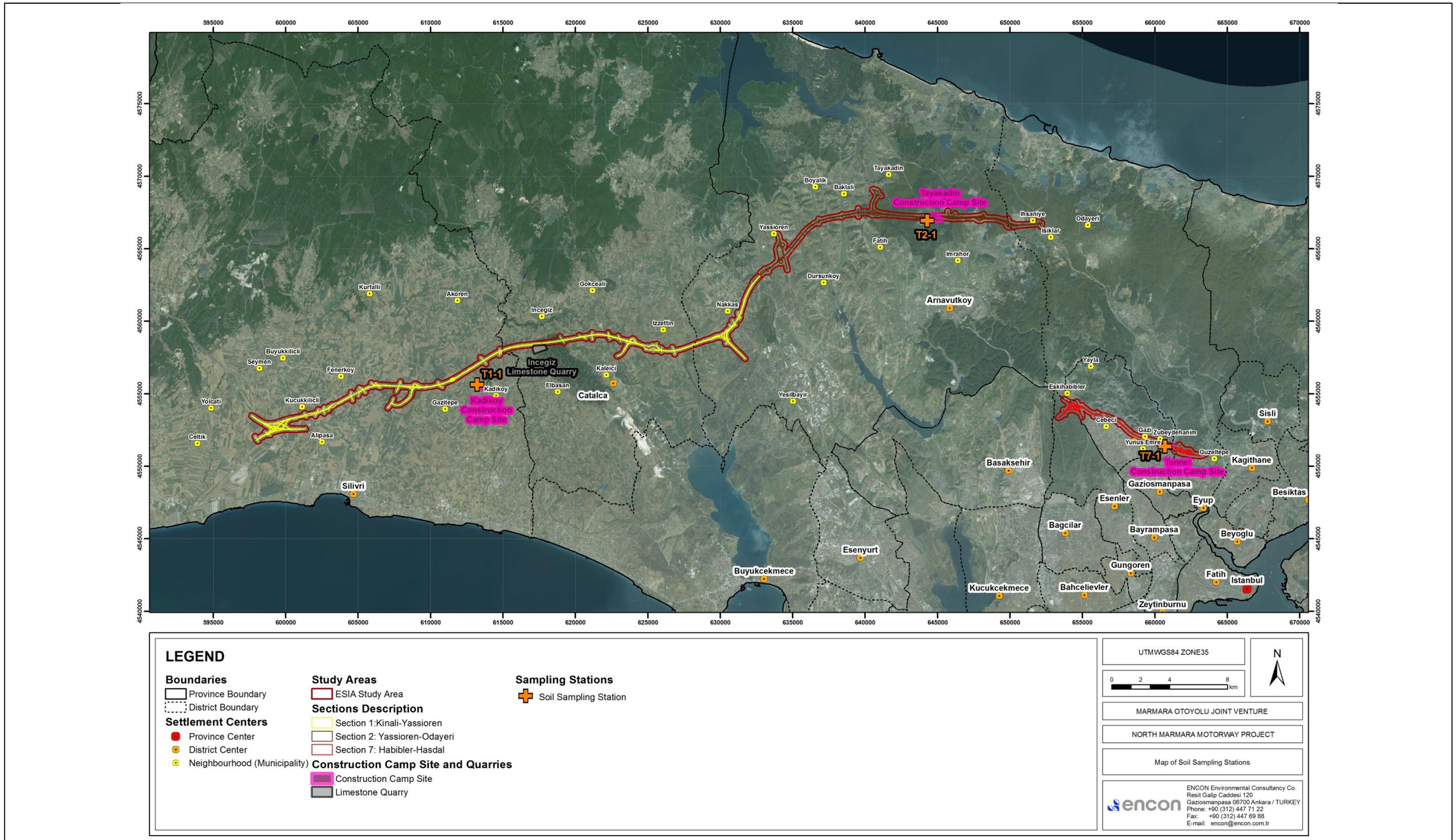
Soil Sampling and Analyses

Potentially contaminated lands are anticipated to be present near Motorway sections located around former quarry and waste disposal sites and urban areas. In Section 4, a former excavated material disposal site is located next to KM 140. Liman Access Road is passing parallel to industrial zones and urban areas. Section 5 passes generally through undisturbed forest lands and rural agricultural areas. Initial kilometers of Section 6 pass close to industrial zones and urban areas near Durhasan. Taskisigi Camp Site in Section 6 has been established at a formerly disturbed (mining) area. As most of the Motorway route passes through agricultural lands in Section 6, potential for encountering historical soil contamination sites in this Section is evaluated to be low.

In the scope of the baseline studies for the North Marmara Motorway Project, a program of soil sampling and laboratory analysis was conducted. Sampling locations are listed in Table 6.9 and shown on the map presented in Figure 6.14. Laboratory result forms are presented in Annex-5.

Table 6.9. List of Soil Sampling Stations

Code of the Station	Location	Sampling Date	UTMWGS84 Zone35		GEOWGS84	
			X (North)	Y (East)	Longitude (N^o)	Latitude (E^o)
T4-1	Yagcilar	01.02.2017	4533177,289	706294,706	40,923700	29,449994
T4-2	Demirciler	01.02.2017	4525373,846	713863,439	40,851529	29,537113
T5-1	Akfirat	14.02.2017	4530856,748	729845,222	40,896541	29,728538
T5-2	Akfirat	05.02.2017	4530662,179	730442,827	40,894622	29,735552
T6-1	Taskisigi	13.01.2017	4525715,219	280481,605	40,853106	30,395745



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 1:Kinali-Yassioren
- Section 2: Yassioren-Odayeri
- Section 7: Habibler-Hasdal

Construction Camp Site and Quarries
- Construction Camp Site
- Limestone Quarry

Sampling Stations
- Soil Sampling Station

UTMWGS84 ZONE35

N

0 2 4 8 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Map of Soil Sampling Stations

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Figure 6.14. Map of Soil Sampling Stations

6.2.2. Geology

The information provided in this section is based on a detailed literature review of the Project route and its vicinity, reports compiled by related authorities such as the Urban Geology Report of Istanbul province and the Anatolian Side Microzonation Report both prepared by the Metropolitan Municipality of Istanbul (MMİ) and the detailed investigation reports consisting of subjects such as geology, geotechnical properties and hydrogeology, prepared separately for each section by expert geotechnical investigation firms. Baseline descriptions are provided under the following sub-topics:

- Regional geology
  - Geological setting and tectonic evolution
  - Stratigraphy

- Project area geology
  - Lithologies
  - Geotechnical characteristics
  - Seismicity and structural geology
  - Geological features with scientific and/or cultural significance

6.2.2.1. Regional Geology

Geological Setting and Tectonic Evolution

Turkey's geology, in general, is highly complex and although studied in the extent of a multitude of studies by several researchers, its main features and their relations with each other are yet to be understood clearly. On the largest scale, Turkey is separated into three main tectonic units, the Pontides, the Anatolides-Taurides and the Arabian Platform (*Ketin, 1966; from Okay, 2008*). Formerly surrounded by oceans, these tectonic units are currently separated by suture zones which mark the closing regions of these oceans. A map presenting the main tectonic units of Turkey is presented in Figure 6.15.

The Anatolides-Taurides present similarities to the continent Gondwana, however, were separated from the main mass of this continent by the southern branch of Neo-Tethys ocean. This ocean, which lies on an approximately E-W direction, at the north of African-Arabian Plates, also closed approximately during Miocene by continental collision of Anatolian Platform and Arabian Plate. Current eastern section of the Mediterranean is a remnant of this ocean. The ocean closing process is still ongoing and the active subduction zone in the Aegean Region is one of the current indicators of this condition (*Okay, 2008*).

At the end of Middle Miocene, Southern Tethis Ocean closed due to the continental collision that occurred along Bitlis-Zagros Suture Zone and also around the same time, towards south of this suture zone, the Red Sea - Aden gulf was formed, pushing the Arabian Plate towards north-northeast. These two large scale tectonic events caused the formation of North Anatolian Fault Zone (NAFZ) and East Anatolian Fault Zone (EAFZ). On the southwestern boundary of Anatolian-Aegean Plate, Aegean Region tectonic structures were also formed (due to N-S stresses) by north-northeast bound movement of the African Plate. Formation of these fault zones and tectonic structures is considered to be the beginning of Neo-tectonic period in Turkey and corresponds approximately to Late Miocene – Early Pliocene (*Okay, 2008*).

The Pontides, which is the main tectonic unit the Project route is located on, presents similarities to the continent Laurasia and corresponds to the tectonic units in the Balkans, the Caucasus and central Europe. All of these units represent the northern branch of Neo-Tethys ocean. This ocean completely disappeared during Miocene, by collision of Anatolia - Taurus Platform with Pontide Island Arc and subsequently, the Izmir-Ankara Erzincan suture zone was formed where the ocean closed (*Okay, 2008; Pourteau, 2011*). The Pontides consists of three terranes, namely the Strandja, Sakarya and Istanbul terranes, the latter being the terrane the Project route is located on (*Okay, 2008*). Other researchers also included the Istanbul terrain under the composite terrain of İstanbul-Zonguldak (*Göcüoğlu, 2010*). Details on tectonic evolution of Istanbul terrain, the terrain the Project is located on, is provided below:

- The terrain is an approximately 400 km wide, 50 km long continental fragment.

- The late Precambrian crystalline basement of the terrain is characterized by gneiss, amphibolite, metavolcanic rocks, metaophiolite and voluminous Late Precambrian granitoids (*Chen et al. 2002; Yiğitbaş et al. 2004; Ustaömer et al. 2005, from Okay, 2008*). Göncüoğlu (2010) associates the consolidation of this basement with Cadomian orogeny of Neoproterozoic era.

- At the western section of the terrane including the Project area, the early Carboniferous series of sandstones-shales comes on this Precambrian base. These units represent a deep marine turbiditic environment. The thickness of this series is over 2000 m (*Okay, 2008*).

- The Paleozoic series are overlain unconformably by Early Triassic continental clastic lithologies (*Göcüoğlu, 2010*). According to Okay (2008), the Triassic series are especially well developed in eastern İstanbul and from older to younger, consists of red sandstones with basaltic lava flows, shallow marine and then deep marine limestones and Upper Triassic deep sea sandstones and shales.

- In the eastern section of the terrane, a thick Middle Jurassic to Eocene succession is clear, whereas the Jurassic and Lower Cretaceous sequence is absent in the western section.

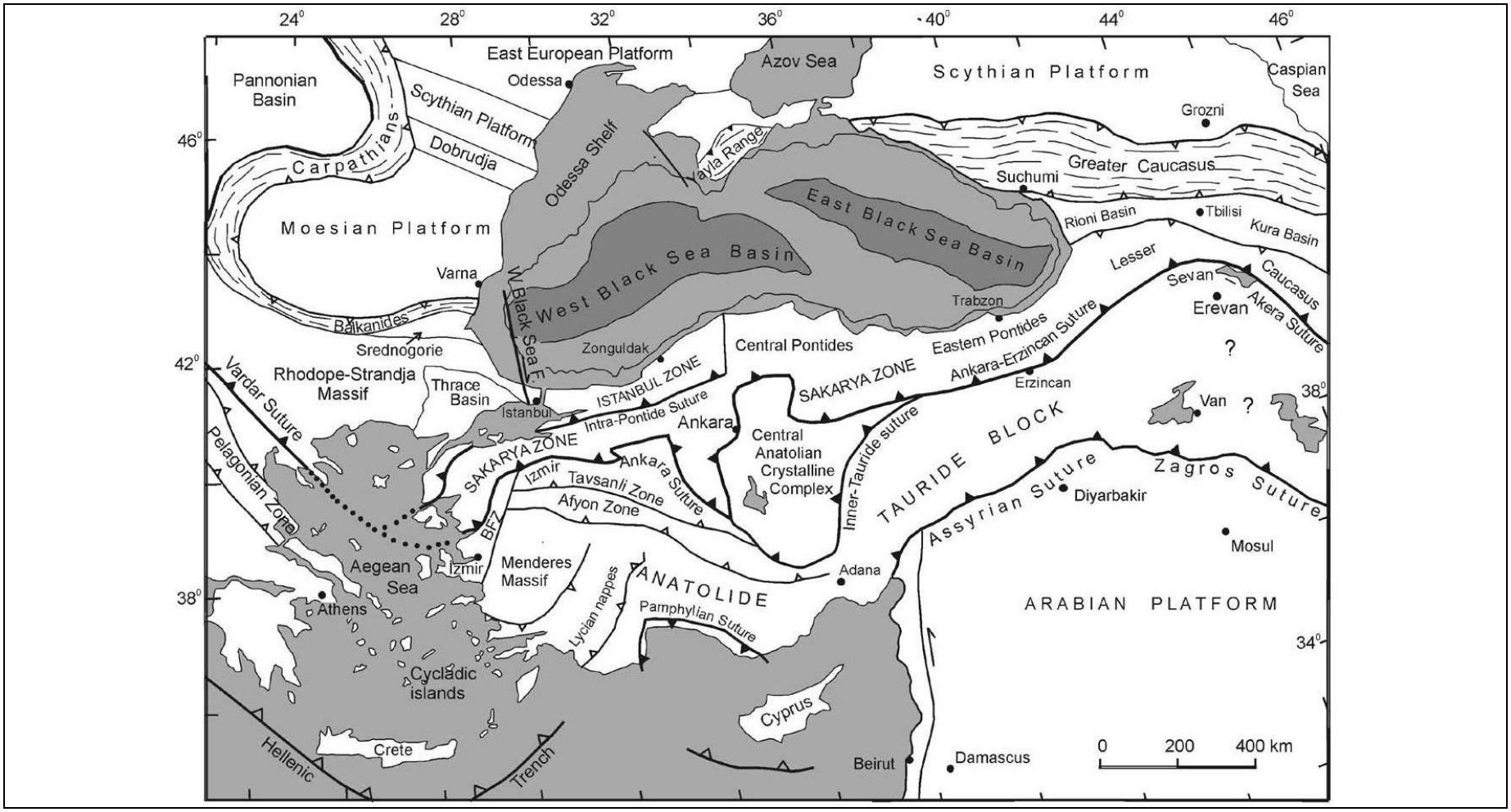


Figure 6.15. Tectonic Map of Turkey and the Region (*Okay, 2008*).

Stratigraphy

Due to its linear spatial nature expanding approximately 186,9 km length on Asian side of Istanbul, Kocaeli and Sakarya provinces, the Project is associated with significantly high number of geological units, distributed in a very complex geological setting, as described above. Therefore, for a compact yet comprehensive description of the lithologies corresponding to the exact Project route and its general area, all of the lithologies of the region are listed in Table 6.10 together with a lithology code assigned to each one, regardless of their localized relations or absence thereof. It should be noted that detailed information is only provided for stratigraphic units identified by geological/geotechnical survey reports for the Project sections.

Table 6.10. Lithologies in the Eastern Istanbul (Asian Side), Kocaeli and Sakarya Provinces

Unit Code	Name	Project Sections where the Units Exist
Istanbul Terrane Units		
IT-11.6	Bakirlikiran Fm.	
IT-11.5.4	Koytepe Member	
IT-11.5.3	Kusca Member	
IT-11.5.2	Kazmali Member	
IT-11.5.1	Ubeyli Member	
IT-11.5	Tepecik Fm	
IT-11.4.2	Sortullu Dolomite Member	
IT-11.4.1	Karabeyli Member	
IT-11.4	Ballikaya Fm	4
IT-11.3.2	Goksu Deresi Member	
IT.11.3.1	Hacilli Member	
IT-11.3	Demirciler Fm.	4
IT-11.2	Sarpdere Fm.	5, 6
IT.11.1.2	Degirmen Member	
IT-11.1.1	Yenikoy Sandstone Member	
IT-11.1	Erikli Fm.	5, 6
IT-11	Gebze Group	
IT-10.6	Kocadere Sandstone Member	
IT-10.5	Kayaran Tepe Member	
IT-10.4	Diabase Member	
IT-10.3	Karacatepe Member	
IT-10.2	Tavsancil Member	
IT-10.1	Kovanli Member	
IT-10	Kapakli Fm. (Cakraz Formation)*	4, 5, 6
IT-9	Sancaktepe Granite	4
IT-8.4	Kucukkoy Member	
IT-8.3	Kartaltepe Member	
IT-8.2	Cebecikoy Member	
IT-8.1	Acibadem Member	
IT-8	Trakya Fm.	4
IT-7.4	Baltalimani Member	
IT-7.3	Ayineburnu Member	
IT-7.2	Yorukali Member	
IT-7.1	Tuzla Member	
IT-7	Denizli Koyu Fm.	4
IT-6.2	Kozyatagi Member	
IT-6.1	Kartal Member	4
IT-6	Pendik Fm.	
IT-5.5	Soganlik Limestone Member	
IT-5.4	Sedefadasi Member	
IT-5.3	İcmeler Member	
IT-5.2	Dolayoba Member	
IT-5.1	Mollafeneri Member	

Unit Code	Name	Project Sections where the Units Exist
IT-5	Pelitli Fm. (i.e. Yumrukaya Group)*	4
IT-4.3	Seyhli Member	
IT-4.2	Umur Deresi Member	
IT-4.1	Gozdag Member	4, 5
IT-4	Yayalar Fm.	
IT-3.4	Tarla Tepe Member	
IT-3.3	Ayazma Quartizite Member	
IT-3.2	Kisikli Member	
IT-3.1	Basibuyuk Member	
IT-3	Aydos Fm.	4, 5
IT-2.2.	Manastir Tepe Member	
IT-2.1.	Gulsuyu Member	
IT-2	Kinaliada Fm.	
IT-1.2.2	Sureyyapasa Member	
IT-1.2.1	Bakacak Member	
IT-1.2	Kurtkoy Fm.	4, 5
IT-1.1	Kocatongel Fm.	4
IT-1	Polonezkoy Group	
Upper Cretaceous-Tertiary Units		
CT-7.6	Agacli Member	
CT-7.5	Sinekli Member	
CT-7.4	Cantakoy Member	
CT-7.3	Gurpinar Member	
CT-7.2	Silivri Member	
CT-7.1	Suloglu Member	
CT-7	Danismen Fm.	
CT-6	Pinarhisar Fm.	
CT-5.3	Kizilcaali Member	
CT-5.2	Yassioren Member	
CT-5.1	Balik Koyu Member	
CT-5	Ceylan Fm.	
CT-4	Sogucak Fm.	
CT-3	Koyunbaba Fm.	
CT-2	Yunuslubayir Fm.	
CT-1.4.2	Aglayankaya Member	
CT-1.4.1	İmam Tepesi Member (Caycuma Fm.)*	5, 6
CT-1.4	Sile Fm. (Atbasi Fm.)	4, 5
CT-1.3.5	Ahmetli Limestone	
CT-1.3.4	Agva Member	
CT-1.3.3	İmrenli Member	
CT-1.3.2	Bagcilar Member	
CT-1.3.1	Bucakli Member	
CT-1.3	Akveren Fm.	4, 5
CT-1.2.6	Kisirkaya Member	
CT-1.2.5	Mahmut Deresi Member	
CT-1.2.4	Bogazkoy Member	
CT-1.2.3	Zekeriyakoy Member	
CT-1.2.2	Degirmen Sirti Tuff Member	
CT-1.2.1	İmrendere Member	
CT-1.2	Garipce Fm.	
CT-1.1.5	Celebi Member	
CT-1.1.4	Suayipli Member	
CT-1.1.3	Akcakese Member	
CT-1.1.2	Sogullu Member	
CT-1.1.1	Edeyli Member	
CT-1.1	Bozhane Fm.	
CT-1	Sariyer Group	
Neogene Units		
N-8	Quaternary Units	4, 5, 6
N-7	Orencik Formation	6
N-6	Kusdili Fm.	
N-5	Domuz Dresesi Fm	
N-4	Alacali Sandstıne	
N-3.5	İkizlertepe Member	

Unit Code	Name	Project Sections where the Units Exist
N-3.4	Altintepe Member	
N-3.3	Tuglacibasi Member	
N-3.2	Dudullu Member	
N-3.1	Orhanli Member	
N-3	Sultanbeyli Fm.	
N-2.3	Bakirkoy Member	
N-2.2	Gungoren Member	
N-2.1	Cukurcesme Member	
N-2	Cekmece Fm.	
N1.3	Mese Tepesi Member	
N1.2	Kayali Tepe Member	
N1.1	Kirac Member	
N-1	Istanbul Fm. (Kayalıtepe Fm.)*	4, 5

**Units listed inside paranthesis are not included as part of these series, but are equivalent of the units they are mentioned together with, in terms of lithology, deposition age and deposition environment.*

Istanbul Terrane Units

Kocatongel Formation (Unit Code: IT-1.1) consists of green, greenish brown claystones and loams with sandstone interlayers to a lesser extent. The formation's base is not exposed and therefore, its deposition age is estimated to be Early Ordovician due to the fact that it is covered transitionally by Bakacak Member of Kurtkoy Formation.

Kurtkoy Formation (Unit Code: IT-1.2) has two members. The lower sections of the formation with purplish, light purplish loam alternation and some sandstone intercalations is called the Bakacak Member, whereas its upper sections with dark purple sandstones is called Sureyyapasa member. The formation is aged Lower Ordovician.

Aydos Formation (Unit Code: IT-3) consists dominantly of quartzites and with some gravelstone lenses and layers at lower sections and varying ratios of clayey loams and shales. Due to its transitive contact with Lower Silurian, the formation's age was determined indirectly as Lower Ordovician.

Gozdag Member of Yayalar Formation (Unit Code: IT-4.1) constitutes of a large section of Yayalar formation. Its dominant lithology is micaceous sandstones. Depending on its macrofossil content, its deposition age was determined to be Early Silurian.

Pelitli Formation (Unit Code: IT-5) upper and lower sections show some differences. The ppper Silurian Pelitli Formation consists mainly of limestones with varying degrees of clay intercalations. The lower sections start with reef and shallow marine limestones and transitions to nodal limestones are seen towards upper sections.

Kartal Member of Pendik Formation (Unit Code: IT-6.1) consists dominantly of highly micaceous, light brown clastics. Especially based on its conodont and ostracod fossil contents, its age was determined as Late Emsian (Early Devonian).

Denizli Koyu Formation (Unit Code: IT-7) is a Middle Devonian-Early Carboniferous formation and consists mainly of limestoens, clayey limestones, nodular limestones and lyddites with some shale intercalations.

Trakya Formation (Unit Code: IT-8) consists of sandstone, loam, shale and gravelstone alternations. The formation also has some limestone intercalations and lenses of varying thicknesses at its lower sections. Its fossil content indicates a deposition age of Early Carboniferous.

Sancaktepe Granite (Unite Code: IT-9) is a permian aged, highly arenized granite unit and has extrusions in Kocatongel and Kurtkoy formations. Mainly consisting of quartz, feldspar, biotit and opaque minerals, the granite also has plagioclase and orthoclase minerals that give it a specked appearance.

Kapakli Formation (corresponds to Western Black Sea Region's Cakraz Formation) (Unit Code: IT-10) consists of terrestrial, reddish gravelstones and sandstones with some volcanic intercalations. The formation's first deposition age is determined to be Late Permian.

Erikli Formation (Unit Code: IT-11.1) consists of quartzwacke-quartzarenite sandstone-loam with shale intercalations, as well as some gravelstones and dolomitic limestones to a lesser extent. It is determined to be Early Triassic aged, depending on its stratigraphic position.

Sarpdere Formation (Unit Code: IT-11.2) has alternations of shales, fine grained sandstones and limestones constitutes as the dominant rock types of the formation. It has a gradual transition with Erikli Formation below, whereas is covered by Late Cretaceous deposits with unconformity above and is considered to be Early Triassic aged.

Demirciler Formation (Unit Code: IT-11.3) consists dominantly of and alternation of sandstones, shale intercalated limestones and clayey limestones. The microfauna identified in the formation indicates an Early Triassic age.

Ballikaya Formation (Unit Code: IT-11.4) consists of a thick carbonate deposition of limestones, dolomitic limestones and dolomites deposited in Early Triassic.

Upper Cretaceous Tertiary Units

Akveren Formation (Unit Code: CT-1.3) consists mainly of limestones and calcarenites with algae and benthic foraminifer content. Its lower sections also have varying degrees of limestone, marl and claystone intercalations. The fossil content indicates a deposition timeframe of Late Campanian to Late Paleocene.

Sile Formation (Unit Code: CT-1.4) is a claystone, lome, sandstone debris flow unit, which is also investigated under the name "Sile Sedimentary Melange" and "Sile Olistostrome". Its nanoplankton content indicates Ypresian (early Eocene) deposition.

Imam Tepesi Member (Caycuma Fm.) (Unit Code: CT 1.4.1) is the lower section of Sile Formation that consists mainly of detritic claystones, loams and sandstones with Early Eocene age.

Neogene Units

Istanbul Formation (Kayalitepe Formation) (Unit Code: N-1), as its name suggests, covers large areas in both sides of the Bosporus and consists of terrestrial, seasonal flood, river, lake and lagoon deposits. Due to these vast number of lithology types in the formation, its age is determined to vary between Late Oligocene-Middle Miocene.

Orencik Formation (Unit Code: N-7) consists of loosely cemented, round to semi-round, brown, grey and green colored gravelstones, gravelly sandstones, sandstones, siltstones, claystones and marls. Its gravelstones have poor sorting, whereas its sandstones are in lenses. The Pliocene aged formation covers all older units with angular unconformity.

Quaternary Units (Unit Code: N-9) consists of uncemented alluvials, slope wash and dunes.

6.2.2.2. Project Area Geology

Lithologies

Section 4

Identified lithologies in the main route and connection routes of Section 4 of the Project are listed below:

- Kocatongel Formation (Unit Code: IT-1.1)
- Kurtkoy Formation (Unit Code: IT-1.4)
- Aydos Formation (Unit Code: IT-3)
- Gozdag Member of Yayalar Formation (Unit Code: IT-4.1)
- Pelitli Formation (also called Yumrukaya Group) (Unit Code: IT-5)
- Kartal Member of Pendik Formation (Unit Code: IT-6.1)
- Denizli Koyu Formation (Unit Code: IT-7)
- Trakya Formation (Unit Code: IT-8)
- Sancaktepe Granite (Unit Code: IT-9)
- Kapakli Formation (Unit Code: IT-10)
- Demirciler Formation (Unit Code: IT-11.3)
- Ballikaya Formation (Unit Code: IT-11.4)
- Akveren Formation (Unit Code: CT-1.3)
- Sile Formation’s claystone sandstone series also investigated under the seperate name Atbasi Formation (Unit Code: CT-1.4)
- İstanbul Formation (also called Kayalitepe Formation) (Unit Code: N 1.2)
- Quaternary Units (Unit Code: N8)

Section 5

Identified lithologies in the main route and connection routes of Section 5 of the Project are listed below:

- Gozdag Member of Yayalar Formation (Unit Code: IT-4.1)
- Kapakli Formation (Unit Code: IT-10)
- Erikli Formation (Unit Code: IT-11.1)
- Sarpdere Formation (Unit Code: IT-11.2)
- Quaternary Units (Unit Code: N8)
- Akveren Formation (Unit Code: CT-1.3)
- Sile Formation's claystone sandstone series, also investigated under the seperate name Atbasi Formation (Unit Code: CT-1.4)
- Sile Formation's Imam Tepesi Member, also investigated under the separate name Caycuma Formation) (Unit Code: CT-1.4.1)
- İstanbul Formation (also called Kayalitepe Formation) (Unit Code: N 1.2)
- Kurtkoy Formation (Unit Code: IT-1.4)

Section 6

Identified lithologies in the main route and connection routes of Section 6 of the Project are listed below:

- Kapakli Formation (in Section 6, this formation corresponds to Cakraz Formation, the equivalent of Kapakli Formation in western Black Sea Region) (Unit Code: IT-10)
- Erikli Formation (Unit Code: IT-11.1)
- Sarpdere Formation (Unit Code: IT-11.2)
- Sile Formation's Imam Tepesi Member, also investigated under the separate name Caycuma Formation) (Unit Code: CT-1.4.1)
- Orencik Formation (Unit Code: N7)
- Quaternary Units (Unit Code: N8)

Geotechnical Characteristics

Section 4

The information provided here is based on Northern Marmara Highway KM: 129+650-151+500 (Section-4) Project Geological, Geotechnical Survey Report. The studies conducted in the scope of detailed site investigations and laboratory tests, which constitute a basis for safe design and construction of multiple cut and fill works, tunnels, viaducts, bridges, overpasses and underpasses included in this section are as follows:

- Identification of lithologies
- 175 drills with a total of approximately 3775 m depth for identification of various geotechnical characteristics

- Water content, dry unit weight, grain size analysis, Atterberg limits, unconfined compression tests, triaxial compression tests, consolidation tests, uniaxial compression tests, point load tests, identification of USCS Soil Classes, Poisson ratio, water absorption characteristics and porosity characteristics for relevant lithologies
- Identification of design parameters (uniaxial compression strength, geological strength index, material constant, degradation factor, elasticity modulus, unit weight, Hoek-Brown strength parameters and deformation modulus) and rock mass rating (RMR) for lithologies,
- Identification of suitability of materials to be used for fill works

The findings of the geological and geotechnical surveys can be summarized as follows:

- No structural elements that may cause geotechnical problems have been identified.
- No areas prone to landslide risk have been identified.
- No areas with weak rock properties that may cause geotechnical problems have been identified.
- There are a total of 30 fills with heights more than 8 m and a total of 20 cuts with heights more than 15 m. Based on worst case scenario estimations, no stability problem is expected for these cut and fill structures. Slope angles for cut and fill structures were all identified with numerical computation methods and identified angles are on the safe side. Furthermore, retainer walls at slope bases have been proposed to collect any debris, in addition to intercepting trenches, side slopes and horizontal drains, to divert groundwater.
- For any cut and fill structure with more than 5 m height, an appropriate granular material will be selected to constitute the base.
- Settling and bearing capacity problems maybe encountered especially at route sections with high plasticity, clayey-silty alluvial soils and therefore application of stabilization techniques to be determined by further geotechnical drills, such as rock fills, jet-grouting and concrete columns might be required.

Section 5

The information provided here is based on Northern Marmara Highway 151+500-188+300 (Section-5) Preliminary Geological Geotechnical Survey Program. The studies to be conducted in the scope of detailed site investigations which constitute a basis for safe design and construction of multiple cut and fill works, tunnels, viaducts, bridges, overpasses and underpasses will include the following data and information:

- Identification of lithologies
- 242 drills for identification of various geotechnical characteristics
- Water content, dry unit weight, grain size analysis, Atterberg limits, unconfined compression tests, triaxial compression tests, consolidation tests, uniaxial compression tests, point load tests, identification of USCS Soil Classes,

Poisson ratio, water absorption characteristics and porosity characteristics for relevant lithologies,

- Identification of design parameters (uniaxial compression strength, geological strength index, material constant, degradation factor, elasticity modulus, unit weight, Hoek-Brown strength parameters and deformation modulus) and rock mass rating (RMR) for lithologies,
- Identification of suitability of materials to be used for fill works

Section 6

The information provided here is based on Northern Marmara Highway KM: 188+184-251+111 (Section-6) Project Geological, Geotechnical Survey Report. The studies conducted in the scope of detailed site investigations and laboratory tests that constitute a basis for safe design and construction of multiple cut and fill works, tunnels, viaducts, bridges, overpasses and underpasses included in this section are as follows:

- Identification of lithologies,
- 528 drills with a total of approximately 8418 m depth for identification of various geotechnical characteristics
- Water content, dry unit weight, grain size analysis, Atterberg limits, unconfined compression tests, triaxial compression tests, consolidation tests, uniaxial compression tests, point load tests, identification of USCS Soil Classes, Poisson ratio, water absorption characteristics and porosity characteristics for relevant lithologies
- Identification of design parameters (uniaxial compression strength, geological strength index, material constant, degradation factor, elasticity modulus, unit weight, Hoek-Brown strength parameters and deformation modulus) and rock mass rating (RMR) for lithologies
- Identification of suitability of materials to be used for fill works

The Report's findings are summarized below:

- No structural elements that may cause geotechnical problems have been identified.
- According to the 1/500.000 scale MTA Landslide Risk Map (see Annex-2.10), an active landslide zone exists between Km 203+850 – Km 203+910. All required investigations have been completed for this section of the highway and necessary solutions will be proposed in the "Geotechnical Project Report".
- No areas with weak rock properties that may cause geotechnical problems have been identified.

- There are a total of 51 fills with heights more than 8 m and a total of 37 cuts with heights more than 15 m. Based on worst case scenario estimations, no stability problem is expected for these cut and fill structures. Slope angles for cut and fill structures were all identified with numerical computation methods and identified angles are on the safe side. Furthermore, retainer walls at slope bases have been proposed to collect any debris, in addition to intercepting trenches, side slopes and horizontal drains to divert groundwater.
- For any cut and fill structure with more than 5 m height, an appropriate granular material will be selected to constitute the base.
- Settling and bearing capacity problems maybe encountered especially at route sections with high plasticity, clayey-silty alluvial soils and therefore application of stabilization techniques to be determined by geotechnical drills, such as rock fills, jet-grouting and concrete columns may also be required.

Seismicity and Structural Geology

Turkey is located in one of the most actively deforming regions in the world. The tectonic in and around Turkey depends on relative motions between the African, the Aegean, the Arabian, the Anatolian, the Black Sea and the Eurasian plates. Neotectonics in Trkey are mainly governed by the following three tectonic elements (*Kasapoğlu and Toksöz, 1983; Bozkurt, 2001; from Bayrak et. Al. 2011*):

- A convergent plate boundary where the African Plate to the south is subducting beneath the Anatolian Plate to the north
- The dextral North Anatolian Fault Zone
- The sinistral East Anatolian Fault Zone

Of these, the faults of the North Anatolian Fault Zone (NAFZ) are also the most prominent and effective faults in the Project area, as well as generally in the entire Marmara Region, making the region one of the most seismically active in Turkey with nine high magnitude (Mw ≥ 7,0) events in the past century (*Kalkan et. Al., 2007*). Bozkurt (*2001*) states that the NAFZ, a 1200-km-long and broad arc-shaped dextral strike-slip fault zone, is actually one of the most seismoactive fault zones in the world (*Bayrak et. Al., 2011*). Earthquakes in the region, with a magnitude of M ≥ 7,0 are listed in Table 6.11. In line with the above-mentioned information and as can be seen from Figure 6.16, where epicenters of the earthquakes that caused damage in Turkey are plotted, Marmara region is an area where earthquakes with damage are highly concentrated.

An approximately 150 km long section of the NAFZ, corresponding to the main Marmara Fault (MMF) is currently a seismic gap and studies conducted following the 7,4 Mw 1999 Kocaeli and 7,2 Mw Duzce earthquakes indicated that occurrence probability of a Mw>=7,0 magnitude earthquake is 65% (*Erdik et. Al, 2004; Schmittbuhl et. Al., 2016*).

Table 6.11. M ≥ 5 Earthquakes in the Region

No	Date	Latitude	Longitude	Ms
1	15.04.1905	40.20	29.00	5,6
2	22.10.1905	41.00	31.00	5,2
3	21.08.1907	40.70	30.10	5,5
4	09.08.1912	40.60	27.20	7,3
5	10.08.1912	40.60	27.10	6,3
6	10.08.1912	40.60	27.10	5,3
7	11.08.1912	40.60	27.20	5,0
8	13.09.1912	40.70	27.00	6,9
9	10.04.1917	40.60	27.10	5,3
10	16.12.1926	40.13	30.72	5,7
11	24.01.1928	40.99	30.86	5,3
12	04.01.1935	40.70	27.47	6,4
13	04.01.1935	40.37	27.17	5,6
14	04.01.1935	40.65	27.35	6,3
15	22.10.1935	40.31	27.21	5,2
16	02.07.1938	40.17	27.88	5,0
17	16.06.1942	40.80	27.80	5,6
18	20.06.1943	40.85	30.51	6,6
19	20.06.1943	40.84	30.73	5,5
20	13.11.1948	40.23	29.02	5,6
21	15.09.1951	40.15	28.02	5,0
22	03.06.1953	40.28	28.53	5,3
23	18.03.1953	40.01	27.49	7,2
24	23.03.1954	40.50	27.50	5,0
25	06.01.1956	40.39	26.29	5,5
26	26.05.1957	40.58	31.00	7,0
27	26.05.1957	40.60	30.74	5,4
28	26.05.1957	40.76	30.81	5,9
29	27.05.1957	40.73	30.95	5,8
30	01.06.1957	40.75	30.86	5,0
31	26.12.1957	40.83	29.72	5,2
32	26.07.1959	40.91	27.54	5,4
33	29.03.1963	40.29	26.15	5,1
34	18.09.1963	40.77	29.12	6,3
35	06.10.1964	40.24	28.16	5,1
36	06.10.1964	40.20	28.20	6,8
37	23.08.1965	40.51	26.17	5,6
38	21.08.1966	40.33	27.40	5,5
39	22.07.1967	40.57	30.80	6,9
40	22.07.1967	40.66	30.62	5,1
41	22.07.1967	40.72	30.51	5,0
42	30.07.1967	40.63	30.53	5,6
43	03.03.1969	40.08	27.50	5,7
44	17.03.1975	40.48	26.08	5,8
45	27.03.1975	40.45	26.12	6,7
46	05.07.1983	40.33	27.21	5,8
47	17.08.1999	40.73	29.97	7,8
48	17.08.1999	40.59	30.62	5,3
49	19.08.1999	40.65	29.09	5,0
50	31.08.1999	40.74	29.97	5,0
51	13.09.1999	40.76	30.08	5,8
52	29.09.1999	40.71	29.30	5,0
53	11.11.1999	40.78	30.29	5,5
54	20.10.2006	40.24	27.98	5,0
55	24.10.2006	40.41	28.99	5,0

Source: The Preliminary Project Geological, Hydrogeological and Engineering Geology Investigation Report of Northern Marmara Motorway KM: 129+650-151+500

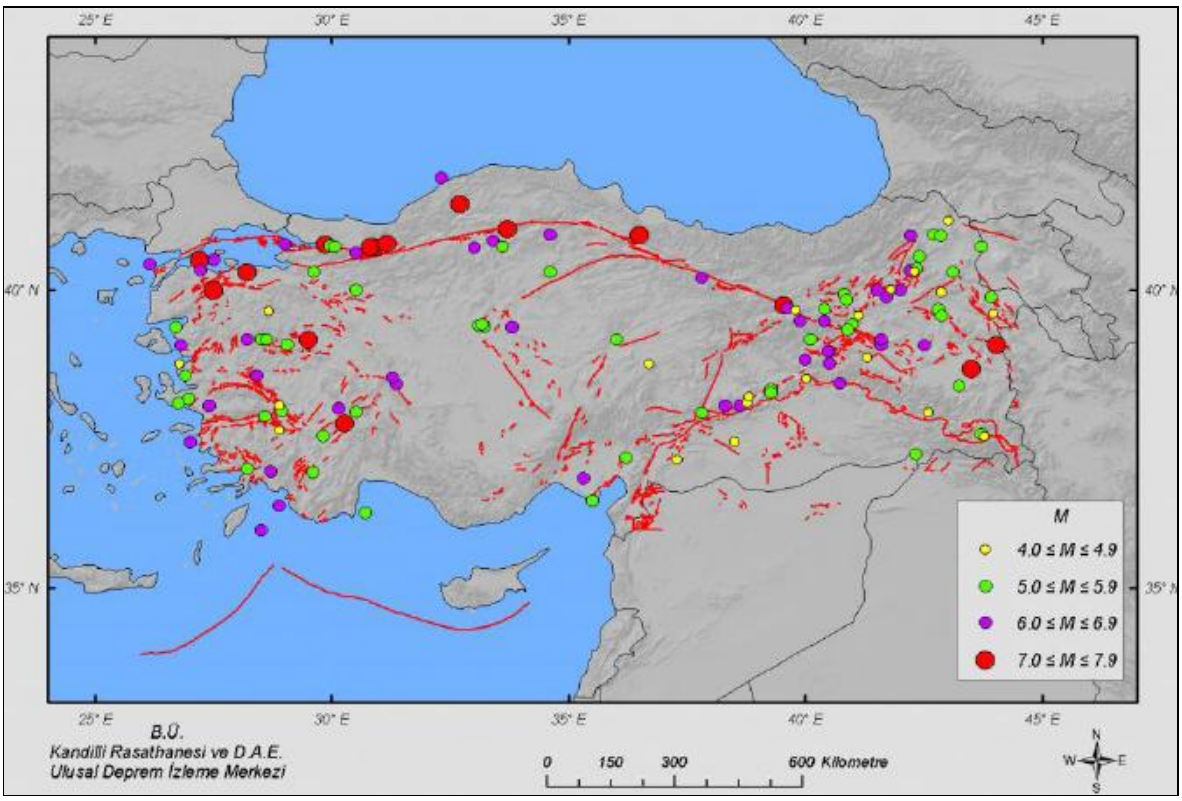


Figure 6.16. Earthquakes with Material Damage (1900-2009) (http://www.koeri.boun.edu.tr/)

Summary descriptions of other faults are presented below (*IBB, 2011*):

- Sariyer-Sile Fault: This NW-SE oriented strike-slip fault lies in an approximate orientation starting from Sile district on the Asian side to Sariyer district on the European side.

- Maltepe-Beykoz Fault: NW-SE oriented strike-slip fault lies in an approximate orientation between Maltepe and Beykoz districts.

- Yakacik Fault: Located adjacent to SW of Aydos mountain, this fault is generally covered with slope wash and therefore definitive information about its strike, dip and other features are not known.

- Catalca Fault: A normal fault with a NW-SE orientation, the fault is located at the eastern and western boundaries of the Catalca Massive.

- Albeykoy Fault: Forming the Alibey River valley and its upstream section called the Pirinçci valley, this NW-SE oriented fault and subsequent drainage pattern was developed due to N-S compressive movements during the Oligocene. It is controlled by weak zones due to conjugated faults and joints.

- Sazlidere Fault: Oriented in the same direction as Catalca Fault and Alibeykoy fault, Sazlidere fault forms the Sazlidere valley and its tributaries.

- Kurna Koyu-Emirli Fault: This strike-slip fault constitutes the border between the Ordovician Kurtkoy and Yayalar Formation with the Lower-Middle Devonian Kartal Formation. It is located to the east of Omerli Dam Lake and to east of Kurna and Emirli villages.

- NE-SW and NW-SE Striking Shearing Faults: Formed as a result of the N-S oriented compression regime during the Oligocene, these faults constitute the valleys of various larger rivers.

- Darica –Tuzla Fault: Not visible on the surface, this approximately 14 km long, NW-SE oriented fault is either a normal fault or is slightly oblique. The fault is located N-NE of Darica and Tuzla peninsulas.

As can be seen in the combined earthquake zones map of Istanbul, Kocaeli and Sakarya provinces presented in Figure 6.17, the entire Project area is located on a 1st degree earthquake zone, which represents the highest risk potential of the 5 zones identified by the map. As can be seen in Figure 6.18, NAFZ faults are located close to the Project area. The nearest location to the fault zone is Kartepe District of Kocaeli Province which is located at the north of the fault zone, approximately 2.5 km away. The other close location to the fault zone is the port connection road (KM: 11+700) that is located at the north of the fault zone at approximately 10 km distance.

Geological Features with Scientific and/or Cultural Significance

By review of the proposed geological heritage list of Turkey, published by the Turkish Association for Geological Heritage Protection, the following sites were identified in the vicinity of the Project route:

- Sogutlu Cave: This cave is located adjacent to Sakarya River, in Sogutlu district of Sakarya province and presents some distinct stalactite and stalagmite formations consisting of the Devionian aged dolomites and dolomitic limestones. Distance of the closest point of the Project route to the cave is approximately 15 km.

- Yukari Hereke Village Permian/Triassic Unconformity: Seperating red continental clastics of Permian rocks from overlying marine triassic sequence, the unconformity is one of the best examples of this type of unconformity and has scientific importance in terms of site geology lectures for geology students. The unconformity lies in Yukari Hereke neighborhood of Kocaeli province and its distance to the closest point of the Project route is approximately 11 km.

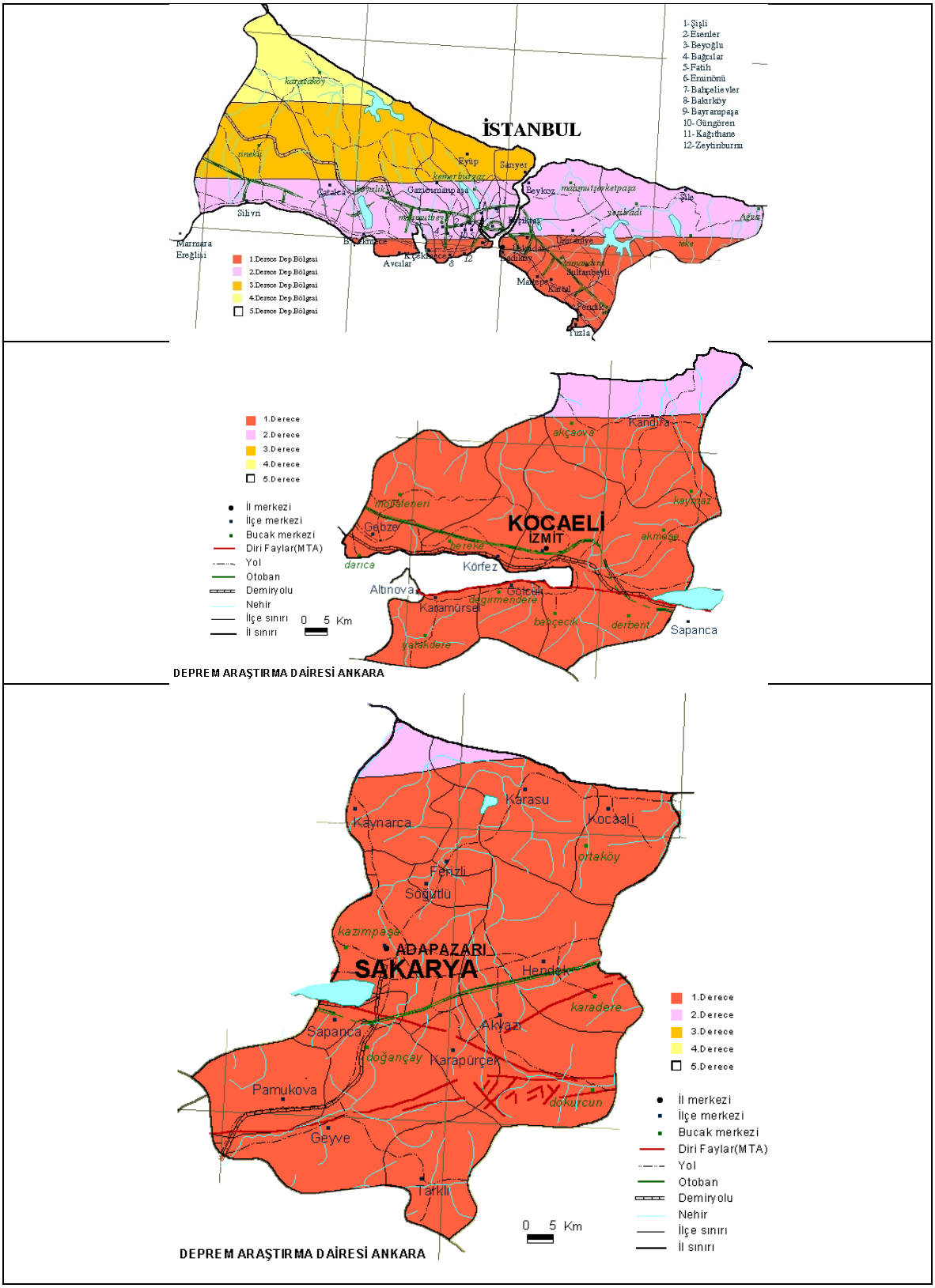


Figure 6.17. Earthquake Zones Map for Istanbul, Kocaeli and Sakarya Provinces

Figure 6.18. Active Fault Map of the Project Area and its General Region (*yerbilimleri.mta.gov.tr*)

6.3. Potential Impacts

Direct impacts on topography and soil and geotechnical risks will be a concern mainly during the construction phase of the Project since the operation activities will not include direct and/or extensive physical interaction with the environmental components. Risk of soil contamination due to accidents and geotechnical and seismic risks would be of the primary concern for the operation phase. Assessment of the impacts for the land preparation and construction and operation phases, in consideration of the baseline conditions, is provided in the following headings.

6.3.1. Land Preparation and Construction Phase

The Project will involve significant earth moving activities and civil works in the construction phase. In this scope, top soil stripping activities, cut and fill operations and other construction works (i.e. tunnel boring) may cause impacts on the existing soil conditions if not properly mitigated. Additionally, geotechnical risks along the Motorway route has to be accurately identified to ensure safety and stability of the large Project structures to be constructed. Mitigation measures will be taken in order to minimize the risk of erosion, geotechnical risks and risk of soil contamination during the activities due to any spill or leakage.

6.3.1.1. Impacts on Topographical Conditions

Topographical conditions play an important role on the design and construction of the Motorway as the cut and fill planning; design and construction of the road alignment (i.e. curves) and the engineering structures (i.e. tunnels, viaducts, excavations, embankments, etc.); measures to be taken against the geotechnical risks such as landslide, etc. are all in direct relation with the topography. In addition, operation and maintenance costs are also affected by the topographical conditions of the selected route.

Excavations (cut) and embankment (fill) operations to be done to cope with the topographical conditions along the selected Motorway route will result in permanent changes in the topography throughout the entire alignment. Excavation and fill volumes estimated for each section of the Motorway is listed in Table 6.12.

Table 6.12. Excavation and Fill Volumes for the Asian Sections

Section	Excavation-Fill Balance			Management of Excavated Material	
	Excavation (m^3)	Fill (m^3)	Balance (Excavation-Fill) (m^3)	Amount to be Reused (%)	Amount to be Stored (%)
Section 4	25.363.345,58	28.835.526,57	-3.472.180,99	70	30
Section 5	16.996.901,04	19.307.395,79	-2.310.494,75	70	30
Section 6	24.653.458,16	25.281.784,64	-628.326,48	50	50
Grand Total	**67.013.704,78**	**73.424.706,99**	**-6.411.002,21**	**63**	**37**

6.3.1.2. Impacts on Soil Environment

Potential impacts of the land preparation and construction activities on the soil environment may include soil disturbance (e.g. loss of fertile top layer, mixing of soil layers and types, soil compaction, etc.) due to top soil stripping, cut and fill operations, construction of road structures and extraction of construction materials at the quarry sites; soil erosion and soil contamination due to unexpected leakages or spills. As the Motorway's Asian sections will be constructed along a long route of 186,9 km and significant volumes of the earthworks will be conducted in the scope of the Project, relevant measures have to be taken to avoid significant impacts on the soil environment. Further evaluation of the potential impacts is provided in the following paragraphs.

Soil Disturbance due to Earthworks, Construction and Materials Extraction

Soil disturbance will occur at all sites where top soil stripping, excavation, construction activities including operation of heavy machinery and materials extraction operations will be conducted. Since Taskisigi Camp Site and Taskisigi 1-2 quarries are located on already disturbed areas, soil disturbance at these sites will be limited. On the other hand, Kutluca and Taskisigi-4 quarries are new sites, thus additional impacts on soils will occur at these sites.

Top Soil Stripping

Top soil corresponding to the footprint of the Project components (road body, excavation and embankment sites, engineering structures, quarries etc.) will stripped to a sufficient depth (may change between 5 to 40 cm depending on local soil conditions) prior to the start of construction activities. Average top soil thickness for forestlands, agricultural lands and pasturelands/steppes have been previously identified in Table 6.8. Table 6.13 presents the estimated amount of top soil to be stripped from Project sites. Since Construction Camp Sites have already been established, these sites have not been included in the assessment.

If not properly managed, top soil itself or its vegetative properties along the Motorway route may be lost throughout the construction phase due to erosion or mixing with coarse or contaminated soils. Thus, top soil management measures have to be applied in the scope of the Project as described in the following sections.

Table 6.13. Top Soil Volume Estimated to be Stripped from Project Sites

Section	Top Soil Thickness (m)			Corresponding Area (m^2)			Estimated Volume of Corresponding Top Soil (m^3)			
	Agricultural	Forest	Pasture/ Steppe	Agricultural	Forest	Pasture/ Steppe	Agricultural	Forest	Pasture/ Steppe	Total (m^3)
Road body, Quarries, Excavated Material Storage Sites										
Section 4	0,25	0,15	0,075	3.582.000	6.810.000	0	895.500	1.021.500	0	1.917.000
Section 5				3.212.000	6.474.000	0	803.000	971.100	0	1.774.100
Section 6				8.187.000	3.955.000	149.000	2.046.750	593.250	11.175	2.662.350
Total				**14.981.000**	**17.239.000**	**149.000**	**3.745.250**	**2.585.850**	**11.175**	**6.342.275**

**Excavated storage sites for Section 6 are yet to be identified.*

Cut and Fill Operations

Depending on the topographical conditions, excavation and fill works will be conducted along the Motorway route and at the foundations/portals of the engineering structures. Excavation works to be conducted in this scope is summarized below:

- Excavations to be done along the Motorway route in order to develop road body;
- Excavations to be done in order to remove weak soils corresponding to the road base;
- Excavations to be done at material borrow sites to provide fill material;
- Excavations to be done to prepare foundations of the engineering structures, drainage structures, etc. to be constructed.

Excavation and fill amount have been given previously in Table 6.13. As can be seen, soils corresponding to the Project area will be disturbed by the excavation and fill works that will be conducted throughout a long route (186,9 km in the Asian side) and in large volumes. Depending on the quality and quantity of the excavated materials, they will be used as fill materials as suitable.

Soil Erosion

Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities (*IFC, 2007. General EHS Guidelines*). If not properly mitigated, the North Marmara Motorway Project may accelerate the natural soil erosion processes as a result of the changes it will cause on the land use patterns and vegetative cover along its route and at other working sites (i.e. construction camp sites, quarries, material borrow sites, excavated material storage areas). This will not only result in the loss of soils but also increase the turbidity of surface water resources through stormwater runoff. Accordingly, potential impacts that may be triggered by increased soil erosion rates would include the following:

- Loss of top soil and reduced agricultural productivity;
- Sediment mobilization and transport resulting in sedimentation of surface drainage networks;
- Reduced quality of nearby water resources/aquatic habitats due to sedimentation;
- Increased risk for landslides.

The North Marmara Motorway Project will result(have resulted in the removal of vegetative cover along its 186,9 km Asian route and also at quarries, material borrow sites and excavated material storage sites. The earthworks and construction activities will be conducted within the expropriation corridor, which will have a width of 100 to 350 m, but the direct physical interaction with soils will occur at the footprint of the Project components (i.e. road body, portals and foundations of engineering structures, etc.).

The potential impacts of soil erosion on the receptors/resources will vary depending on the existing exposure levels of soils. As can be seen from Table 6.5, Section 4 and Section 5 will be more sensitive in terms of soil erosion impact as erosion levels at around %83 and 64% of the area within the study corridor in these sections are classified as “severe”. The amount of soils that will be mobilized will depend on the construction techniques.

Soil Contamination

Soil contamination may occur in several ways during the land preparation and construction phase (e.g. construction and materials extraction works) of the Project as described by Joint Assistance to Support Projects in European Regions (*JASPERS, 2010*) in the Sectoral EIA Guideline for Motorway and Road Construction Projects. This may contribute to any historical contamination present at the works sites or deposition of pollutant substances (SO_2, NO_x and heavy metals) that occur by means of rain and snowfalls. Potential sources of soil contamination for the Project, for which mitigation measures will be developed and taken, are listed below (*JASPERS, 2010*):

- Spreading on and infiltration in soil of pollutant substances as result of uncontrolled or accidental discharges, spills or leakage of hydro-carbons (oils, lubricants, fuels, dyes, solvents) along the Motorway construction corridor (i.e. from construction machinery) and at work sites including asphalt plants, concrete plants, etc. during transfer, mixing, storage or use of substances;
- On soil deposition of dust possibly contaminated with other air pollutants resulting from earthworks, loading and unloading of raw materials, construction traffic, asphalt plants, concrete plants, etc.;
- On soil spreading of leakage from sewerage network and of water loaded with binders, cement milk and suspensions from the platforms of concrete plants or from the locations where concrete is used;
- Infiltration in soil of leachate from uncontrolled deposits of wastes and construction materials.

It is not possible to estimate the amount and frequency of accidental spills or leakage of hazardous substances due to the nature of the contamination process. It is anticipated that the incidents would take place only occasionally and since response measures will be taken immediately, any spill or leakage would be ceased before it reaches significant amounts. It should be noted that, due to its nature, the Project will not involve use of hazardous materials in significant amounts thus magnitude of any spill or leakage at one time would be limited.

Contaminated Lands

Land is considered contaminated when it contains hazardous materials or oil concentrations above background or naturally occurring levels due to historic activities. Contaminated lands map pose risks to the health of construction workforce and ecology. Besides, they may bring liabilities (e.g. cost of remediation, damage of business reputation and/or business-community relations) to the business owner planning activities on such sites (*IFC, April 2007*).

As mentioned under baseline conditions, sites potentially contaminated due to former mining and waste disposal activities are present within the Project area (in Section 4 next KM 140 and at certain parts of Liman Access Road, in Section 6 near Durhasan and at Taskisigi Camp and quarries 1-2).

6.3.1.3. Geological and Geotechnical Risks

The geotechnical and geological investigations of the baseline are conducted to ensure the requirements for stability of the road during the construction and operation phase and that the route selection process reflected these characteristics. Geotechnical assessments are also required to assess stability, settlement and integrity of the designed structures. Thus, the significance of instability and erosion potential of soils is first and foremost defined by the various applicable minimum design factors and the corresponding geological and geotechnical properties required to achieve the design standards. From a purely environmental perspective, main concerns would be related to soil erosion so that local environmental quality is not affected adversely.

Stability and Landslide Risks

The geotechnical studies for Section 1, 2 and 7 are ongoing and any geological or geotechnical risks would be identified as a result of these studies.

Seismic Risk

The Project route is passing through 2nd and 3rd degree earthquake zones, which represent the second and third highest risk areas (among 5 zones identified for Turkey). In the European part the only active faults located close to the project route are North Anatolian Fault Zone (NAFZ) faults located under Marmara Sea. European part of the project route (including sections 1, 2 and 7) is passing at the northern part of the residential zones of Istanbul, also located at the north of the NAFZ. Therefore, the nearest point of the project is at least 25 km away from the fault zone.

Consequently, seismic protection is one of the most critical design issues for the Motorway. Detailed investigations were conducted for assessing the stability conditions for the structural elements for both normal operation loads and under seismic loads. The Motorway is required to be designed and built to stringent Turkish and international engineering standards that will minimize the potential damage in event of an earthquake. In the design of the engineering structures, the Standard Specifications for Highway Bridges published by the American Association of State Highway and Transportation Officials (AASHTO) has been used. In the seismic calculations, the Standard Specifications used for the seismic design of the highway bridges has been taken as basis. Where required, Project-specific revisions have been/would be done with the approval of KGM to adequately adapt these specifications to the Project.

6.3.2. Operation Phase

In the operation phase, the activities will not involve any additional physical interaction thus no additional significant direct impact on topography, soils and geological conditions is anticipated under normal operating conditions.

On the other hand, soil contamination risks may be sourced from the improper handling of the hazardous materials to be used in the road maintenance activities and leakage/spill of fuels, chemicals, etc. during the unexpected accidents. The associated impacts would be similar to the impacts described for the construction phase and a similar mitigation strategy would be adopted for the mitigation of potential impacts. On the other hands, seismic risks would be of concern for the entire operational life of the Motorway thus further evaluation on the potential risks and mitigation approaches is provided below.

Impacts on Soil Environment

Impacts on soil environment are anticipated to be limited in the operation phase and may include soil erosion and degradation on road embankments and soil contamination that may be sourced from the improper handling of the hazardous materials to be used in the road maintenance activities and leakage/spill of fuels, chemicals, etc. during the unexpected accidents. JASPERS (2010) list the potential impacts for operation phase in its Sectoral EIA Guidelines for Motorway and Road Construction Projects as follows:

- Soil erosion and pollution along the road route due to the meteoric water flowing down on road embankments;
- Soil degradation along the route due to works for road embankments maintenance;
- Accidental, incidental and seasonal soil pollution from:
    - Spreading on and infiltration in soil of pollutant substances following the traffic accidents or failures (especially but not only in the liquid freight transport), incidental discharges of substances used for road maintenance, snow-melt loaded with de-icing chemical products or sand;
    - On soil deposition of traffic pollutant substances (SO_2, NO_x and heavy metals), from rain and snowfalls.

In addition, deicing agents to be used in colder winter conditions and herbicides that may be used for the management of vegetation in the right-of-way may be potential sources of soil contamination during the operation phase.

6.4. Mitigation Measures

Mitigation measures to be taken for the protection of soils and minimization of geological/geotechnical risks during the land preparation and construction and operation phases of the North Marmara Motorway Project are described below. Basically, KGM's technical specifications will be adopted in developing the mitigation strategy as they include well-established practices developed in line with the relevant international standards and guidelines.

An Emergency Preparedness and Response Plan (see Annex-3) has been developed for the Project. This plan includes the measures to be taken to avoid and/or response to soil contamination events. Thus, in addition to the measures described in this Chapter, relevant measures will be taken in case of soil contamination incidents in accordance with this Plan.

6.4.1. Land Preparation and Construction Phase

Mitigation measures to be taken to avoid and/or minimize impacts on soil environment during the land preparation and construction phases of the Project are described below. Topography was one of the most important environmental criteria considered in the route selection process. It has been aimed that the route and the Motorway design conforms with the existing topographical conditions to the maximum extent possible. To avoid extraction of additional material from quarries/material borrow sites and increased interaction with the topography, excavated materials will be reused wherever the quality and quantity of the material is adequate. Further planning will be done to identify the source of the additional material extraction and storage site requirements. Necessary assessments will be conducted for additional sites to be identified outside of the ESIA study corridor.

Measures to be taken to Minimize Soil Disturbance

Principally, the area of the temporary work sites and permanent Project units will be limited in order to minimize the amount of soils to be disturbed. For this purpose, working sites will be bordered by means of proper methods (i.e. fencing, marking, etc.) and construction workforce will be informed about not breaching the predetermined borders. Additionally, drivers of the construction machinery and equipments will be trained to use only prescribed routes to minimize the area to be physically interacted. Other Project-specific measures to be taken in each relevant subject are further described below.

Top Soil Management

Measures to be taken to minimize the loss of top soil and its vegetative structure are described below:

Stripping and Temporary Storage of Top Soil

Prior to construction activities, fertile top soil available at the Project area (Motorway route, quarry/material borrow sites, storage sites, etc.) will be stripped to sufficient depth (may change between 5 to 40 cm depending on local soil conditions) and will be stored separately from other coarse materials/soils (subsoil) at top soil storage areas to be designated along the Motorway route (within the expropriation corridor) or other work sites under conditions suitable for the conservation of vegetative properties. The following procedures will be followed in accordance with KGM's Technical Specifications and good site practices in the scope of top soil stripping and storage practices:

- To avoid soil compaction, stripping operation will not be done when soil is wet.
- Average height of top soil stacks will be 1,5 meters. Side slope of these stacks will not exceed 3:1 (h:v).
- Drainage of top soil storage areas will be provided by open channels. In order to minimize the amount of rain water that can infiltrate into the top soil stack, the upper parts of the top soil stacks will be compressed. Excessive compression can cause anaerobic conditions. Therefore, compression operations will be carried out mildly.
- If it is necessary, soil stacks will be protected against the risk of floods by creating berms of adequate height.
- In case of long term storage of top soil, soil compaction and reduction in organic content of the soil may occur. In this context, if the storage will last for more than three months, the upper part of fertile soil will be planted temporarily in order to conserve organic content. In planting operations, selected species of legume and grails will be used in proper seed mixture ratios.
- Organic (grass, etc.) or inorganic (polyethylene, etc.) materials will be applied on the top soil to be stored to improve its quality and avoid erosion, desiccation or invasion of wild herbs.

Reinstation of Top Soil

Top soil stripped and stored in suitable conditions will be reused in rehabilitation of temporary construction sites upon completion of construction activities, on the finalization of side slopes and/or in the scope of landscaping activities. The following procedures will be followed in accordance with KGM's Technical Specifications and good site practices to ensure effectiveness of reinstatement process:

- Sub soil will be loosened by hand or machinery to a depth of 15 cm prior to the reinstation of top soil. For compact or heavy clay soils, loosening depth is to be increased up to 40-50 cm.
- Following the loosening operation, ground will not be leveled before the reinstation of top soil so that a favorable rough surface is obtained for the adsorption of top soil.
- Average depth of top soil to be reinstated on regular lands will be 15 cm.

- Depth of top soil for areas to be planted will be as follows:
  - Side slopes: 10 cm
  - Areas to be germinated: 15 cm
  - Shrub plantation areas: 45 cm
  - Tree roots: 70 cm
- Following the reinstation of top soil, grading operation will be conducted in alignment with the natural slope and drainage conditions. Any stone, grass or undesired materials will be removed to the extent possible and the land will be prepared for the upcoming planting operations.
- Combined thickness of topsoil and the vegetative growth layer will not be less than that prevailing in the undisturbed areas.

Soil Erosion Minimization and Control

The following procedures will be followed in accordance with KGM's Technical Specifications and good site practices to minimize and control soil erosion at the Project sites and their surroundings:

- Erosion control measures (e.g. geotextile filter barriers that would reduce the flow velocity and trap the sediments, drainage channels, settling structures, etc.) will be implemented along the route prior to the start of construction works in order to reduce or prevent off-site sediment transport during construction. Temporary erosion control measures will be moved forward as the construction progresses.
- Stripping and excavation works will be planned in a way that maximum 30.000 m^2 of exposed land will be created at once. Mulching will be applied to stabilize exposed areas.
- Activities will be modified or suspended during extreme rainfall and high winds to the extent practical.
- Contouring will be applied and length and steepness of slopes will be minimized.
- All the earth works will be structured at the end of each work day in a way to control probable surface run-off due to precipitation and minimize associated erosion.
- All the water flow coming from the areas surrounding the work sites and from the side slopes will be diverted by means of temporary channels, earth banks and temporary engineering structures to avoid mixing of clean (non-contact) and contaminated (contact) runoff.
- Erosion control measures will be implemented at the outlet of culverts.
- At the outlet of the erosion control structures, relevant measures (i.e. use of riprap) will be taken to reduce the flow velocity and erosion impact.
- Following the completion of base excavations, permanent erosion control measures will be taken and slope improvement works will be conducted.
- Dikes will be formed around the excavated material storage sites in order to prevent loss of soil due to erosion.
- Channels and ditches will be designed in consideration of post-construction flows.

- Following the completion of concrete lining of the drainage ditches, temporary erosion control structures will be dismantled and the sites will be rehabilitated.
- Temporary service road gradients will be limited to reduce runoff-induced erosion.
- All the work sites will be revegetated to the extent possible promptly following the completion of works at that site.

In addition to the measures listed above, the following additional measures will be taken at the quarry and materials borrow sites to minimize the risk of erosion:

- Open pit mining method will be used at quarries and tunneling will not be applied. Open pit will be developed in benches.
- Borders of the quarry and material borrow sites will be identified by using proper methods (i.e. fencing, etc.) and material extraction activities will be conducted within these borders.
- During the operation of the quarries and material borrow sites; runoff from rain will be diverted from the face of the slopes, which are exposed in the excavation process. The runoff will then be conveyed in channels to stable disposal points.
- Quarries and material borrow sites will be rehabilitated following the completion of material extraction activities.

Avoidance and Minimization of Soil Contamination Risk

Oil, fuel, dye etc. may spill or leak at the construction sites during transportation, storage, preparation or use. Training will be provided to the personnel working with such substances to minimize the risk of accidents. For accidents that cannot be avoided by taking relevant measures, immediate response measures will be implemented in accordance with the Emergency Preparedness and Response Plan presented in Annex-3 in order to prevent dispersion of contamination. The actions to be taken to avoid and/or minimize soil contamination are as follows:

- Any substance/material that would result in soil contamination will not be allowed to be discharged onto soil environment;
- Any spill or leakage event will be responded in accordance with the procedures described in the Emergency Preparedness and Response Plan (see Annex-3);
- Proper construction machinery and equipment endowed with low polluting engines will be used to minimize deposition of air pollutants on soils;
- Wastes and wastewaters to be generated as a result of Project activities will be properly managed in line with the requirements of national legislation as well as IFC EHS Guidelines as described in details in Chapter 7 (“Wastes”) and Chapter 8 (“Water Resources”). In this context, direct contact of the uncontrolled wastes and wastewaters with soil environment will be avoided by taking relevant measures;

- Hazardous wastes (i.e. diesel fuel oil, degreasers, solvents, etc.) will be handled at designated areas in accordance with the Hazardous Wastes Management Procedure developed as a part of the Project-specific Environmental and Social Management Plan presented in Annex-6. In this respect, contact of hazardous wastes and materials with soil resources will be prevented by taking relevant measures (e.g. storage on impervious ground, training of personnel).

Management of Contaminated Lands

Management of contaminated lands is essential to avoid risks on human health and ecology. When contamination of land is suspected or confirmed during any Project phase, the cause of the uncontrolled release will be identified and actions will be taken to avoid further releases and associated adverse impacts. The following measures will be taken:

- Relevant provisions of the Turkish Regulation on the Soil Pollution Control and Sites Contamination by Point Sources, which are basically in line with IFC's risk assessment and management approach for the contaminated lands, will be complied with for the management of potentially contaminated sites. Collaboration will be made with local authorities for the identification and management of the sites.
- Construction personnel will be trained on identification and management of potential contaminated sites. In case of encounter, local authorities will be informed and their directions will be followed regarding the management of contaminated sites. Measures will be designed on a case by case basis depending on the scale and content of the contamination.

6.4.2. Operation Phase

Even though operation activities will not involve direct physical impact on topography and soils, mitigation measures will be taken to minimize and control soil erosion that may continue to be a risk at the embankment areas, exposed soils, quarry sites, etc if not properly managed. Similarly, emergency preparedness and response measures will be in place against the risk of soil contamination due to probable road accidents, activities at the maintenance and operation centers and service areas. Similarly, effectiveness of the design measures taken against geological and geotechnical risks will be ensured throughout the operation phase by taking required management measures. Measures to be taken during the operation phase are detailed under the following headings.

Soil Erosion Control during Operation

- Soil erosion process during road operation will be prevented and/or minimized by timely strengthening and rehabilitation of the road and scheduling against heavy rainfall periods.
- On-site control of all erosion control structures will be done once a week. In cases when the precipitation amount exceeds 10 mm in 24 hour periods, all the erosion control measures and their conditions will be checked on site. If required, relevant structures will be properly maintained.
- Embankment and cutting slopes will be checked by competent persons at least once a year (preferentially following of spring months) to identify any erosion, landslide, stability, etc. risks.
- Erosion control structures will be cleaned when half of their capacity is filled with sediment. Damaged structures or structures that are not functioning properly will be maintained/restructured.
- Stormwater management measures that are designed to slow peak runoff flow, reduce sediment loads and increase infiltration will be kept functional. These may include vegetated swales planted with salt-resistant vegetation, terracing, detention ponds and basins, etc.
- Proper erosion and sediment control measures will be used during road paving works to decrease runoff from repair sites.
- Afforestation activities will be conducted in accordance with the Afforestation Plan presented in Annex-4 to reduce the risk of erosion in the large-scale.

Soil Contamination Avoidance/Minimization and Response

- Against the risk of soil pollution due to road accidents that may result in the spill of hazardous liquids or substances on the road surface and surrounding areas, actions defined in the Emergency Preparedness and Response Plan (see Annex-3) will be implemented.
- Low polluting de-icing products will be used in the scope of the deicing operations. Additional measures defined in Chapter 8 (“Water Resources”) for the road deicing operations will also contribute to the protection of soil resources.
- Treated effluents and wastes from the operation and maintenance centers as well as services areas will be discharged/disposed of in accordance with the requirements of the national legislation and IFC’s EHS Guidelines. Relevant measures for waste and wastewater management are described in Chapter 7 (“Wastes”) and Chapter 8 (“Water Resources”).

Geotechnical Safety

In the design of the engineering structures, the Standard Specifications for Highway Bridges published by the American Association of State Highway and Transportation Officials (AASHTO) has been used. In the seismic calculations, the Standard Specifications used for the seismic design of the highway bridges has been taken as basis. Where required, Project-specific revisions have been/would be done with the approval of KGM to adequately adapt these specifications to the Project.

Foundations and legs of the viaducts and bridges as well as other structural elements will be controlled by competent technical personnel at least once a year (preferentially in April) in order to identify any structural motion, undermining, maintenance requirements, etc. that may pose risks on the durability of the structures and take the relevant corrective measures.

In case of natural disasters (i.e. earthquakes) that may risk the structural safety of the Project structures, the operation personnel will conduct visual inspections, take immediate actions (e.g. communication with local people, restricting access to risky areas, etc.) and collaborate with local emergency response authorities to prevent any adverse impact on the health and safety of the local people or users of the Motorway.

6.5. Summary of Assessment and Residual Impacts

Table 6.14 provides a summary on the assessments for impacts on topography, soils and geology. Significance of the identified impacts before and after the implementation of mitigation measures are summarized in this table. As can be seen from the Table, potential impacts on the relevant environmental components are anticipated to be reduced to low levels in the long-run with effective implementation of mitigation measures, except the changes in the topography. It should be noted that a certain period of time (from months to years) will be needed to ensure that the residual impacts are adequately mitigated to acceptable levels as measures such as rehabilitation of temporary Project sites against erosion or afforestation take time to show their effectiveness. Erosion and soil contamination risks are manageable by trained personnel through well-established site management plans. Thus, once the mitigation measures described in the ESIA Report are implemented, no significant risk would be posed by the construction and operation activities of the Project. Regarding seismic and geotechnical risks, international and national standards have to be strictly complied with in the design of the Motorway in order to reduce the residual impacts to acceptable levels and avoid intolerable consequences that may risk the health and safety of the nearby communities and users of the roads and integrity of the Motorway components in case of seismic events.

Table 6.14. Summary of the Topography, Soils and Geology Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Topography	Land preparation and construction	Change of existing topographical conditions due to cut and fill operations; Disturbance of soils	Adverse	Restricted	Long	Medium (for linear Project with 186,8 km length, 100-350 m expropriation corridor) •Section 4 Excavation: 25,3 mi. m^3 Fill: 28,8 mi. m^3 •Section 5 Excavation: 17 mi. m^3 Fill: 19,3 mi. m^3 •Section 6 Excavation: 24,6 mi. m^3 Fill: 25,3 mi. m^3	Irreversible	One-off	Moderate (B)	Medium (2) (Natural topograpghy)	Medium (B2)	•Motorway have been designed and will be constructed in conformity with the existing topographical conditions to the maximum extent possible. •Excavated materials will be reused whereever the quality and quantity of the material is adequate, to avoid extraction of additional material from quarries/material borrow sites. Further planning will be done to identify the source of the additional material extraction and storage site requirements. Necessary assessments will be conducted for additional sites to be identified outside of the ESIA study corridor. •Working sites will be bordered by means of proper methods (i.e. fencing, marking, etc.) and construction workforce will be informed about not breaching the predetermined borders. •Drivers of the construction machinery and equipments will be trained to use only prescribed routes to minimize the area to be physically interacted.	Medium
Soils	Land preparation and construction	Risk of loss of quantity and quality (e.g. vegetative structure) of top soil	Adverse	Restricted	Short	Medium (for linear Project with 186,9 km length, 100-350 m expropriation corridor) 3,7 million m^3 (agricultural area)	Short-term reversible	Continuous	Moderate (B)	High (3) (Agricultural areas)	High (B3)	<u>Stripping and Temporary Storage of Top Soil</u> •Prior to construction activities, fertile top soil available at the Project area (Motorway route, quarry/material borrow sites, storage sites, etc.) will be stripped to sufficient depth (may change between 5 to 40 cm depending on local soil conditions) and will be stored separately from other coarse materials/soils (subsoil) at top soil storage areas to be designated along the Motorway route or other work sites under conditions suitable for the conservation of vegetative properties. •To avoid soil compaction, stripping operation will not be done when soil is wet. •Average height of top soil stacks will be 1,5 meters. Side slope of these stacks will not exceed 3:1 (h:v). •Drainage of top soil storage areas will be provided by open channels. In order to minimize the amount of rain water that can infiltrate into the top soil stack, the upper parts of the top soil stacks will be compressed. Excessive compression can cause anaerobic conditions. Therefore, compression operations will be carried out mildly. •If it is necessary, soil stacks will be protected against the risk of floods by creating berms of adequate height. •In case of long term storage of top soil, soil compaction and reduction in organic content of the soil may occur. In this context, if the storage will last for more than three months, the upper part of fertile soil will be planted temporarily in order to conserve organic content. In planting operations, selected species of legume and grails will be used in proper seed mixture ratios. •Organic (grass, etc.) or inorganic (polyethylene, etc.) materials will be applied on the top soil to be stored to improve its quality and avoid erosion, desiccation or invasion of wild herbs. <u>Reinstation fo Top Soil</u> •Top soil stripped and stored in suitable conditions will be reused in rehabilitation of temporary construction sites upon completion of construction activities, on the finalization of side slopes and/or in the scope of landscaping activities. •Sub soil will be loosened by hand or machinery to a depth of 15 cm prior to the reinstation of top soil. For compact or heavy clay soils, loosening depth is to be increased up to 40-50 cm. •Following the loosening operation, ground will not be leveled before the reinstation of top soil so that a favorable rough surface is obtained for the adsorption of top soil. •Average depth of top soil to be reinstated on regular lands will be 15 cm. •Depth of top soil for areas to be planted will be suitable for side slopes, shrub plantation areas, tree roots, etc. •Following the reinstation of top soil, grading operation will be conducted in alignment with the natural slope and drainage conditions. Any stone, grass or undesired materials will be removed to the extent possible and the land will be prepared for the upcoming planting operations. •Combined thickness of topsoil and the vegetative growth layer will not be less than that prevailing in the undisturbed areas.	Low
						Medium (for linear Project with 87, 186,9 km length, 100-350 m expropriation corridor) 2,6 million m^3 (forest area)				Medium (2) (Forest areas)	Medium (B2)		Low
						Low 11.175 m^3 (for 14,9 ha) (pasturelands/steppe)				Low (1) (Pastures/ Steppe)	Low (B1)		Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
	Land preparation and construction	Erosion of soils due to earthworks	Adverse	Restricted	Long	Medium (assummed for the linear Project with 186,9 km length, 100-350 m expropriation corridor. The amount of material to be mobilized will depend on the construction technique)	Long-term reversible	Continous	Moderate (B)	High (3) •Neighborhoods in Section 4 •Section 5: Yagcilar, Kutluca, Semsettin Sipahiler, Himmetli Kasikci, Toylar •Section 6: Cayirkoy, Durhasan, Gedikli, Karaabdulbaki, Sapakpinar, Suleymaniye, Akmese, Besevler	High (B3)	•Erosion control measures (e.g. geotextile filter barriers that would reduce the flow velocity and trap the sediments, drainage channels, settling structures, etc.) will be implemented along the route prior to the start of construction works in order to reduce or prevent off-site sediment transport during construction. Temporary erosion control measures will be moved forward as the construction progresses. •Stripping and excavation works will be planned in a way that maximum 30.000 m2 of exposed land will be created at once. Mulching will be applied to stabilize exposed areas. •Activities will be modified or suspended during extreme rainfall and high winds to the extent practical. •Contouring will be applied and length and steepness of slopes will be minimized. •All the earth works will be structured at the end of each work day in a way to control probable surface run-off due to precipitation and minimize associated erosion. •All the water flow coming from the areas surrounding the work sites and from the side slopes will be diverted by means of temporary channels, earth banks and temporary engineering structures to avoid mixing of clean (non-contact) and contaminated (contact) runoff. •Erosion control measures will be implemented at the outlet of culverts. •At the outlet of the erosion control structures, relevant measures (i.e. use of riprap) will be taken to reduce the flow velocity and erosion impact. •Following the completion of base excavations, permanent erosion control measures will be taken and slope improvement works will be conducted. •Dikes will be formed around the excavated material storage sites in order to prevent loss of soil due to erosion. •Channels and ditches will be designed in consideration of post-construction flows. •Following the completion of concrete lining of the drainage ditches, temporary erosion control structures will be dismantled and the sites will be rehabilitated. •Temporary service road gradients will be limited to reduce runoff-induced erosion. •All the work sites will be revegetated to the extent possible promptly following the completion of works at that site. <u>Rehabilitation of Quarries and Material Borrow Sites</u> •Open pit mining method will be used at quarries and tunneling will not be applied. Open pit will be developed in benches. •Borders of the quarry and material borrow sites will be identified by using proper methods (i.e. fencing, etc.) and material extraction activities will be conducted within these borders. •During the operation of the quarries and material borrow sites; runoff from rain will be diverted from the face of the slopes, which are exposed in the excavation process. The runoff will then be conveyed in channels to stable disposal points. •Quarries and material borrow sites will be rehabilitated following the completion of material extraction activities.	Low
										Medium (2) •Section 5: Tepecik, Sevindikli •Section 6: Eseler, Bayraktar, Korucuk, Karapinar, Kulaksiz	Medium (B2)		Low
										Low (1) •Section 5: Karayakuplu •Section 6: Neighborhoods between KM 220-250 and Uzunbey	Low (B1)		Low
	Operation											•Soil erosion process during road operation will be prevented and/or minimized by timely strengthening and rehabilitation of the road and scheduling against heavy rainfall periods. •On-site control of all erosion control structures will be done once a week. In cases when the precipitation amount exceeds 10 mm in 24 hour periods, all the erosion control measures and their conditions will be checked on site. If required, relevant structures will be properly maintained. •Embankment and cutting slopes will be checked by competent persons at least once a year (preferentially following of spring months) to identify any erosion, landslide, stability, etc. risks. •Erosion control structures will be cleaned when half of their capacity is filled with sediment. Damaged structures or structures that are not functioning properly will be maintained/restructured. •Stormwater management measures that are designed to slow peak runoff flow, reduce sediment loads and increase infiltration will be kept functional. These may include vegetated swales planted with salt-resistant vegetation, terracing, detention ponds and basins, etc. •Proper erosion and sediment control measures will be used during road paving works to decrease runoff from repair sites. •Afforestation activities will be conducted in accordance with the Afforestation Plan to reduce the risk of erosion in the large-scale.	Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
	Land preparation and construction,	Risk of soil contamination due to accidental spills, leakages, etc.	Adverse	Restricted	Short	Low (Cannot be exactly quantified. Depends on the scale of incident (e.g. leakage, spill, etc.). However,since amount of hazardous substances to be used will be limited and response measures can be easily taken immediately by good management, it is likely that any spill or leakage would be ceased before it reaches significant amounts)	Short-term reversible	One-off or Intermittent	Minor (C)	High (3) (If occurs at agricultural areas, pastures, forests)	Medium (C)	Emergency Preparedness and Action Plan will be implemented. •Any substance/material that would result in soil contamination will not be allowed to be discharged onto soil environment. •Any spill or leakage event will be responded in accordance with the procedures described in the Emergency Preparedness and Response Plan •Proper construction machinery and equipment endowed with low polluting engines will be used to minimize deposition of air pollutants on soils. •Wastes and wastewaters to be generated as a result of Project activities will be properly managed in line with the requirements of national legislation as well as IFC EHS Guidelines. In this context, direct contact of the uncontrolled wastes and wastewaters with soil environment will be avoided by taking relevant measures. •Hazardous wastes and materials (i.e. diesel fuel oil, degreasers, solvents, etc.) will be handled at designated areas in accordance with the Hazardous Wastes and Management Procedure developed as a part of the Project-specific Environmental and Social Management Plan. In this respect, contact of hazardous wastes and materials with soil resources will be prevented by taking relevant measures (e.g. storage on impervious ground, training of personnel). •During operation, Against the risk of soil pollution due to road accidents that may result in the spill of hazardous liquids or substances on the road surface and surrounding areas, actions defined in the Emergency Preparedness and Response Plan (see Annex-3) will be implemented. •During operation, Low polluting de-icing products will be used in the scope of the deicing operations. Additional measures defined in Chapter 8 (“Water Resources”) for the road deicing operations will also contribute to the protection of soil resources. •During operation, Treated effluents and wastes from the operation and maintenance centers as well as services areas will be discharged/disposed of in accordance with the requirements of the national legislation and IFC’s EHS Guidelines.	Low
										Medium (2) (If occurs at vegetated areas, recreational areas, shrubs,etc.)	Low (C2)		Low
	Operation									Low (1) (If occurs at artificial areas such as areas with urban fabric, industrial areas, mine dumps, construction sites, etc.)	Low (C1)		Low
Geology-Geotechn.	Land preparation, construction, Operation	Seismic risks	Adverse	Wide	Medium	High (worst case	Irreversible	One-off	Major (A)	High (The Project route is passing through1st degree earthquake zone)	High (A3)	•Foundations and legs of the viaducts and bridges as well as other structural elements will be controlled by competent technical personnel at least once a year (preferentially in April) in order to identify any structural motion, undermining, maintenance requirements, etc. that may pose risks on the durability of the structures and take the relevant corrective measures.	Low
		Landslide risks	Adverse	Restricted	Medium	High	Short term Reversible	One-off	Major (A)	High (3) •Section 6: KM 203-204	High (A3)	•In the design of the engineering structures, the Standard Specifications for Highway Bridges published by the American Association of State Highway and Transportation Officials (AASHTO) has been used. In the seismic calculations, the Standard Specifications used for the seismic design of the highway bridges has been taken as basis. Where required, Project-specific revisions have been/would be done with the approval of KGM to adequately adapt these specifications to the Project.	Low
						Medium			Moderate (B)	Medium (2) •Section 5: local active landslide zones	Medium (B2)		Low
						Low			Minor (C)	Low (1) •Section 4: no landslide risk identified in the scope of geological-geotechnical studies	Low (C1)		Low

CHAPTER 7

USE OF RESOURCES AND WASTES

CHAPTER 7. USE OF RESOURCES AND WASTES

The Project will require the use of construction materials to be extracted from quarries and material borrow sites and supplied from the providers and use of materials for the operation and maintenance activities to be conducted in the operation phase. As a result of the use of resources and other construction and operation/maintenance activities as well as the domestic requirements of the personnel and the users of the road, different types of wastes will be generated throughout the life of the Project. All the wastes to be generated during the construction and operation phases of the Project are required to be properly managed in line with the requirements of national waste management legislation and international good practice in order to avoid impacts on soils, nearby water resources and flora and fauna elements. This Chapter identifies the resources to be used in this context and assesses the impacts associated with waste generation. Waste management measures to be applied in accordance with relevant Turkish regulations and international standards (i.e. IFC's General EHS Guidelines) are also described in this Chapter. Potential impacts of materials supply and waste generation on soil and water resources, ecological components and socio-economic environment are discussed in the relevant chapters of this ESIA Report.

7.1. Assessment Methodology and Data Sources

To assess the impacts associated with the use of resources and waste generation, information provided by the Project Sponsors on the quarries, excavation and fill amounts, etc. has been reviewed. To understand the existing waste management infrastructure of the region, public information given in the internet sites of Istanbul Metropolitan Municipality, Kocaeli Metropolitan Municipality and Sakarya Metropolitan Municipality have been relied on. For the calculation of the amount of municipal solid wastes, waste statistics published by TurkStat (2014) have been considered, together with the maximum number of personnel to be employed. It should be noted that amount of certain types of wastes (e.g. hazardous wastes, waste tires, electrical and electronic equipment wastes, medical wastes, waste vegetable oils, etc.) cannot be quantified at this stage thus only the capacity of the existing infrastructure for any waste to be produced will be assessed in the scope of this Chapter.

Significance Criteria

The significance criteria for the impacts on land use and property will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on the land use components, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 7.1.

Table 7.1. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	Medium (2)	Low (1)
Local waste infrastructure	If the local waste infrastructure has not sufficient capacity; landfills do not meet the requirements of the regulations		If the local waste infrastructure has sufficient capacity; landfills meet the requirements of the regulations

7.2. Baseline Conditions

7.2.1. Quarries and Material Borrow Sites

Mining sector in Istanbul is mainly based on the extraction of non-metallic industrial raw materials used in construction activities. Sandstone, limestone and silica sand are the main types of mineral being extracted in the city. Mineral map of the city is presented in between Figure 7.1 and Figure 7.3. Number of mining licenses issued for the mines and geological resources in Istanbul are listed in Table 7.2.

Table 7.2. Number of Mining Licenses and Areas in Istanbul

Group No	Description of the Group in the Mining Law	2013		2014		2015	
		Number of Licenses	Total Area (ha)	Number of Licenses	Total Area (ha)	Number of Licenses	Total Area (ha)
I-A Group	Sand and gravel	3	29,97	3	9,97	3	29,97
I-B Group	Brick-tile clay, cement clay, marn, tras, other rock materials used in cement and ceramic industries	11	450,09	11	450,09	13	549,78
II-A Group	Rock material used by producing aggregate, ready-made concrete and asphalt from calcite, dolomite, limestone, granite, andesite, basalt	137	10.977,42	137	11.182,09	139	11.543,93
II-B Group	Stones produced as stone as marble, travertine, granite, andesite, basalt	13	998,20	12	883,41	12	883,41
Group IV	Lignite, coal, gold, silver, copper, zinc, chromium, iron, cobalt, nickel, aluminum, trona, sulphur, etc.	159	146.341,12	151	142.589,12	153	144.821,11
Geological Resources and Mineral Waters		1	2.104,58	1	2.104,58	1	2.104,58
Mine		7	3.501,15	7	3.501,15	7	3.501,15
Group V	Diamond, sapphire, opal, amazonite, etc.	2	743,28	3	1.708,92	3	1.708,92
Total		**333**	**165.145,81**	**325**	**162.449,33**	**331**	**165.142,85**

Source: Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016.

In the scope of the North Marmara Motorway Project, four limestone quarries (Kutluca, Taskisigi 1-2-4) will be used in Sections 5 and 6; and one sandstone quarry (Yagbasan) will be used for Section 6 to supply the material requirements. Raw material production license has been obtained for this quarries (see Table 7.3).

Table 7.3. Raw Material Extraction Sites to be Used in the Project

Quarry Site	Motorway Section	Area (ha)	Group	Type of Raw Material to be Extracted	Estimated Production	
					Daily	Annual
Kutluca Quarry	5	28,9	II-A	Limestone	5.400 ton	5.600.000 ton
Taskisigi Quarry 1-2	6	16,8	II-A	Limestone	15.250 ton	16.000.000 ton
Taskisigi Quarry 4	6	39,1	II-A	Limestone	1.500 ton	1.600.000 ton
Yagbasan Sandstone	6	42,9	I-A	Sandstone	4.500 ton	4.800.000 ton

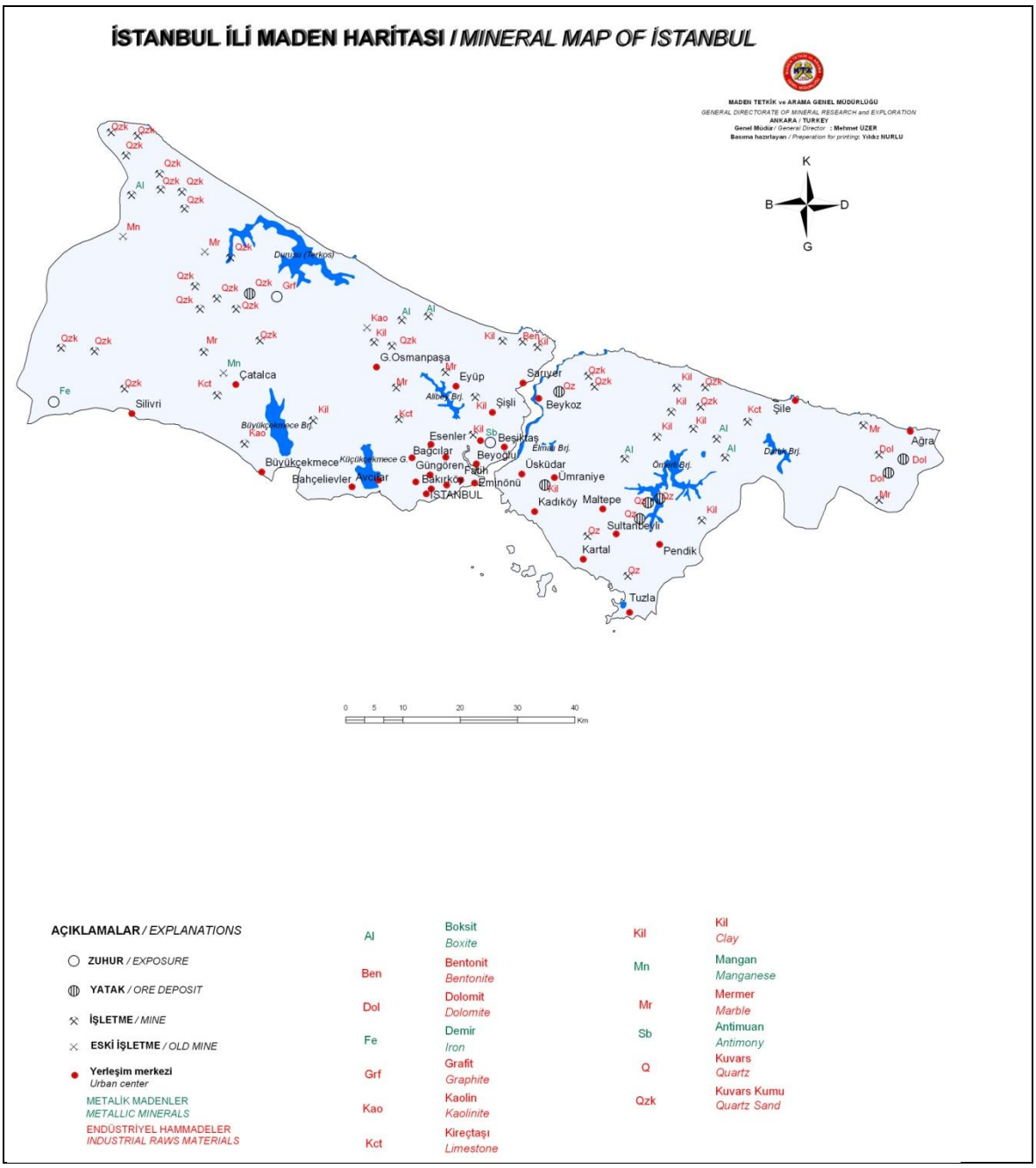


Figure 7.1. Mineral Map of Istanbul (*www.mta.gov.tr*)

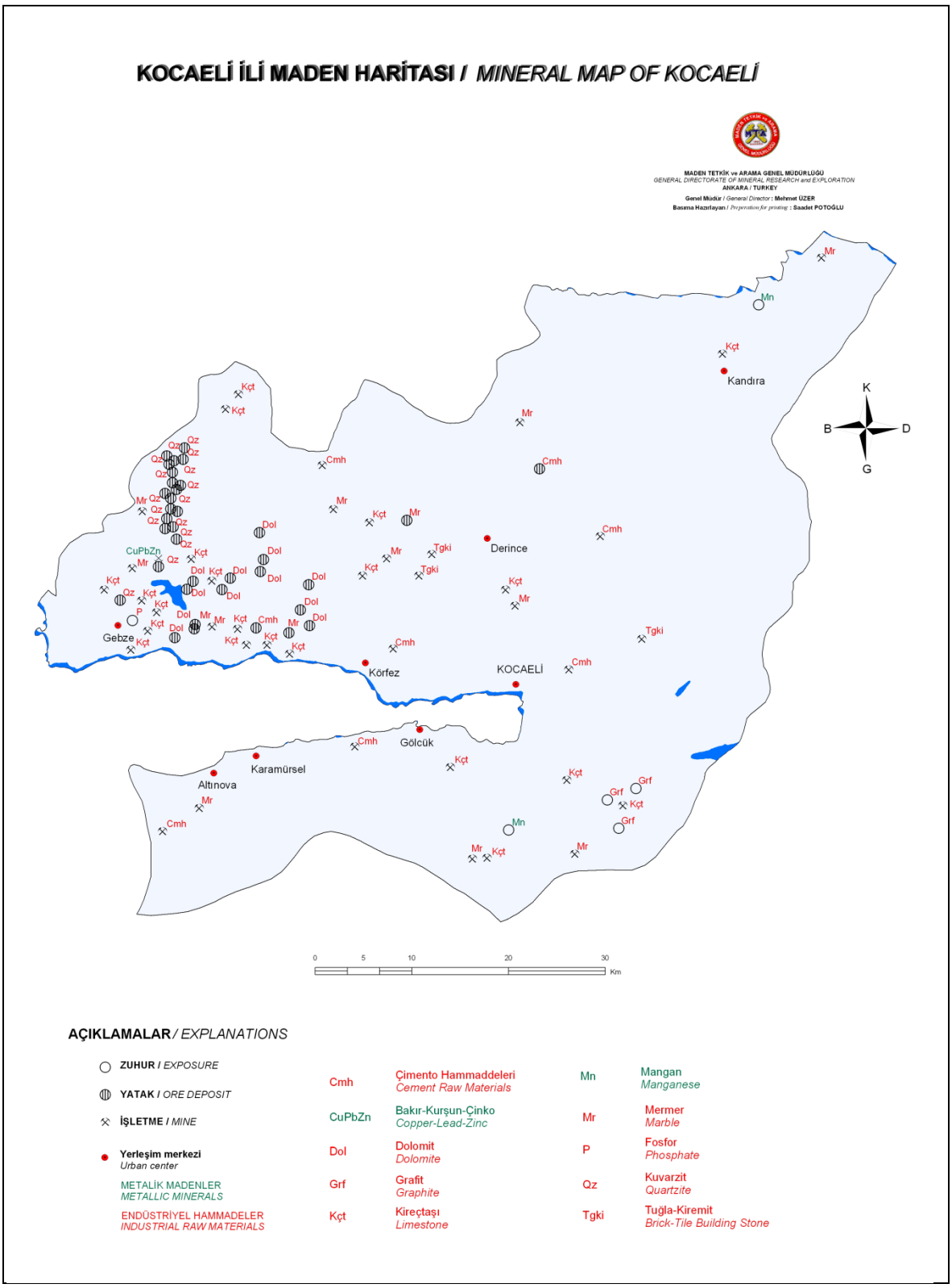


Figure 7.2. Mineral Map of Kocaeli (*www.mta.gov.tr*)

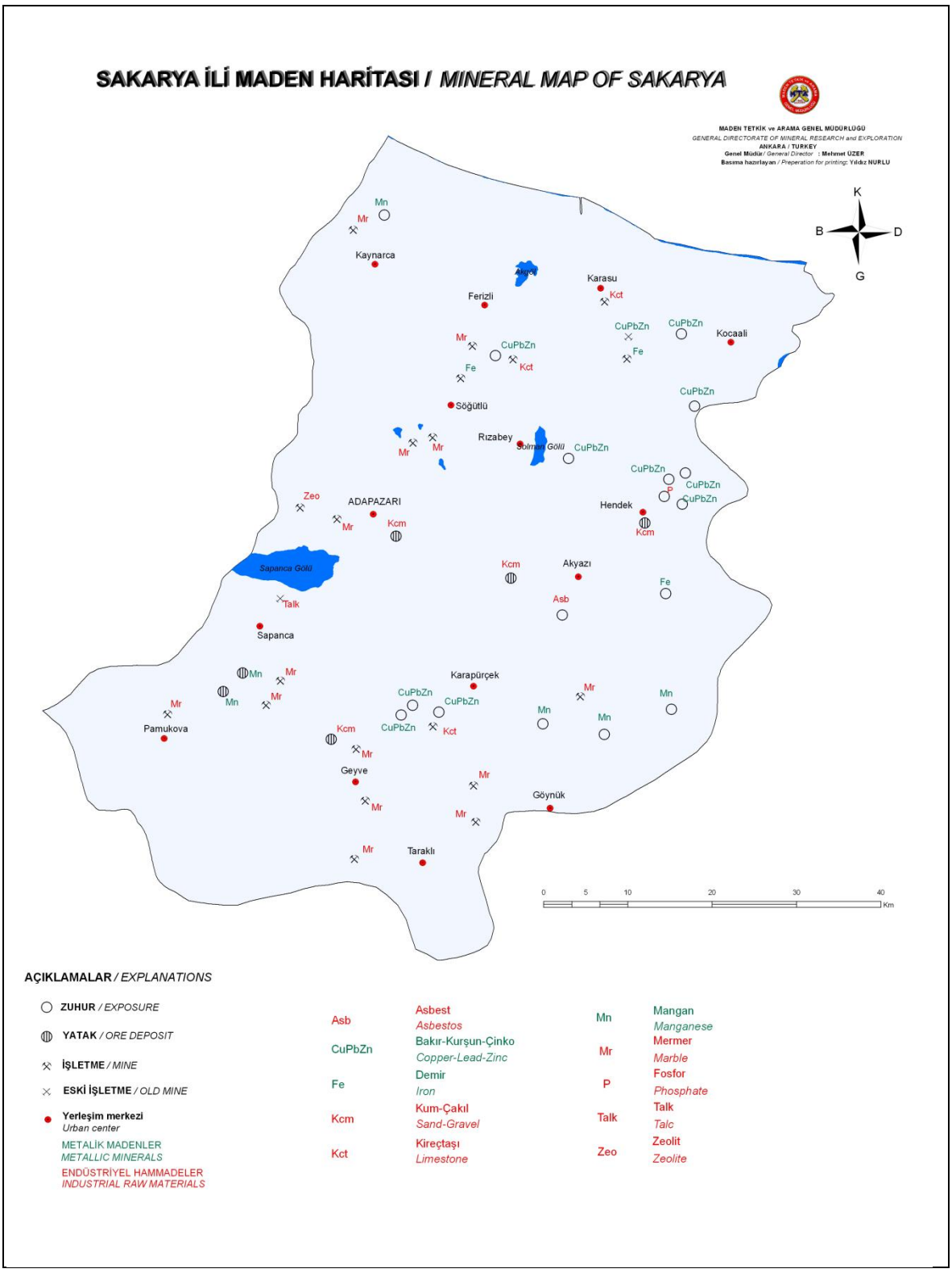


Figure 7.3. Mineral Map of Sakarya (*www.mta.gov.tr*)

7.2.2. Existing Waste Management Infrastructure in the Region

Through a private association (ISTAC A.S) established in 1994, Istanbul Metropolitan Municipality operates three sanitary landfills in Istanbul province; namely Odayeri and Silivri Seymen landfills in the European side and Komurcuoda Landfill in the Asian side. In Kocaeli and Sakarya, IZAYDAS which has been established by Kocaeli Metropolitan Municipality and landfill facilities of Sakarya Metropolitan Municipality will be used. IZAYDAS has two operating sites with a capacity of 600 ton/day in Dilovasi and 1.000 ton/day in Solaklar district. Sakarya Metropolitan Municipality also has a landfill area which was built in 2009. The landfill contains 3 divisions; the total capacity of the facility is 2.895.770 m^3/day (1.800 ton/day) (see Table 7.4; see Figure 7.4)

In Istanbul, solid wastes produced are collected by the waste trucks of district municipalities, transferred to one of the eight solid waste transfer stations (four in the European side and four in the Asian side) and disposed of at these landfills, which are designed as Class II Landfills in accordance with the requirements of the Regulation on the Landfill of Wastes. In this context, landfills have proper impermeability layers and the leachate collected at the landfills is treated by means of physical, chemicals and anaerobic processes. In the European side, the treated wastewaters are discharged in the sewerage system of the Istanbul Water and Sewerage Administration (ISKI), while in the Asian side discharge is done into Izmit Water and Sewerage Administration (IZSU) and Sakarya Water and Sewerage Administration (SASKI) (*Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016; https://www.izaydas.com.tr, www.sakarya.bel.tr*).

Table 7.4. Landfills and Transfer Stations for Asian Sections

Type of Facility	Side	Average Waste Amount (ton/day)
Landfill Sites		
Sile Komurcuoda Landfill	Asia/Istanbul	5.500
Dilovasi Landfill	Asia/Kocaeli	600
Solaklar Landfill	Asia/Kocaeli	1000
Sakarya MM Landfill	Asia/Sakarya	1.800
Transfer Stations		
Hekimbasi Transfer Station	Asia	1.900
Kucukbakkalkoy Transfer Station	Asia	1.550
Aydinli Transfer Station	Asia	1.500
Sile Transfer Station	Asia	75
Gebze Transfer Station	Asia	500
Kandıra Transfer Station	Asia	300
Karamürsel Transfer Station	Asia	6
Körfez Transfer Station	Asia	200

Source: https://atikyonetimi.ibb.gov.tr/hizmetlerimiz/duzenli-depolama-alanlari; https://www.izaydas.com.tr, www.sakarya.bel.tr.

For the Asian part of the North Marmara Motorway, Sile Komurcuoda, Dilovasi, Solaklar and Sakarya Metropolitan Municipality landfills would be used for the management of Project-sourced wastes. Distance of Komurcuoda landfill to the north side of the Asian part of the motorway is 21 km, Solaklar is very close to the Project area; Solaklar Landfill site is located 250 m to the Motorway. Dilovasi landfill is about 2,5 km away from the Liman Access Road.

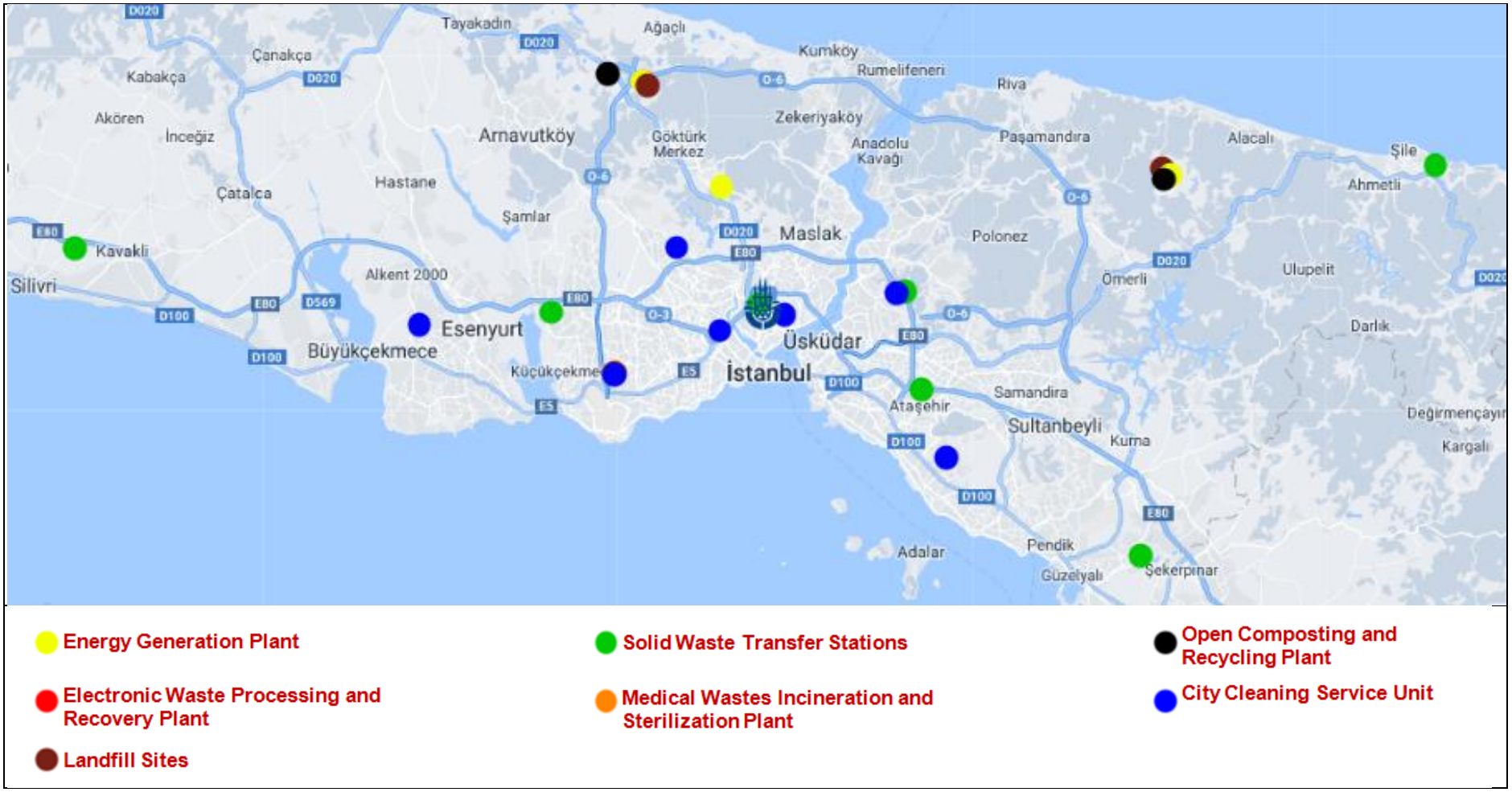


Figure 7.4. Locations of the Waste Management Facilities of Istanbul Metropolitan Municipality

There are a number of construction and demolition waste disposal sites in Asian side of the Motorway serving for the management of construction and demolition wastes from the efforts of urban transformation, repair and alteration works. A list of the existing construction and demolition waste disposal sites operated by ISTAC A.S. in Istanbul including their capacities and occupancy rates are provided in Table 7.5, IZAYDAS in Kocaeli and Sakarya MM are also allocating disposal sites within the municipality areas by the permission of the Metropolitan Municipality.

Istanbul Metropolitan Municipality issues licenses for the transportation of the construction and demolition wastes produced in the city (35-40 million m^3/year). A large number of licensed transportation vehicles/trucks serve in the city for this purpose, collecting and disposing of the construction and demolition wastes at the areas designated by the Municipality (*Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016*). Construction and demolition wastes from the efforts of urban transformation, repair and alteration are processed and recycled as superstructure materials in varying sizes, at a recycling site with the capacity of 200 tons/hour (*https://atikyonetimi.ibb.gov.tr/*). In Kocaeli, IZAYDAS's disposal sites inat Uctepeler and Hereke serve the storage of construction and demolition wastes.

Table 7.5. List of Construction and Demolition Waste Disposal Sites in Asia

Location of the Disposal Sites		**Total Capacity (m^3)**	**Occupancy Rate (%)**
Istanbul	Cekmekoy/Omerli	11.034.106	98%
	Cekmekoy/Omerli 70-71-72	5.189.333	97%
	Sile/Avcikoru 277-278-285-287	2.612.919	98%
	Beykoz/Riva 176-283	2.510.940	81%
	Sile/Sahilkoy 142-143-144-146-285-286	3.259.957	71%
	Beykoz/Huseyinli 166-1-2 (Tekkoc)	7.147.945	2%
Kocaeli	Uctepeler/Kocaeli/IZAYDAS	1.000.000	9%
	Hereke/Kocaeli/IZAYDAS	720.000	10%

Source: http://www.istac.istanbul/tr, www.izaydas.com.tr

There are about 220 waste facilities possessing required environmental permits and licenses in Istanbul, Kocaeli and Sakarya in total. These facilities serve for the recovery of packaging materials including plastics, metals, composite packages, paper and cardboards, glass and wood produced collection and segregation facilities in relevant districts. Amount of waste recovered at these facilities in 2015 is approximately summed up to 157.942 tonnes (State of Environment Reports, *Provincial Directorates of Environment and Urbanization, Istanbul, Kocaeli, Sakarya, 2015*).

Hazardous and special wastes produced in the area are managed by different methods including recovery, disposal, on-site processes, export, etc. Amount of hazardous wastes recorded in 2015 was around 130 million kg for Istanbul, 932 million kg for Kocaeli (this number is respectively higher than the other cities since industrial areas and one of the biggest waste disposal facility IZAYDAS is located in Kocaeli), 22 million kg for Sakarya. Non-hazardous and special wastes including waste tires, medical wastes, waste vegetable oils, waste batteries and accumulators produced in the area are being managed (e.g. recovery) and/or disposed of at licensed facilities (State of Environment Reports, *Provincial Directorates of Environment and Urbanization, Istanbul, Kocaeli, Sakarya, 2015*).

Medical wastes generated in Asian part of the motorway are collected by special vehicles regularly from different points and disposed at the medical waste sterilization and/or incineration facilities of ISTAC A.S. located within the Odayeri Landfill site, IZAYDAS located in Kocaeli and Waste Disposal Facility of Sakarya Metropolitan Municipality. The total medical waste disposed in the area is summed up to 8.595 ton of them were disposed of at the medical waste incineration & sterilization facilities. (*Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016; http://www.istac.istanbul/tr* State of Environment Reports, *Provincial Directorates of Environment and Urbanization, Istanbul, Kocaeli, Sakarya, 2015*).

There is one licensed waste vegetable oil interim storage and recovery facility in Istanbul that has a capacity of 26.880.000 kg. In Kocaeli there are 2 licensed companies for vegetable oil disposal, their total capacity is 74.000.000 ton/year. Amount of waste vegetable oil collected in Istanbul in 2015 was recorded as 2.715.307 kg *(Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016).* Waste vegetable oil amount for Kocaeli and Sakarya are respectively; 16.470 ton and 4.236 tonnes. Since there is no licensed company in Sakarya the waste vegetable oils are disposed in companies at close cities. (State of Environment Reports, *Provincial Directorates of Environment and Urbanization, Kocaeli, Sakarya, 2015*).

In Istanbul, there are licensed waste tire recovery and disposal facilities. In 2015, a total of 10.355 waste tires were sent to recovery facilities and a total of 10.734 ton was sent to cement factories for final disposal *(Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016*). In Kocaeli; 4056.7 tonnes of waste tyres were sent to recovery for Sakarya this number is 99,89 tonnes. Approximately the same amounts of tyres are sent to cement factories for final disposal. (State of Environment Reports, *Provincial Directorates of Environment and Urbanization, Kocaeli, Sakarya, 2015*).

There are 7 licensed temporary waste accumulator storage facilities in Istanbul and no licensed waste accumulator recovery facility is present. In 2015, amount of waste accumulators collected in Istanbul was recorded as 3.616.626 kg and amount of waste batteries collected was recorded as 5.089 kg *(Istanbul Governorate, Provincial Directorate of Environment and Urbanization, 2016).* In Kocaeli; amount of waste accumulators is 148.758 kg and the amount for waste batteries is 26.869. Thease amounts for Sakarya are respectively; 135.286 and 392 kg.

Regarding the management of hazardous wastes, IZAYDAS (Izmit Waste and Residue Treatment Incineration and Utilization Corp.) is the facility providing services in the field of hazardous waste incineration (including energy production) and landfill in the region. The facility was established by the Kocaeli Metropolitan Municipality in 1996. In 2015, 30,232 tons of waste has been disposed in the incineration plant and 16,010,500 kWh of electrical energy has been produced in return (*IZAYDAS, 2015*). The facility has increased its capacity by 50% in 2011 and the existing capacity of the facility to meet waste disposal demands of the waste producers has been declared by IZAYDAS as sufficient (*https://www.izaydas.com.tr/*). Road distance of the IZAYDAS facility to the end of Section 2 (KM 60+648) is around 160 km (via 3rd Bridge).

7.3. Potential Impacts

As with other infrastructure projects, raw materials such as rock, sandstone, limestone, basalt, etc. will be used in significant quantities during the construction of the North Marmara Motorway Project. In the operation phase, use of materials will be limited with the maintenance activities to be conducted at the road, operation and maintenance centers and fuel stations.

Different types of wastes (hazardous, non-hazardous or inert) will be generated as a result of the materials use and personnel requirements during the land preparation and construction and operation activities. As use of construction materials and personnel involvement will be at significant levels during the construction phase, waste generation will be a more important issue when compared to operation phase. Types of wastes to be generated in each phase are identified in the following sections, with quantification for certain types of wastes (i.e. municipal, excavated materials) wherever possible.

If not properly managed, waste generation may cause soil contamination, pollution of surface and groundwater resources, disturbance of flora and fauna components, visual nuisance and risks to public and personnel health and safety. Adverse impacts on ecosystem components including soil, surface and ground water resources as well as flora and fauna components and other social issues associated with waste generation can be avoided and/or minimized with effective implementation of good waste management practices in accordance with the requirements of national legislation and international standards. The incremental load to be put on the existing waste management infrastructure of the city will be another aspect related with the Project-sourced waste generation.

7.3.1. Land Preparation and Construction Phase

Wastes anticipated to be generated at the camps and other work sites during the construction phase of the Project would mainly include cleared vegetation, municipal (domestic) solid wastes, treatment sludge, packaging wastes, excavation wastes, construction wastes, debris from settling ponds at concrete plants, hazardous wastes (including packaging wastes that contacted with hazardous substances), waste oils, waste tires, waste vegetable oils and other types of special wastes. Further information on the main types of wastes anticipated to be generated in the scope of land preparation and construction activities are provided below.

Waste Management Regulation includes a list of wastes as an appendix. In this list, hazardous wastes are marked with a star sign (*) plus one of the codes of (A) or (M); where (A) refers to wastes that will be directly categorized as hazardous and (M) refers to wastes for which hazardousness characteristics will be determined by means of analyses to be done in accordance with the Regulation. Table 7.6 provides an indicative list of probable waste types, which has been extracted from the list of wastes given as an appendix of the Waste Management Regulation, which may be produced during the land preparation and construction activities. The waste codes are as specified in the Regulation and remarks column indicates the hazardousness classification of the wastes as described previously in this paragraph.

Table 7.6. Indicative List of the Potential Types of Wastes that may be produced during the Land Preparation and Construction Activities

Waste Code	Waste Code Definition	Remarks
01	**Wastes Generated During the Exploration, Extraction, Operation and Physical or Chemical Processing of Ores**	
01 01	**Wastes generated due to mining excavations**	
01 01 01	Wastes due to metallic ores	
01 01 02	Wastes due to non-metallic ores	
13	**Oil Wastes and Liquid Fuel Wastes (Excluding Renewable Oils)**	
13 01	**Waste Hydraulic Oils**	A
13 02	**Waste Engine, Transmission and Lubrication Oils**	A
13 03	**Waste Insulation and Heat Conduction Oils**	A
13 04	**Bilge Oils**	A
13 05	**Oil/Water Separator Contents**	A
13 07	**Wastes of Liquid Fuels (Fuel oil, diesel, gasoline, other fuels including mixuters)**	A
15	**Waste Packaging and Absorbents, Wiping Clothes, Filter Materials and Protective Clothing Not-Classified Under Other Waste Types**	
15 01	**Packaging (Including Packaging Material Collected by the Municipality Separately)**	
15 01 01	Paper and cardboard packaging	
15 01 02	Plastic packaging	
15 01 03	Wood packaging	
15 01 04	Metallic packaging	
15 01 05	Composite packaging	
15 01 06	Mixed packaging	
15 01 07	Glass packaging	
15 01 09	Textile packaging	
15 01 10*	Packaging containing traces of hazardous materials or contaminated with hazardous materials	A
15 01 11*	Metallic packaging material containing hazardous porous solid structures (asbestos, for example), including empty pressurized containers	A
15 02	**Absorbents, Filter Materials, Wiping Clothes and Protective Clothing**	
15 02 02*	Absorbents, filter materials (oil filters if not classified in any other way), wiping clothes, protective clothing contaminated with hazardous materials	M
15 02 03	Absorbents, filter materials, wiping clothes and protective clothing excluding 15 02 02	
16	**Wastes not Classified under any other Type of Waste in the List**	
16 01	**Wastes Generated due to Vehicle Maintenance (Excluding 13, 14, 16 06 and 16 08), End-of-life Vehicles and the Dismantling of End-of-life Vehicles (including construction machinery) in Various Transportation Categories**	
16 01 03	End-of-life tires	
16 02	**Electrical and Electronic Equipment Wastes**	A
16 04	**Explosive Wastes**	A
16 06	**Batteries and Accumulators**	A
17	**Construction and Demolition Wastes (Including Excavations Conducted at Contaminated Sites)**	
17 01	**Concrete, Brick, Tile and Ceramic**	
17 01 01	Concrete	
17 01 02	Bricks	
17 01 03	Tiles and ceramic	
17 01 06*	Mixtures or separated groups of concrete, brick, tile and ceramic containing hazardous substances.	M
17 01 07	Mixtures or separated groups of concrete, brick, tile and ceramic, excluding 17 01 06	
17 02	**Wood, Glass and Plastic**	
17 02 01	Wood	
17 02 02	Glass	
17 02 03	Plastic	
17 02 04*	Wood, glass and plastic containing or contaminated with hazardous substances.	A
17 03	**Mixtures Containing Bitumen, Coal Tar and Products Containing Tar**	
17 03 01*	Mixtures with bitumen, containing coal tar	M
17 03 02	Mixtures containing bitumen, excluding 17 03 01	
17 03 03*	Coal tar and products containing tar	A

Waste Code	Waste Code Definition	Remarks
17 04	**Metals (Including Their Alloys)**	
17 04 01	Copper, bronze and brass	
17 04 02	Aluminium	
17 04 03	Lead	
17 04 04	Zinc	
17 04 05	Iron and steel	
17 04 06	Tin	
17 05	**Soil (Including Excavations Conducted in Contaminated Sites), Stones and Dredging Mud**	
17 05 03*	Soil and stones containing hazardous substances	M
17 05 04	Soil and stones excluding 17 05 03	
17 09	**Other Construction and Demolition Waste**	
17 09 01*	Construction and demolition waste containing mercury	M
17 09 02*	Construction and demolition waste containing PCB (example: filling paste containing PCB, resin-based base coating material containing PCB, coated enamelling units containing PCB, capacitors containing PCB)	M
17 09 03*	Other construction and demolition waste containing hazardous substances (including mixed waste)	M
17 09 04	Mixed construction and demolition waste, excluding 17 09 01, 17 09 02 and 17 09 03	
19 13 08	Concentrated liquids and aqueous liquid wastes due to groundwater rehabilitation, excluding 19 13 07	
20	**Municipal Waste including Separately Collected Fractions (Household Waste and Similar Commercial, Industrial and Institutional Waste)**	
20 01	**Separately Collected Fractions (Excluding 15 01)**	
20 01 01	Paper and cardboard	
20 01 02	Glass	
20 01 08	Biodegradable kitchen and canteen wastes	
20 01 10	Clothing	
20 01 11	Textile products	
20 01 13*	Solvents	A
20 01 14*	Acids	A
20 01 15*	Alkalines	A
20 01 17*	Photo chemicals	A
20 01 19*	Pesticides	A
20 01 21*	Fluorescent lamps and other mercury-containing wastes	A
20 01 37*	Wood containing hazardous substances	M
20 01 38	Wood excluding 20 01 37	
20 01 39	Plastics	
20 01 40	Metals	
20 02	**Garden and Park Wastes (Including Cemetery Wastes)**	
20 02 01	Biodegradable wastes	
20 02 02	Soil and stones	
20 02 03	Other non-biodegradable wastes	
20 03	**Other Municipal Wastes**	
20 03 01	Mixed municipal waste	
20 03 04	Cesspit mud	

Source: Turkish Waste Management Regulation, Appendix-4.

Municipal Solid Wastes

According to the data published by Turkstat (*2014*), the daily average municipal solid waste generated by a person in Turkey is 1,08 kg and in Istanbul is 1,16 kg (including packaging waste). This amount for Kocaeli is 0,91 kg, and for Sakarya 1 kg. By taking into account that most of the construction works will be realized in Kocaeli and camp sites will be located there the average value determined for Kocaeli, maximum number of personnel to be employed in each section and estimated amount of municipal waste to be generated are summarized in Table 7.7. Assuming %30 (*Ministry of Environment and Urbanization, 2013*) of the municipal solid wastes (by weight) is formed of packaging wastes, estimated amount of packaging wastes within the total municipal wastes to be produced is also provided in the last column of the table.

Table 7.7. Estimated Municipal Waste Generation for Each Section (as of March 2017) for Construction

Location	Number of Maximum Personnel Anticipated to be Employed in Each Section (including contractors and sub-contractors) (persons)	Total Amount of Daily Municipal Waste Generation (kg/day)	Amount of Packaging Wastes within the Daily Municipal Waste Production (kg/day)
Section 4	2.500	2.275	700
Section 5	900	820	250
Section 6	1.100	1.100	300
Total	**4.500**	**4.195**	**1.250**

The total capacity of the landfills located at the Asian side of the project, namely Komurcuoda, Dilovası, Solaklar and Sakarya MM, sums up to nearly 9.000 ton/day. Capacity of Dilovasi and Solaklar landfill in Kocaeli, which would serve to the municipal waste to be produced in Section 4 and Section 5, is given as 1.600 ton/day, while capacity of the landfill site of Sakarya Metropolitan Municipality is given as 1.800 ton/day. The total amount of municipal solid waste to be produced at the camp sites in Kocaeli (including Cayirkoy Camp Site of Section 6) on a daily basis (around 2 ton/day) during the construction phase forms 0,1% of the daily capacity of the landfills at Dilovasi and Solaklar. The total amount of municipal solid waste to be produced at the camp sites in Sakarya on a daily basis (around 0,25 ton/day) during the construction phase forms 0,01% of the daily capacity of the Sakarya Metropolitan Municipality's landfill. Additionally it should be noted that the Camp Sites will be in place for a maximum of 3 years within the construction period. Thus, the load to be provided by the Project during the construction phase on the capacity of existing waste disposal infrastructure will be negligible.

During the operation phase, personnel to be employed at the toll plazas, control centers and operation/maintenance centers as well as the employees, visitors and users of the service areas will be the sources of municipal waste production. As given in Chapter 3 (“Project Description”) total number of personnel anticipated to be employed at operation buildings (e.g. toll plazas, control centers and operation centers) is estimated to be 325. For the visitors who will use the service areas, it is assumed that the daily average municipal solid waste generation would be around 25% of the daily average municipal solid waste generation by a person in Kocaeli (0,91 kg). It has been assumed that the average number of personnel to be employed at each service areas would be 90. Municipal solid waste generation anticipated for the operation phase is given in Table 7.8. According to this assessment, amount of municipal solid waste to be generated daily is estimated as 1,4 ton/day, which correspond to around 0,02% of the total daily capacity of landfills. Thus, the load to be provided by the Project during the operation phase on the capacity of existing waste disposal infrastructure will be negligible.

Table 7.8. Estimated Municipal Waste Generation for Each Section (as of March 2017) for Operation

Location	Estimated Number Personnel/Visitors	Daily Municipal Waste Production (kg/day)	Amount of Packaging Wastes within the Daily Municipal Waste Production (kg/day)
European Side			
Operation buildings	325	300	90
Service areas (x5) (visitors)	1.600	370	110
Service areas (x5) (personnel)	800	730	220
Total	**2.725**	**1.400**	**420**

Excavated Materials

As discussed in the previous chapters, fill material requirements of the Project will be aimed to be primarily supplied from the excavations to be done in the scope of the construction works, wherever the quality and quantity of the materials are sufficient. On the other hand, additional construction materials requirements will be supplied from nearby quarries. Excavation and fill volumes for the Project have been previously provided in Chapter 6 (“Topography, Soils and Geology”), while the key findings for each section are summarized below:

In Section 4, 70% of the excavated materials will be used in fill operations and the remaining 30% will be sent to disposal sites. Waste excavation material which will not be used for filling and construction activities will be stored in storage sites the locations of the selected sites are defined in Chapter 3 “Project Description”. Further planning will be done to identify the source of the additional material extraction and storage site requirements.

- In Section 5, volume of the excavation material is not adequate for the planned fill volumes. The remaining amount needed for filling activities will be supplied from Kutluca Quarry. Waste excavation material which will not be used for filling and construction activities will be stored in storage sites the locations of the selected sites are defined in Chapter 3 “Project Description”. Further planning will be done to identify additional storage site requirements.

- In Section 6, the difference between excavation material and the material need for filling activities is minor. The remaining amount needed for filling activities will be supplied from Taskisigi and Yaglica quarries. Waste excavation material will be stored at designated excavated material storage sites to be selected.

Potential impact of the Project due to construction materials extraction will be minimized by reusing the excavated materials as fill material to the extent possible. This will also minimize the area required for storage. Amount of materials to be reused and stored at the designated excavated material storage areas in each section have been provided in details in Section 6.3.1.1 of Chapter 6 (“Topography, Soils and Geology”) and summarized in Table 7.9.

Table 7.9. Amount of Excavated Materials to be Reused and Stored in the scope of the Project

Section	Amount of Excavated Materials	
	To be Reused in Construction Works (m^3)	To be Stored (m^3)
Section 4	17.754.342	7.609.004
Section 5	11.897.831	5.099.070
Section 6	12.326.729	12.326.729
Total	**41.978.902**	**25.034.803**

Construction and Demolition Wastes

Fences, barriers, buildings, walls, former engineering structures, etc. corresponding to the Motorway route will be dismantled and removed prior to construction resulting in generation of construction and demolition wastes.

Hazardous and Special Wastes

Hazardous waste shares the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as “hazardous” by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics (*IFC, April 2007*). Turkish Waste Management Regulation specifies the hazardousness properties (explosive, oxidizing, flammable, irritating, toxic, carcinogenic, etc.) of wastes and lists the types of wastes that are to be handled directly as hazardous or after tests to be done if their hazardousness properties and concentrations are confirmed. Additionally, specific regulations are in force for the management of special wastes such as waste tires, medical wastes, waste vegetable oils, waste batteries and accumulators.

In the scope of the North Marmara Motorway Project, it is likely that special wastes, hazardous wastes (e.g. spent solvents) or wastes contaminated with substances having hazardous properties (e.g. packaging wastes, personal protective devices, oily cleaning rags, empty paint cans, chemical containers, used lubricating oil, used batteries, lighting equipments such as lamps or lamp ballasts, etc.) would be produced during the construction activities, as it is the case in many projects (*IFC, April 2007*).

Amount of waste motor oils may be relatively higher in comparison to other types of hazardous and special wastes due to the large number of equipments to be involved in the construction works. Assuming that the average oil capacity of the construction machineries is 20 liters and motor oils of these machineries will be changed 4 times a year, total amount of waste oil to be produced can be estimated as given in Table 7.10.

Table 7.10. Estimated Amount of Waste Motor Oil to be Produced

Section	Total Number of Machines	Total Motor Oil Capacity of Machines	Annual Amount of Motor Oil to be Changed
Section 4	250	5.000 L	20.000 L
Section 5	123	2.460 L	9.840 L
Section 6	292	5.840 L	23.360 L
Total	**665**	**13.300 L**	**53.200 L**

7.3.2. Operation Phase

Solid waste generation during operation and maintenance activities may be caused by road resurfacing waste (e.g. removal of the old road surface material); road litter, illegally dumped waste, or general solid waste from rest/service areas; animal carcasses; vegetation waste from right-of-way maintenance; and sediment and sludge from stormwater drainage system maintenance (including sediment traps and oil/water separation systems). Hazardous wastes may also be produced in limited quantities at the maintenance and operation centers. Paint waste may also be generated from road and bridge maintenance for example due to removal of old paint from road stripping and bridges prior to re-painting (*IFC, April 2007*). These wastes are required to be properly managed in line with the requirements of national waste management legislation and international good practice in order to avoid impacts on soils, nearby water resources and flora and fauna elements.

7.4. Mitigation Measures

Wastes to be generated in the scope of Project activities will be managed in accordance with the waste management hierarchy (see Figure 7.5). In this respect, waste generation will be avoided or minimized at the source to the extent possible. If this is not possible, on-site waste reuse options will be explored and implemented. If this is not possible, alternative external recycling/recovery options will be evaluated. As an ultimate alternative, wastes will be sent to final disposal only if other waste management methods are not possible. Legitimate contractors having proper licenses from the Ministry of Environment and Urbanization for the transportation, recycling/recovery or disposal of specific types of wastes will be used. Detailed procedures to be applied for each type of waste to be generated is provided in the Solid Waste Management Procedure prepared as a part of the Environmental and Social Management Plan presented in Annex-6. Trainings will be provided to Project personnel regarding the proper implementation of waste management procedures in line with the requirements of national legislation and good site practices.

Figure 7.5. Waste Management Hierarchy
(Source: https://www.epa.gov)

National waste management legislation, consisting of the following regulations, will be complied with in the scope of all Project activities:

- Waste Management Regulation
- Hazardous Waste Control Regulation
- Regulation on the Control of Waste Oils
- Regulation on the Control of Waste Vegetable Oils
- Regulation on the Control of Waste Batteries and Accumulators
- Regulation on the Control of Waste Tires
- Regulation on the Control of Medical Wastes

Regarding the management/disposal of Project-sourced wastes, written agreements/protocols will be done with the local waste management service providers (e.g. ISTAC A.S., IZAYDAS, other private licensed waste transportation/recycling/ recovery) that have valid permits and licenses from the Ministry of Environment and Urbanization. Copies of the relevant documents will be kept at the camp sites and Project offices.

7.4.1. Land Preparation and Construction Phase

Hazardous and special wastes including waste oils, tires, etc. will be sourced from maintenance of vehicles and equipments during the construction phase. These hazardous and special wastes will be separately collected in proper containers/drums and managed in accordance with the requirements of the national waste management regulations. General measures that will be applied to avoid or minimize potential impacts or risks sourced from waste generation are listed below:

- Wastes will be collected systematically in closed containers and various types of wastes (non-hazardous, hazardous and special wastes) will be sorted for proper handling and disposal.
- Recyclable wastes will be collected separately to be sent to licensed recycling facilities.
- To the extent possible, use of non-hazardous materials will be preferred. Where use of hazardous materials is inevitable, hazardous wastes will be segregated from non-hazardous wastes. Thus, hazardous waste formation will be minimized.
- No waste will be disposed of or buried on site. Illegal dumping will not be allowed.
- It will be ensured that construction camp sites and surroundings are kept clean and that windblown litter is cleared on a daily basis.
- Site personnel will be trained on proper waste management procedures.
- For the temporary storage of the hazardous and non-hazardous wastes at the camp sites, temporary waste storage areas will be established.
- Licensed waste transportation vehicles will be used to remove wastes being temporarily stored at Project sites. Private companies and relevant municipalities will be interviewed for this purpose. Possible management options will be evaluated in accordance with the relevant waste management regulations and these actions will be recorded and kept by Project Management.

Temporary hazardous and non-hazardous waste storage areas will have the following features:

- Roof and sides of the area will be properly covered to prevent rainwater intrusion;
- Floor of the area will be sealed with either reinforced concrete or epoxy material;
- Drainage of the areas will be provided and the channels will drain to blind holes;
- Access to storage areas will be through controlled gates having proper locking systems;
- Necessary signs and boards will be properly placed; name and contact number of the personnel responsible from the area will be put on the boards;
- Separate storage compartments will be provided for the storage of different types of wastes;
- Leak-proof containment structures will be placed under the tanks/drums holding liquid wastes;
- For the storage of liquid wastes greater than 220 liters, secondary containment with an available volume of at least 110 percent of the largest storage container or 25 percent of the total storage capacity (whichever is greater) will be provided;
- Relevant fire-fighting equipments (i.e. mobile fire extinguishers) will be kept ready outside the storage areas;
- Absorbents will be kept available for response to potential leakage/spill events;
- Adequate ventilation will be provided where volatile wastes are to be stored.

All the hazardous and non-hazardous waste storage areas will be visually inspected by assigned site personnel on a regular basis.

Municipal Wastes

Municipal solid wastes to be generated at camps and other work sites will be stored in closed containers and delivered to related municipality trucks or licensed firms for disposal. Separate waste containers (drums, bins, skips or bags) will be provided for different types of waste. As mentioned previously, Sile Komurcuoda, Dilovası, Solaklar and Sakarya Metropolitan Municipality landfills would be the alternatives for the disposal of Project-sourced municipal wastes.

Excavated Materials

Materials to be excavated from the Motorway route will be reused as fill material in the construction of road base, shoulders, side slope arrangements, etc. to the extent the quality and quantity of materials allows in order to minimize the amount of excavated materials to be permanently stored and area (i.e. forest lands) to be disturbed by storage sites.

When there is excess of excavated materials or the materials are not suitable for being used in construction, these wastes will be permanently stored in the areas to be designated as storage sites. Permits for the use of storage sites will be obtained from the related authorities. Transportation of the materials to the storage sites will be performed by using licensed vehicles. Information on the excavated materials storage sites are provided in Section 3.2.2 (“Storage Sites”).

Construction Wastes

Construction and demolition wastes will be disposed of in accordance with the Regulation on Excavation, Construction and Demolition Wastes. Scrap metals to be generated will be collected separately from other type of wastes. These wastes will be disposed of by the recycling companies which are licensed by Ministry of Environment and Urbanization.

Hazardous and Special Wastes

Hazardous and special wastes (i.e. waste oils, waste tires, waste batteries etc.) will be collected separately in closed containers and will be delivered to licensed firms for transportation to licensed recycling, recovery or final disposal facilities/sites.

Waste oils generated at the facilities will be analyzed at the competent laboratories and will be classified according to their categories. Accordingly, waste oils will be stored separately in the tanks, containers or similar structures placed at temporary waste storage sites. Waste oils temporarily stored at the facility will removed from the site to recovery facilities by licensed waste oil transfer vehicles in line with Regulation on the Control of Waste Oils.

Medical waste, which might be produced at the Construction Site medical rooms will be stored separately from other kinds of wastes. To achieve this, special storage bags and boxes will be provided. The project will also designate special areas where unauthorized persons would not have access. Until final disposal, un-sharp wastes will be stored in special designed red bags which are marked by the sign of “International Bio-Hazards” and writing “Warning: Medical Waste” on both sides. Those that are sharp will be stored separately in boxes or containers that are designed (puncture, tearing, breaking and blasting resistance, water resistance and leak-proof, impossible to open or scramble) in accordance to related regulations. The sign of “International Bio-Hazards” and writing “Warning: Sharp Medical Waste” will be visible on these boxes or containers. Medical waste storage temporarily during the field research will be transported with the special medical waste transport vehicles operating according to the Regulation on the Control of Medical Wastes.

Waste batteries and accumulators to be generated will be stored separately from other type of wastes and wasted accumulators at the temporary waste storage areas. Waste batteries and accumulators temporarily stored at these sites will be removed by means of licensed vehicles in line with Regulation on the Control of Waste Batteries and Accumulators.

Treatment Sludge

Treatment sludge to be produced at the package domestic wastewater treatment plants at the camp sites will be analyzed in accordance with the national Waste Management Regulation in order to identify its characteristics (hazardous or non-hazardous). Depending on its hazardousness characteristics, waste treatment sludge will be disposed of at a licensed waste disposal site by means of companies having license from the Turkish Ministry of Environment and Urbanization.

7.4.2. Operation Phase

During the operation phase, measures proposed for the management of construction phase wastes will also be taken wherever applicable. Additional waste management measures to be taken to avoid/minimize waste production and manage the unavoidable wastes in sound manner during the operation phase are provided below:

- Chlorine free solvents and lead-free paints will be used within the scope of maintenance activities.
- Any waste identified or generated in the Motorway corridor as a result of the site cleanings, sediment removal, tree/shrub trimming, animal death and spill/scattering of waste tires, metal pieces, etc. will be immediately removed from the road surface and disposed of in accordance with the relevant national regulations within 7 days;
- Road resurfacing wastes will be primarily recycled wherever it is feasible by using in the aggregated or as a base material for the pavement;
- Recyclable materials such as glass, scrap tires, certain types of slags and ashes will be added to the new asphalt and concrete mixes;
- Amount of unused products (e.g. paint, herbicide) that needs disposal will be minimized by managing the inventories properly;
- Any obsolete product will be removed/managed in accordance with the requirements of Turkish regulations;
- Characteristics (hazardous or non-hazardous) of the sediment and sludge that will come out from the drainage system maintenance activities will be identified in accordance with the requirements of Turkish Waste Management Regulation and a disposal method suitable for the identified characteristics will be applied;
- Wherever feasible, vegetation waste will be composted for reuse as landscaping fertilizer;
- Removed, old road surface materials will be reused in paving or stockpiled for being reused in proper applications (e.g. as road base material) wherever feasible.

7.5. Summary of Assessment and Residual Impacts

Table 7.11 provides a summary on waste management. With proper implementation of good waste management practices, waste generation would not cause any significant impact on the soil or water resources or on the ecosystem components that would bring associated risks on health and safety of the community and/or Project personnel.

Table 7.11. Summary of the Assessments Waste Management

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource/ Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Local waste infrastructure	Land preparation and construction	Incremental load on the capacities of the local waste management facilities (landfills, recycling/recovery facilities, etc.)	Adverse	Wide	Medium	Low (daily waste amount less than 1% of the daily capacity of the landfill) Municipal waste: 4,2 ton/day corresponding 0,1% of the the daily capacity of landfills	Irreversible	Continous	Moderate (B)	Low (1)	Low (B1)	• Cooperation will be made with the licensed local service providers (e.g. ISTAC A.S., other private licensed waste transportation/recycling/ recovery firms and written agreements/protocols will be made regarding the regular and sound management/disposal of Project-sourced wastes. • Amount of wastes to be sent to off-site management will be minimized with the implementation of the Solid Waste Management Procedure that relies on the waste managament hierarchy. • Wastes will be collected systematically in closed containers and various types of wastes (non-hazardous, hazardous and special wastes) will be sorted for proper handling and disposal. • Recyclable wastes will be collected separately to be sent to licensed recycling facilities. • To the extent possible, use of non-hazardous materials will be preferred. Where use of hazardous materials is inevitable, hazardous wastes will be segregated from non-hazardous wastes. Thus, hazardous waste formation will be minimized. • No waste will be disposed of or buried on site. Illegal dumping will not be allowed. • It will be ensured that construction camp sites and surroundings are kept clean and that windblown litter is cleared on a daily basis. • Site personnel will be trained on proper waste management procedures. • For the temporary storage of the hazardous and non-hazardous wastes at the camp sites, temporary waste storage areas will be established. • Licensed waste transportation vehicles will be used to remove wastes being temporarily stored at Project sites. Private companies and relevant municipalities will be interviewed for this purpose. Possible management options will be evaluated in accordance with the relevant waste management regulations and these actions will be recorded and kept by Project Management. • Temporary hazardous and non-hazardous waste storage areas will roof and sides of the area will be properly covered to prevent rainwater intrusion; floor of the area will be sealed with either reinforced concrete or epoxy material; drainage of the areas will be provided and the channels will drain to blind holes. • Access to storage areas will be through controlled gates having proper locking systems. • Necessary signs and boards will be properly placed; name and contact number of the personnel responsible from the area will be put on the boards. • Separate storage compartments will be provided for the storage of different types of wastes. • Leak-proof containment structures will be placed under the tanks/drums holding liquid wastes. • For the storage of liquid wastes greater than 220 liters, secondary containment with an available volume of at least 110 percent of the largest storage container or 25 percent of the total storage capacity (whichever is greater) wil be provided. • Relevant fire-fighting equipments (i.e. mobile fire extinguishers) will be kept ready outside the storage areas. • Absorbents will be kept available for response to potential leakage/spill events. • Adequate ventilation will be provided where volatile wastes are to be stored. • All the hazardous and non-hazardous waste storage areas will be visually inspected by assigned site personnel on a regular basis.	Low
						Low Packaging waste: 1,3 kg/day	Short-term reversible				Low (B1)		Low
	Operation			Wide	Long	Low (daily waste amount less than 1% of the daily capacity of the landfill) Municipal solid waste 1,4 ton/day corresponding 0,04% of the daily capacity of landfills	Irreversible	Continous	Moderate (B)	Low (1)	Moderate (B1)	• Chlorine free solvents and lead-free paints will be used within the scope of maintenance activities. • Any waste identified or generated in the Motorway corridor as a result of the site cleanings, sediment removal, tree/shrub trimming, animal death and spill/scattering of waste tires, metal pieces, etc. will be immediately removed from the road surface and disposed of in accordance with the relevant national regulations within 7 days; • Road resurfacing wastes will be primarily recycled wherever it is feasible by using in the aggregated or as a base material for the pavement; • Recyclable materials such as glass, scrap tires, certain types of slags and ashes will be added to the new asphalt and concrete mixes; • Amount of unused products (e.g. paint, herbicide) that needs disposal will be minimized by managing the inventories properly; • Any obsolete product will be removed/managed in accordance with the requirements of Turkish regulations; • Characteristics (hazardous or non-hazardous) of the sediment and sludge that will come out from the drainage system maintenance activities will be identified in accordance with the requirements of Turkish Waste Management Regulation and a disposal method suitable for the identified characteristics will be applied; • Wherever feasible, vegetation waste will be composted for reuse as landscaping fertilizer; Removed, old road surface materials will be reused in paving or stockpiled for being reused in proper applications (e.g. as road base material) wherever feasible.	Low
						Low Packaging waste: 0,4 kg/day	Short-term reversible						

CHAPTER 8

WATER RESOURCES

CHAPTER 8. WATER RESOURCES

This Chapter identifies the existing water resources' characteristics (physical, biological and chemical) and usage along the Motorway route and assesses the potential direct impacts of the North Marmara Motorway Project on these aspects. Measures proposed for the mitigation of the potential impacts and the residual impacts are also described in this Chapter.

8.1. Assessment Methodology and Data Sources

To assess the impacts to the water resources and possible water usage by the Project Sponsors the main water resources in the area has been determined and evaluated by considering the physical and chemical characteristics of the resources. The data concerning the dam lakes near project area has been obtained from State Hydraulic Works (DSI) database. Sampling points for the surface water resources where possible impacts are foreseen have been determined and water has been analyzed based on Turkish legislative requirements. Through this sampling and evaluation the baseline quality data of the surface and groundwater resources will be obtained for future reference for impact assessment.

Significance Criteria

The significance criteria for the impacts on water resources will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on the water resources. The sensitivity/value criteria to be used in the scope of impact assessment for the resources that will be based on the existing and potential use of the resource, existing quality, and expert judgment.

8.2. Baseline Conditions

The Motorway crosses a large number of surface water resources including intermittent and perennial rivers, creeks, etc. These resources may be affected from the Project activities in several ways during the construction and operation phases of the Project if not properly mitigated.

To characterize the baseline water quality conditions at such areas and other surface water bodies crossed by the Project, an intensive baseline water quality sampling and analyses program (covering both surface and groundwater resources) has been conducted. The program included in-situ measurements, sampling and laboratory analyses. The interpretation of measurement results is done in accordance with relevant standards and baseline conditions regarding surface and groundwater resources are provided in this Chapter.

8.2.1. Catchment Basins within the Project

Marmara Catchment Basin

Borders of Marmara Catchment Basin can be illustrated as; Koru Mountain, Ganos Mountain and Istıranca Mountain Chain on Thracian part of the catchment basin and Alem Mountain, Aydos Mountain, Kayalidag, Gokdag, Avdan Mountain, Katırlı Mountain and Kaz Mountain Chain starting from north of Anatolian part (see Figure 8.1). Total area of Marmara Catchment Basin is 2,308,464 ha and population density is 657 person/km^2 while Turkey's average is 94 person/km^2 according to TUIK (*Catchment Basin Protection Plans, Marmara Catchment Basin, TUBITAK MAM, 2013*).

Sakarya River Basin

Sakarya River Basin is located at the north-west of Anatolian Peninsula. The river basin borders could be defined as; Bolu Mountains at the north, Idris and Elmadag Mountains and Haymana Plateau at the east, Emir and Murat Mountains and Bayat and Cihanbeyli Plateaus at the south; Domanic and Uludag at the west (see Figure 8.1). The total surface area of the basin is 58.600 km^2 and population density is 129 person/km^2 while Turkey's average is 94 person/km^2 according to TUIK statistics. (*TUBITAK MAM, 2013*)

Leading Environmental Pressures in Marmara and Sakarya Catchment Basins

In most of the creeks in Istanbul, water quality class is IV because of NH4-N. Also, the creeks which feed Iznik Lake are also class IV, in other words are polluted.

Industry has grown very fast in Kocaeli-Gebze since 1990. There are more than 3000 industrial facilities including the ones in organized industrial areas. Throughout the basin, particularly in Istanbul, many WWTPs apply only pretreatment (*TUBITAK MAM, 2013*).

The main pollution pressures on Sakarya basin could be summed up as; discharge of non-treated/partly treated wastewaters, non-treated industrial wastewater discharges, agriculture and live stock breeding activities, material borrowing from river beds. The downstream Sakarya Sub basin is receiving this water and also polluted due to agricultural activities.

Water quality of the basin elements are mainly varying from Class II to Class IV due to NH4-N, total phosphorus, TKN, Orthophosphate and NO_3-N. Since the basin is very wide the class indicators are varying based on locations and respective pollution sources.

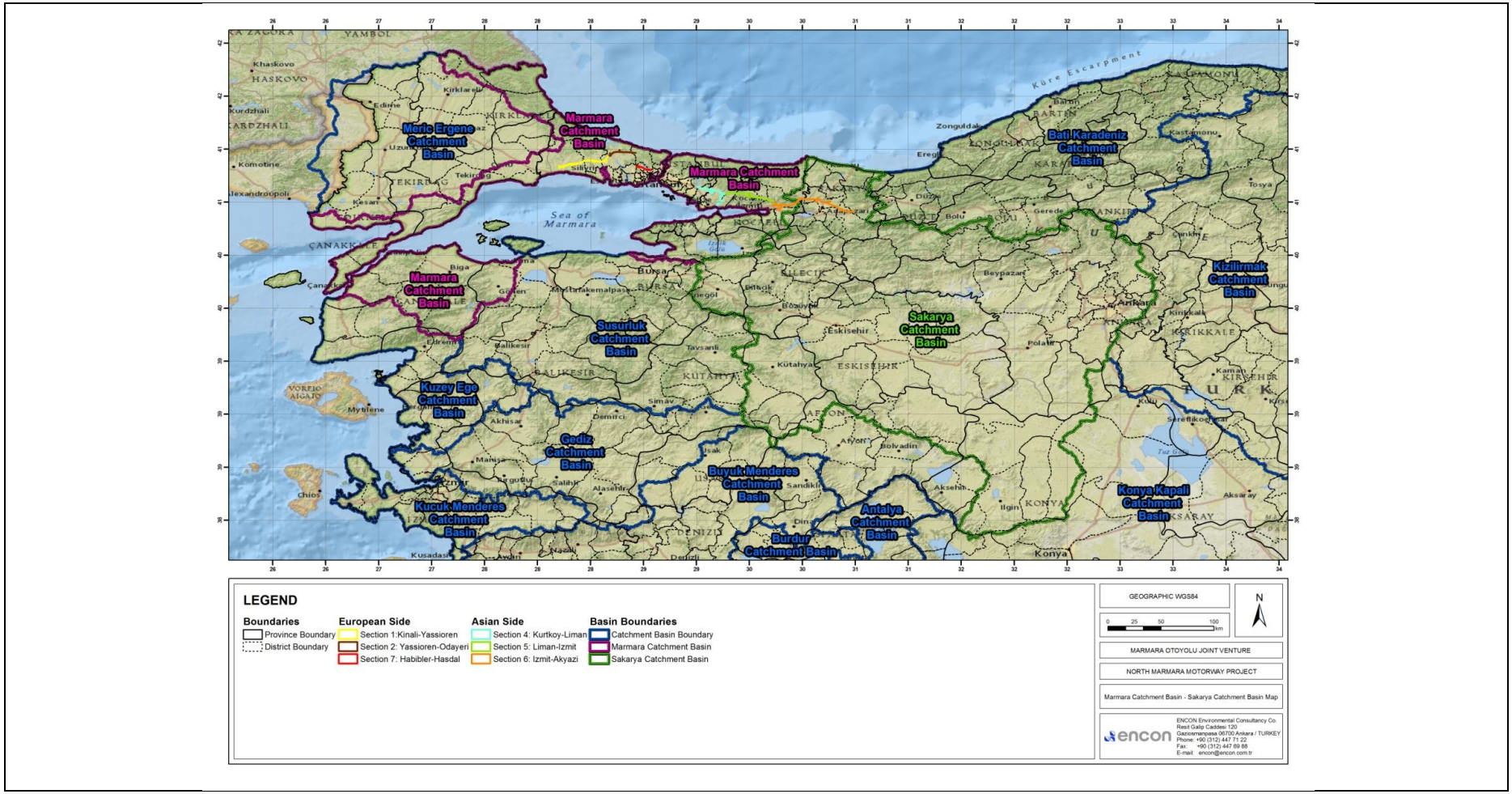


Figure 8.1. Marmara Catchment Basin – Sakarya Basin Map

8.2.2. Surface Waters within the Project

8.2.2.1 Standing Water Bodies (Marmara and Sakarya Basins)

Bayraktar Dam Lake (Section 5)

The dam lake is at approximately 2,83 km south of KM (201+200) of the motorway (see Figure 8.2). Dam Lake is constructed in 1985 for irrigation and flood management purposes and still is being used for same purpose. Total dam volume is 133.000 m^3. Total height of the dam lake is 25 m from thalweg while reservoir volume is 1.360.000.000 m^3 and reservoir area is 182 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

The dam is providing irrigation water for an area of 293 ha.

Bıçkıdere Lake (Section 5)

The dam lake is at approximately 1,42 km west of KM (190+700) of the motorway (see Figure 8.2). Dam Lake is constructed in 1978 for irrigation and flood management purposes and still is being used for same purpose. Total dam volume is 700.000 m^3. Total height of the dam lake is 25 m from thalweg while reservoir volume is 2.390.000.000 m^3 and reservoir area is 405 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

The dam is providing irrigation water for an area of 267 ha.

Kirazdere (Yuvacik) Dam Lake (Section 4)

The dam lake is at approximately 11 km south-west of KM (0+495) of the motorway (see Figure 8.2). Dam Lake is constructed between 1987-1999 for drinking purposes and still is being used for same purpose. Total dam volume is 5.200.000 m^3. Total height of the dam lake is 109 m from thalweg while reservoir volume is 60.000.000 m^3 and reservoir area is 2 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

Kurtdere Dam Lake (Section ?)

The dam lake and HEPP is at approximately 1,6 km south-east of KM (0+500) of the motorway (see Figure 8.2). Dam Lake is constructed in 1974 for irrigation and flood management purposes and still is being used for same purpose. Total dam volume is 98.000 m^3. Total height of the dam lake is 26 m from thalweg while reservoir volume is 1.250.000.000 m^3 and reservoir area is 198 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

The dam is providing irrigation water for an area of 250 ha.

Tahtalı Lake

The dam lake is at approximately 5,71 km north-east of KM (178+200) of the motorway (see Figure 8.2).

Sahinler Dam Lake

The dam lake is at approximately 9,96 km north-east of KM (187+700) of the motorway (see Figure 8.2). Dam Lake is constructed in 1994 for irrigation purposes and still is being used for same purpose. Total dam volume is 131.000 m^3. Total height of the dam lake is 23 m from thalweg while reservoir volume is 1.450.000.000 m^3 and reservoir area is 290 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

The dam is providing irrigation water for an area of 320 ha.

Seytandere Dam Lake

The dam lake is at approximately 2,94 km south of KM (201+300) of the motorway (see Figure 8.2). Dam Lake is constructed between 1981-1985 for irrigation and flood management purposes and still is being used for same purpose. Total dam volume is 277.000 m^3. Total height of the dam lake is 18 m from thalweg while reservoir volume is 2.000.000 m^3 and reservoir area is 395 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

The dam is providing irrigation water for an area of 643 ha.

Elmali II Dam Lake

The dam lake is at approximately 21,71 km north-west of KM (100+5) of the motorway (see Figure 8.2). Dam Lake is constructed between 1952-1955 for drinking purposes and still is being used for same purpose. Total dam volume is 103.000 m^3. Total height of the dam lake is42 m from thalweg while reservoir volume is 10.000.000 m^3 and reservoir area is 3 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

Omerli Dam Lake

The dam lake is at approximately 13,15 km north of KM (0+000) of the motorway (see Figure 8.2). Dam Lake is constructed between 1968–1973 for drinking purposes and still is being used for same purpose. Total dam volume is 277.000 m^3. Total height of the dam lake is 18 m from thalweg while reservoir volume is 2.000.000 m^3 and reservoir area is 395 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

Darlık Dam Lake

The dam lake is at approximately 23,17 km south-east of KM (152+200) of the motorway (see Figure 8.2). Dam Lake is constructed between 1986-1988 for drinking purposes and still is being used for same purpose. Total dam volume is 1.600.000 m^3. Total height of the dam lake is 73 m from thalweg while reservoir volume is 107.000.000 m^3 and reservoir area is 6 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

Hasanlar Dam and HEPP

The dam lake is at approximately 57,98 km north-east of KM (2+200) of the motorway (see Figure 8.2). Dam Lake is constructed between 1965-1972 for energy generation, irrigation and flood management purposes and still is being used for same purpose. Total dam volume is 1.651.000 m^3. Total height of the dam lake is 71 m from thalweg while reservoir volume is 55.000.000 m^3 and reservoir area is 3 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

Golkoy Dam Lake

The dam lake is at approximately 73,23 km east of KM (2+200) of the motorway (see Figure 8.2). Dam Lake is constructed between 1965-197 for irrigation and flood management purposes and still is being used for same purpose. Total dam volume is 1.534.000 m^3. Total height of the dam lake is 22 m from thalweg while reservoir volume is 24.000.000 m^3 and reservoir area is 1 km^2 on normal water elevation (*Source: State Hydraulic Works' Website*).

Sapanca Lake

The lake is located at approximately 11,81 km south-east of KM (217+200) of the motorway (see Figure 8.2). Sapanca Lake is one of the few natural lakes that have drinking water potential. The lake is used for drinking purposes for Sakarya and Kocaeli. The maximum depth of the lake is 61 m. and normal water elevation is 31 m. (TUBITAK MAM, 2013). Lake reservoir is approximately 120.000.000 m^3.

Denizli Pond

The lake is used for drinking purposes and has 15.000 m^3/day capacity. It's located 0,75 km north east of KM (0+000).

Poyrazlar Lake

The lake has an area of 60 ha maximum depth of the lake is 3 m. Maximum water level is 25 m. It's located at 3,31 km north-east of KM(232+500)

Taskisigi Lake

The lake has an area of 90 ha maximum depth of the lake is 63 m. It's located at 5,03 km north of KM(0+200)

Buyuk Akgol Lake

The lake has an area of 500 ha maximum depth of the lake is 6 m. Maximum water level is 4 m. It's located at 33,85 km north of KM(245+800)

Kucuk Akgol

The lake has an area of 20 ha maximum depth of the lake is 6 m. It's located at 25,13 km north of KM(235+900)

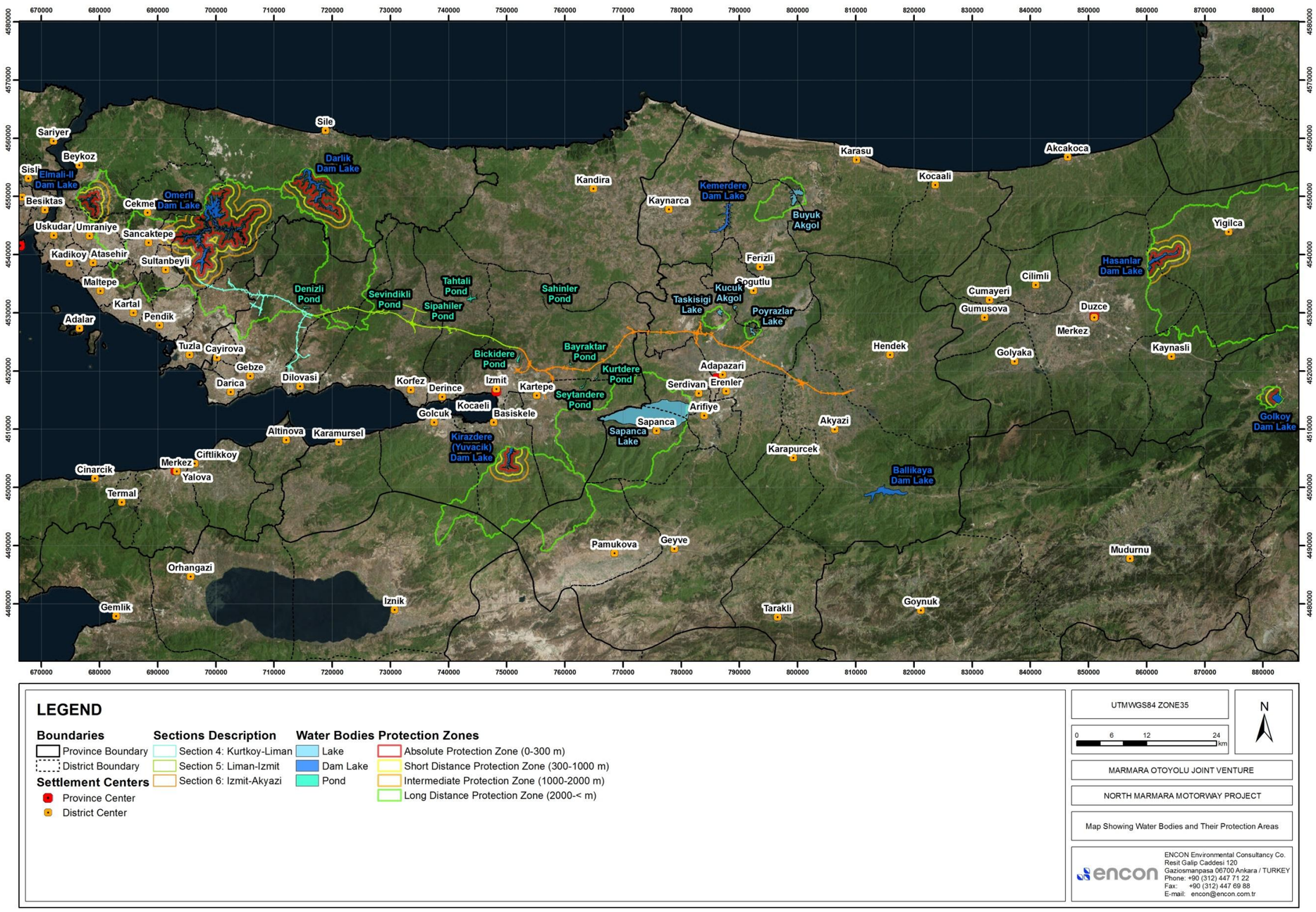
Ballıkaya Dam (Planned)

The dam is planned to be built to supply the water demand of Sakarya in following years.

Kemerdere Dam (Planned)

The dam is planned to be built to supply the water demand of Sakarya in following years.

Also there are two small ponds close to the construction area. Sipahiler Pond is 0,40 km north-east of KM (171+200) and Sevindikli Pons is 0,82 km north-east of KM(0+000).



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

Water Bodies Protection Zones
- Lake
- Dam Lake
- Pond
- Absolute Protection Zone (0-300 m)
- Short Distance Protection Zone (300-1000 m)
- Intermediate Protection Zone (1000-2000 m)
- Long Distance Protection Zone (2000-< m)

UTMWGS84 ZONE35

N

0 6 12 24 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Map Showing Water Bodies and Their Protection Areas

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Figure 8.2. Map Showing Water Bodies and Their Protection Areas

8.2.2.2. Running Water Bodies

Based on its structure Marmara catchment is not considered as a river catchment since it contains a high number of creeks and streams. The quality of water resources in the catchment vary based on the pollution pressures they are exposed. The water quality parameters are detected in very different levels and based on findings the water classes vary from Class I to Class IV. The main rivers in Marmara region are namely; Sakarya, Ergene, Susurluk, Meriç and Biga Creek. As mentioned before there are more streams and creeks are located in the region.

Sakarya catchment on the other hand could be defined as a river catchment since Sakarya river and its streams are located within the area. Sakarya River constitutes 3,4 % of freshwaters of Turkey. Sakarya cathment involves 6 sub-catchments namely; Upstream Sakarya Catchment, Porsuk Stream Catchment, Ankara Stream Catchment, Middle Sakarya Catchment, Karasu-Goksu Streams Catchment and Downstream Sakarya Catchment. The project will be constructed in Downstream Sakarya Catchment area.

The main rivers within the area could be listed as follows:

- Göksu Stream Göksu-Karasu Catchment, 25 km north-west of KM(129+650)
- Karasu Stream Göksu-Karasu Catchment, 38,43 km north-east of KM(2+425)
- Mudurnu Stream Downstream, 3,20 km north-east of KM(242+400)
- Çarksuyu Stream Downstream, 4,37 km north of KM(0+000)
- Seydi Stream Upstream, not in the project area
- Bardakçı Creek Upstream, not in the project area
- Gökpınar Creek Upstream, not in the project area
- Ilıcaözü Creek Upstream, not in the project area
- Porsuk Stream Porsuk Catchment, not in the project area
- Ilıcaözü Deresi Ankara Catchment, not in the project area
- Ankara Stream Ankara Catchment, not in the project area
- Kirmir Stream Middle, not in the project area
- Aladağ Stream Middle, not in the project area
- Nallıdere Creek Middle, not in the project area
- Değirmendere Creek Middle, not in the project area
- Çatak Stream Middle, not in the project area
- Göynük Stream Middle, not in the project area

Most of the small streams close to the project area are unnamed. The locations of the river crossings matching the sampling stations for surface water quality analysis within the construction area of the closest motorway sections are provided in the Table 8.1 below:

Table 8.1. Running Waters Locations within the each Section of Asian Part

Sections	River name (if avaliable)	District/Province	Basin
Section 4			
S 4-1	Buyukgol Stream	Istanbul; Topcalirlar	Omerli Dam Basin
S 4-2	Unnamed stream	Istanbul; Karaagil	Omerli Dam Basin
S 4-3	Unnamed stream	Istanbul; Kadilli village	Omerli Dam Basin
S 4-4	Cumakoy Stream	Kocaeli; Cumakoy	Omerli Dam Basin
S 4-5	Kiremitli Stream	Kocaeli; Cumakoy mevkii	Omerli Dam Basin
S 4-6	Unnamed stream	Kocaeli Denizli village	Marmara Basin
S 4-7	Unnamed stream	Kocaeli; Demirciler	Marmara Basin
Section 5			
S 5-1	Unnamed stream	Kocaeli; Sevindikli village	Sevindikli Lake Basin
S 5-2	Unnamed stream	Kocaeli; Between Karayakuplu-Sipahiler	Sipahiler Pond Basin
S 5-3	Unnamed stream	Kocaeli; Korucuk village	Sipahiler Pond Basin
Section 6			
S 5-4	Bicki Stream	Kocaeli; Sepetci	Marmara Basin
S 5-5	Unnamed stream	Kocaeli; Cayirkoy	Marmara Basin
S 6-2	Gedikli Creek	Kocaeli; Bayraktar	Bayraktar Dam Basin
S 6-3	Unnamed stream	Kocaeli; Karaabdulbaki village	Marmara Basin
S 6-4	Unnamed stream	Sakarya; Adapazari; Akmese	Sakarya Basin
S 6-5	Unnamed stream	Sakarya; Adapazari; Korucuk	Sakarya Basin
S 6-6	Carksuyu	Sakarya; Adapazari	Sakarya Basin
S 6-7	Sakarya River	Sakarya; Adapazari; Celebiler	Sakarya Basin
S 6-9	Mudurnu Stream	Sakarya; Adapazari	Sakarya Basin

The lakes located in Marmara Region are mainly Büyükçekmece Lake, Küçükçekmece Lake, Durusu Lake, İznik Lake, Sapanca Lake, Ulubat Lake and Manyas Lake. Other than natural lakes there are several dam lakes and artificial lakes within the region.

8.2.2.3. Groundwater

Groundwater is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. Groundwater is recharged to the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells.

Groundwater is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies. Groundwater is managed and controlled by State Hydraulic Works under Ministry of Forestry and Water Affairs in Turkey.

Based on the researches of State Hydraulic Works groundwater operating reserve of Marmara Catchment is ~297 x 10^6 m^3/year. Considering the operating reserve will be around 70-80% the total natural reserve could be summed up to ~396 x 10^6 m^3/year. The natural reserve for Sakarya is ~2.192 x 10^6 m^3/year, the operation reserve is 1.519 x 10^6 m^3/year.

The total amount of ground water allocated for drinking, bathing and industrial use purposes for Marmara is calculated as 297,71 x 10^6 m^3/year which is equal to the total ground water reserve. The total amount allocated drinking, bathing and industrial use purposes for Sakarya Catchment is 896 x 10^6 m^3/year.

Groundwater pollution most often results from improper disposal of wastes on land. Major sources include industrial and household chemicals and garbage landfills, excessive fertilizers and pesticides used in agriculture, industrial waste lagoons, tailings and process wastewater from mines, leaking underground oil storage tanks and pipelines, sewage sludge and septic systems.

Considering that groundwater could be used as bathing water at camp site facilities the nearest groundwater resources were studied within the scope of this study. The quality of the groundwater is presented in next section.

8.2.3. Field Surveys and Findings

A water quality assessment is undertaken to establish a description of the baseline condition through Project route. So; samples are taken and relevant analysis are conducted by ENCON Laboratory Inc. on January 2017. Sampling points and relevant details of the study are given at below table.

Table8.2. Water Resource Quality Sampling Stations

Sampling Station	KM	Coordinates	
		East	North
S4-2 (Kandilli) Surface Water	141+500	35 T 707557	4533269
S4-3 (Cumaköy) Surface Water	146+100	35 T 712441	4531885
S4-5 (Denizli) Surface Water	149+800	35 T 715335	4530858
S4-7 (Çerkeşli) Surface Water	150+500	35 T 713818	4524795
S5-1 (Şemseddin) Surface Water	165+400	35 T 731451	4530575
S5-2 (Sevindikli) Surface Water	169+400	35 T 734244	4528534
S5-3 (Sipahiler) Surface Water	173+000	35 T 737274	4527479
S5-4 (Sepetci) Surface Water	188+600	35 T 752302	4523998
S5-5 (Yassıbagı) Surface Water	191+700	36 T 247455	4521013
S6-1 (Eseler) Surface Water	195+400	36 T 251001	4520282
S6-2 (Bayraktar) Surface Water	199+000	36 T 254195	4519631
S6-4 (Akmese) Surface Water	213+500	36 T266967	4525607
S6-5 (Korucuk) Surface Water	216+500	36 T 269756	4525441
S6-6 (Evrenkoy) Surface Water	221+600	36 T 274966	4525034
S6-7 (Komurluk) Surface Water	232+600	36 T 284470	4520904
S6-8 (Dogancılar) Surface Water	232+000	36 T 286920	4523612
S6-9 (Kucukesence) Surface Water	241+400	36 T 292035	4516627
GW1-4 (Demirciler) Groundwater	150+150	35 T 715532	4525445
GW1-5 (Kutluca) Groundwater	166+000	35 T 731644	4533139
GW1-4 (Taskısıgı) Groundwater	226+500	36 T 281184	4525917

The water resource quality sampling locations are shown in Figure 8.3.

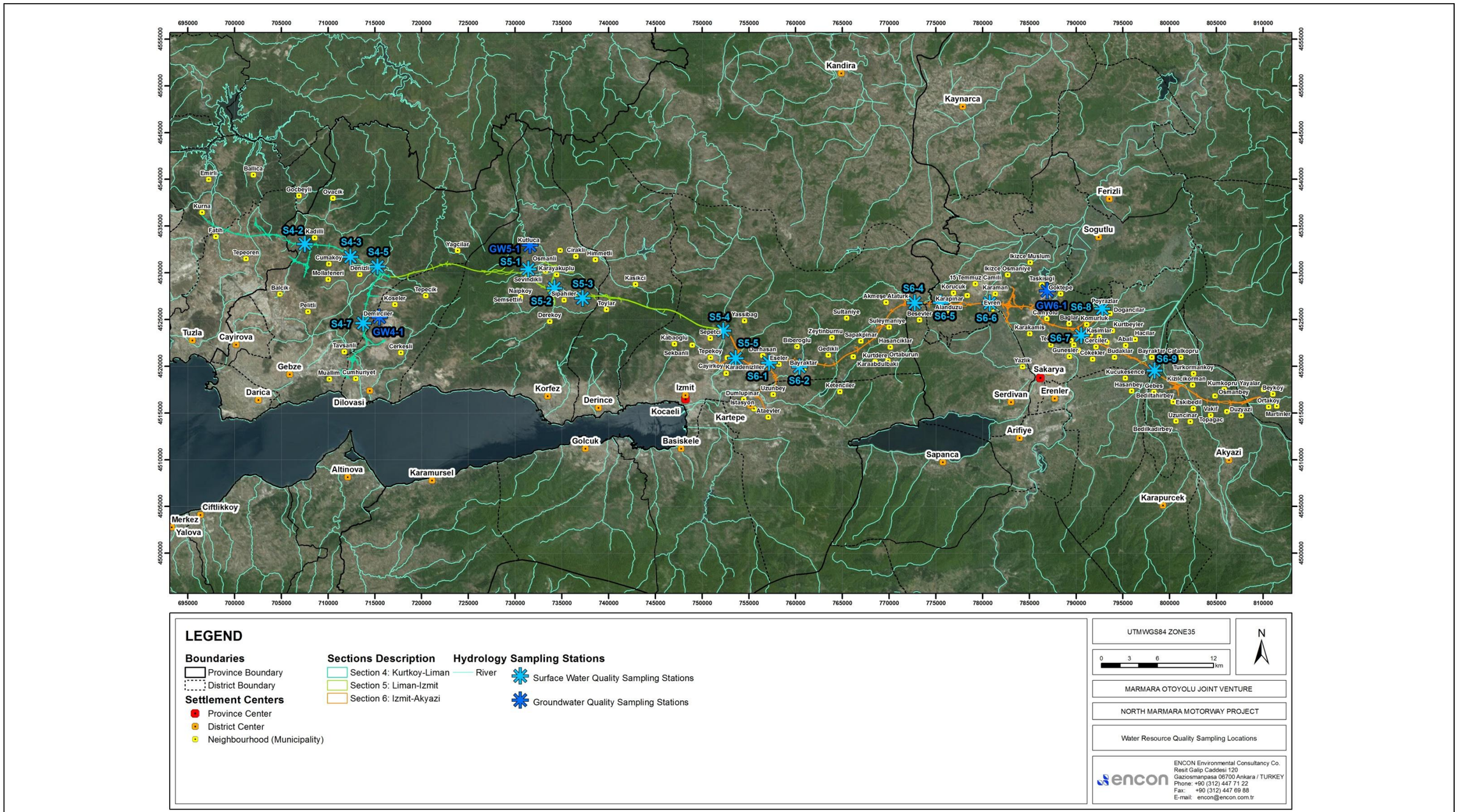


Figure 8.3. Water Resource Quality Sampling Locations

Sampling locations were selected from the main streams feeding the dams used for drinking water supply purposes and also the distance to the construction sites and road crossings. Sampling points for water quality were determined such that they would represent the locations where potential impacts can be expected. This way, it was aimed to characterize baseline water quality conditions (including both surface and groundwater resources) at sensitive areas (streams feeding dams and lakes used for drinking water purposes) and other surface water bodies crossed by the Project. Desktop based studies and field study findings indicated that selected sampling points are representative for remaining surface water bodies (fed by sampled streams and therefore not needed to be sampled). Therefore, it was not needed to sample and analyze all water bodies crossed by the project. The locations of water quality sampling stations are shown in Figure 8.3.

Surface Water Quality Regulation (30.11.2012 dated, 28483 numbered) stipulates that a water resource can only be classified into one of the four classes, when the measured values for all parameters comply with the values defining that water class. Accordingly, the lowest water quality class observed for a parameter determines the water quality class of that water resource, even though other parameters might indicate higher quality classes (Class IV being the lowest water quality class).

Above indicated classes' limit values and relevant parameters are submitted at Table 2 (Quality Class Criteria of Inland Surface Water Resources According to General Chemical and Physicochemical Parameters) of the Regulation. So, the analysis – which are conducted according to parameters of the Table 2 of the Regulation- results, for the collected water samples and water quality classifications according to Table 2 of the regulation is given at below Table 8.3.

Table 8.3. Results Water Quality Analysis Based on Annex-5 Table 2 of Surface Water Quality Regulation

Parameters	Unit	Table 2 of SWQR				S4-1	S4-2	S4-3	S4-5	S4-6	S4-7	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-4	S6-5	S6-6	S6-8	S6-9
		Class I	Class II	Class III	Class IV																		
Ammonium Nitrogen	mg/L	<0.2	1.0	2.0	>2.0	0,8288	0,952	0,7168	<0,2	<0,2	<0,2	<0,2	<0,2	2,878	0,336	<0,2	<0,2	<0,2	<0,2	0,448	<0,2	<0,2	<0,2
BOD	mg/L	<4.0	8.0	20.0	>20.0	<3,00	<3,00	<3,00	4,52	<3,00	<3,00	<3,00	5,04	3,16	<3,00	<3,00	<3,00	4,36	<3,00	10,44	4,30	4,64	4,84
Dissolved Oxygen	mg/L	>8.0	6.0	3.0	<3.0	13,21	13,76	13,26	12,94	11,87	12,35	12,95	13,03	12,56	12,96	13,57	13,51	13,43	13,32	11,23	9,2	12,35	12,12
Fluoride	µg/L	≤1000.0	1500.0	2000.0	>2000.0	55,1	125,1	41,4	48,3	53,4	57,1	47,3	115,7	125,8	95,4	141,8	202,7	114,8	116,5	73,7	80,6	83,0	102,1
Conductivity	µS/cm	<400.0	1000.0	3000.0	>3000.0	565,0	347,0	320,0	285,0	720,0	808,0	325,0	448,0	608,0	522,0	629,0	778,0	516,0	572,0	428,0	462,0	193,2	530,0
COD	mg/L	<25.0	50.0	70.0	>70.0	5,78	5,97	8,16	11,87	<3,00	<3,00	6,75	11,03	8,21	6,67	8,69	7,42	12,02	8,73	34,08	16,00	13,40	11,21
Manganese	µg/L	≤100.0	500.0	3000.0	>3000.0	210,947	14,62	66,31	24,22	11,44	11,48	16,17	15,23	<10,0	<10,0	77,32	87,77	81,17	64,49	52,94	87,52	<40,0	117,2
Nitrate Nitrogen	mg/L	<3.0	10.0	20.0	>20.0	2,506	1,449	0,314	0,19	1,001	3,825	0,151	0,389	0,469	0,913	0,866	2,682	1,472	0,807	2,626	0,972	<0,1	1,63
Orthophosphate Phosphorus	mg/L	<0.05	0.16	0.65	>0.65	0,097	0,071	0,044	0,032	<0,02	0,105	<0,02	<0,02	<0,02	<0,02	0,02	<0,02	0,031	0,027	0,55	0,288	0,021	0,122
pH	-	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6,85	8,75	8,28	8,65	8,29	8,23	8,73	8,60	8,45	8,79	8,64	8,45	8,44	8,61	8,87	7,66	8,81	8,67
Color	m^{-1}	RES 436 nm: ≤1.5 RES 525 nm: ≤1.2 RES 620 nm: ≤0.8	RES 436 nm: 3.0 RES 525 nm: 2.4 RES 620 nm: 1.7	RES 436 nm: 4.3 RES 525 nm: 3.7 RES 620 nm: 2.5	RES 436 nm: >4.3 RES 525 nm: >3.7 RES 620 nm: >2.5	<0,5 0,37 0,04	0,68 <0,37 0,16	0,80 <0,37 0,12	0,78 <0,37 0,1	0,84 0,70 0,64	<0,45 <0,37 0,14	<0,45 <0,37 <0,016	<0,45 <0,37 0,04	<0,45 <0,37 0,12	<0,45 <0,37 0,1	<0,45 <0,37 0,04	<0,45 <0,37 0,06	<0,45 <0,37 0,08	<0,45 <0,37 0,1	1,52 0,48 0,2	<0,45 <0,37 0,06	<0,45 <0,37 0,04	<0,45 <0,37 0,04
Selenium	µg/L	≤10.0	15.0	20.0	>20.0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0	<10,0
Sulphur (S^{-2})	µg/L	≤2.0	5.0	10.0	>10.0	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00	<2,00
Total Nitrogen	mg/L	<3.5	11.5	25.0	>25.0	3,763	2,717	1,329	2,128	1,396	4,702	12,02	5,181	3,579	2,735	2,438	3,724	3,888	8,687	6,037	5,178	4,314	7,249
Total Phosphorus	mg/L	<0.08	0.2	0.8	>0.8	0,108	0,081	0,041	0,057	<0,017	0,094	<0,017	<0,017	<0,017	<0,017	<0,017	<0,017	0,041	0,031	0,773	0,595	0,034	0,273
TKN	mg/L	<0.5	1.5	5.0	>5.0	1,232	1,204	1,008	1,932	<0,500	0,840	11,872	4,788	3,108	1,820	1,568	1,036	2,408	7,868	3,388	4,172	4,228	5,600
Oil and Grease	mg/L	<0.2	0.3	0.5	>0.5	0,101	0,158	0,062	0,21	<0,05	<0,05	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	<0,2	0,25	<0,2	0,5	<0,2

Class I Water Quality | Class II Water Quality | Class III Water Quality | Class IV Water Quality

When analysis results given in Table are evaluated according to Table 2 Surface Water Quality Regulation, the water quality class at S4-1, S4-2, S4-3, S4-6, S4-7 and S6-1 sampling stations are determined as Class II, at S4-5, S5-2, S5-4, S5-5, S6-2, S6-5, S6-6 and S6-8 are determined as Class III, at S5-1, S5-3, S6-4 and S6-9 are Class IV, Parameters determining the water quality classes are given at below table.

Table 8.4. Water Quality Classes of the Sampled Water Resources

Sampling Station	Water Quality Class	Determining Parameters
S4-1	Class II	Ammonium nitrogen, conductivity, manganese, orthophosphate phosphate, nitrogen, total phosphate, TKN
S4-2	Class II	Total phosphorus, TKN, orthophosphate phosphate, manganese, conductivity, ammonium nitrogen
S4-3	Class II	TKN, Ammonium nitrogen
S4-5	Class III	TKN
S4-6	Class II	Conductivity
S4-7	Class II	TKN, Total phosphorus, total nitrogen, orthophosphate phosphate, nitrate nitrogen, conductivity
S5-1	Class IV	TKN
S5-2	Class III	TKN
S5-3	Class IV	Ammonium nitrogen
S5-4	Class III	TKN
S5-5	Class III	TKN
S6-1	Class II	Conductivity, total nitrogen, TKN
S6-2	Class III	TKN
S6-4	Class IV	TKN
S6-5	Class III	BOD, Orthophosphate phosphate, total phosphorus, TKN
S6-6	Class III	Orthophosphate phosphate, total phosphorus, TKN
S6-8	Class III	TKN, Oil and grease
S6-9	Class IV	TKN

As it can clearly be seen at the table, almost all determining parameters show an agricultural pollution on surface waters. As it can be seen from the Figure 8.3, sampling points are at on or very close to agricultural lands. Besides since TKN parameter is respectively high in most of the sources the analysis results suggest that surface waters are highly polluted with domestic wastewater.

In addition to Table 2, Quality Class Criteria of Inland Surface Water Resources According to General Chemical and Physicochemical Parameters, samples are taken and analysis have been conducted according to Table 5 Primary Substances and Environmental Quality Standards for Surface Water Resources parameters of Surface Water Quality Regulation. Mentioned table is adapted from 2013/39/EU numbered EU Directive and reason of being of the Table and relevant limits in the Table is determining discharge conditions of the primary substances. According to the regulation; arithmetic average of annual analysis results of the relevant substances should be compared with Annual Average Environmental Quality Standard (AA-EQS) and Maximum Environmental Quality Standard (MAX-EQS), which are given in Table 5. If arithmetic average of annual analysis results are lower than both standards, environmental quality standard is met.

However, results which are submitted below Table are for once. So, these results can only give a general idea about water quality of relevant sampling stations.

Table 8.5. Results of Water Quality Analyses with respect to Primary Substances given in Annex-5, Table 5 of Surface Water Quality Regulation

Parameter	Unit	AA-EQS	MAX-EQS	S6-7
1,2Dichloroethane	µg/L	10	-	<0.1
Acloniphene	µg/L	0.12	0.12	<0,05
Alochlor	µg/L	0.3	0.7	<0,25
Anthracene	µg/L	0.1	0.4	<0,1
Atrazine	µg/L	0.6	2	<0,05
Benzene	µg/L	10	50	<0,1
Benzo(a)pyrene	µg/L	$1.7*10^{-4}$	0.27	<0,15
Benzo(b)fluoranthene	µg/L	-	0.017	<0,13
Benzo(g,h,i)preylene	µg/L	-	$8.2*10^{-3}$	<0,1
Benzo(k)fluoranthene	µg/L	-	0.017	<0,11
Bifenox	µg/L	0.012	0.04	<0,05
Bromic Diphenyl Ether	mg/L	-	$1.4*10^{-4}$	<0,02
C10-13 Chloroalkane	µg/L	0.4	1.4	<1
Mercury and Compounds	µg/L	-	0.07	<0,05
Cybutryn	µg/L	0.0025	0.016	<0,05
DEHP	µg/L	1.3	-	<0,13
Dichlorvos	µg/L	6×10^{-4}	7×10^{-4}	<0,1
Dicofol	µg/L	$1.3*10^{-3}$	-	<0,1
Dİcholoromethane	µg/L	20	-	<0,1
Dioxins and Dioxin Like Compounds	pg-TEQ/L	-	-	48,92
Diurone	µg/L	0.2	1.8	<0,05
Endosulfan	µg/L	0.005	0.01	<0,1
Fluoranthene	µg/L	0.0063	0.12	<0,1
HBCDD	ng/L	1.6	500	<0,8
Hexacholorobenzene	µg/L	-	0.05	<0,1
Hexachloro-butadiene	µg/L	-	0.6	<0,1
Hexachloro-cyclohexane	µg/L	0.02	0.04	<0,1
Heptachlor and Heptachlor-exo-epoxide	µg/L	2×10^{-7}	3×10^{-4}	<0,1
Indeno (1,2,3-cd) pyrene	µg/L	-	-	<0,1
Isoproturon	µg/L	0.3	1.0	<0,12
Cadmium and Compounds	µg/L	<0.08 (Class I) 0.08 (Class II) 0.09 (Class III) 0.15 (Class IV) 0.25 (Class V)	<0.45 (Class I) 0.45 (Class II) 0.60 (Class III) 0.90 (Class IV) 1.50 (Class V)	<0,05
Chlorfenvinphos	µg/L	0.1	0.3	0,386
Chlorpyrifos	µg/L	0.03	0.1	<0,1
Lead and Compounds	µg/L	1.2	14	1,225
Naphthalene	µg/L	2	130	0,1244
Nickel and Compounds	µg/L	4	34	13,52
Nonyl Phenols	µg/L	0.3	2.0	<1
Octhyl Phenol	µg/L	0.1	-	<1
Pentachlorobenzene	µg/L	0.007	-	<0,1
Pentachlorophenol	mg/L	0.4	1	<0,0125
PFOS	ng/L	0.65	0.036	<0,13
Polycyclic Aromatic Hydrocarbons	µg/L	-	-	<0,15
Quinoxyphene	µg/L	0.15	2.7	<0,05
Simazine	µg/L	1	4	<0,05
Cypermethrin	µg/L	$8*10^{-5}$	$6*10^{-4}$	<0,1
Terbutryn	µg/L	0.065	0.34	<0,05
Tributil Tin Compounds	ng/L	0.2	1.5	<10,0
Trifluarilin	µg/L	0.03	-	<0,1
Trichlorobenzenes	µg/L	0.4	-	<0,1
Tricholoromethane	µg/L	2.5	-	<0,1

The analysis results indicate that none of the sampled waters are exceeding the regulation criteria.

In order to complete the water quality assessment on site 3 samples from different locations have been taken and analyzed for evaluating the quality of the groundwater which could be used at camp sites. The groundwater quality will be evaluated taking into account the limit values of Table 2 of Surface Water Quality Regulation (30.11.2012 dated, 28483 numbered). Including certain parameters this table will support the basic evaluation of the groundwater to be used at camp site as bathing water. (See Table 8.6 for results)

Table 8.6. Results Groundwater Quality Analysis Based on Annex-5 Table 2 of Surface Water Quality Regulation

Parameters	Unit	Table 2 of SWQR				GW 5-1	GW 4-1	GW 6-1
		Class I	Class II	Class III	Class IV			
Ammonium Nitrogen	mg/L	<0.2	1.0	2.0	>2.0	<0,2	<0,2	<0,2
BOD	mg/L	<4.0	8.0	20.0	>20.0	<3.00	<3.00	<3.00
Dissolved Oxygen	mg/L	>8.0	6.0	3.0	<3.0	12,54	7.0	3,14
Fluoride	µg/L	≤1000.0	1500.0	2000.0	>2000.0	60,8	66,3	78,6
Conductivity	µS/cm	<400.0	1000.0	3000.0	>3000.0	561,0	841.0	807.0
COD	mg/L	<25.0	50.0	70.0	>70.0	4,25	3,08	4,72
Manganese	µg/L	≤100.0	500.0	3000.0	>3000.0	<10.0	142,2	<40.0
Nitrate Nitrogen	mg/L	<3.0	10.0	20.0	>20.0	0,46	2,44	4,34
Orthophosphate Phosphorus	mg/L	<0.05	0.16	0.65	>0.65	<0,02	0,166	0,058
pH	-	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	8,20	7,44	7,50
Color	m^{-1}	RES 436 nm: ≤1.5 RES 525 nm: ≤1.2 RES 620 nm: ≤0.8	RES 436 nm: 3.0 RES 525 nm: 2.4 RES 620 nm: 1.7	RES 436 nm: 4.3 RES 525 nm: 3.7 RES 620 nm: 2.5	RES 436 nm: >4.3 RES 525 nm: >3.7 RES 620 nm: >2.5	<0,45 <0,37 <0,016	<0,45 <0,37 0,08	<0,45 <0,37 0,04
Selenium	µg/L	≤10.0	15.0	20.0	>20.0	<10.0	<10.0	<10.0
Sulphur (S^{-2})	µg/L	≤2.0	5.0	10.0	>10.0	<2.00	<2.00	<2.00
Total Nitrogen	mg/L	<3.5	11.5	25.0	>25.0	1,721	3,388	5,323
Total Phosphorus	mg/L	<0.08	0.2	0.8	>0.8	<0,017	0,165	0,071
TKN	mg/L	<0.5	1.5	5.0	>5.0	1,260	0,924	0,980
Oil and Grease	mg/L	<0.2	0.3	0.5	>0.5	<0,2	<0,2	<0,2

	Class I Water Quality		Class II Water Quality		Class III Water Quality		Class IV Water Quality

For evaluation of the baseline conditions for groundwater quality again Annex-5, Table 2 of the Surface Water Quality Regulation was used. This approach also provided consistency for evaluating the groundwater and surface water quality together. The results of the groundwater analyses are given in Table 8.6 above.

The analysis results for GW 5-1, GW 4-1 and GW 6-1 stations presented in Table 8.6 indicate that the water quality Class is varying from Class II to Class III based on the parameters taken into consideration. The pollution is mainly caused by the values of dissolved oxygen, conductivity, orthophosphate and total phosphorus parameters. Nitrate pollution is mainly caused by agricultural activities including irrigation and livestock breeding. Thus, it can be said that groundwater quality and surface water quality in the area show parallel results indicating agricultural pollution and there might be exchange of waters between surface and groundwater resources in the area.

Water quality analysis reports will be presented in Annex-5.

8.2.4. Wastewater Management

Wastewater will be generated during land preparation and construction activities and also during operation phases of the project.

Wastewater will be generated during land preparation and construction activities of the project from construction sites and accommodation facilities for workers (camp site, kitchen, cafeteria, etc.). The basic approach will be to reuse the wastewater generated by project activities in activity cycle during construction. This approach will not require any water discharge to environmental media.

For the areas where reusing will not be an option water should be treated in order to reduce or eliminate the contaminants before being discharged to receiving media.

For construction phase the water demand per person is calculated as 150 l/day which can be calculated as 30 m^3 per person daily. Based on this approach the wastewater to be generated will be calculated as equal to the demand. The following table 8.7 indicates the total amount of wastewater to be generated during the construction phase.

Table 8.7. Amount of wastewater to be produced in construction phase

Location	Number of Maximum Personnel Anticipated to be Employed in Each Section (including contractors and sub-contractors) (persons)	Total Amount of Daily Wastewater Generation (m^3/day)
Section 4	2.500	75.000
Section 5	900	27.000
Section 6	1.100	33.000
Total	**4.500**	**135.000**

Throughout the project construction phase the domestic wastewater generated in camp sites will be transferred to local sewage networks where possible. For the areas that are not close to sewage systems of the cities the domestic wastewater will be treated in Wastewater Treatment Plants to be established in compliance with national and international standards.

Treated wastewater shall be analyzed in order to ensure that the quality and quantity of the wastewater to be discharged will be in compliance with the limit values indicated in national and international regulations. In addition necessary permits will be obtained from regulating administrations. The quality of the wastewater shall be in compliance with the limit values indicated in Regulation on Water Pollution Control, Table 8.8.

Table 8.8. Domestic Wastewater Discharge Requirements

Parameter	Turkish Legal Requirement ([a])		IFC ([b])
	2-hr Composite Sampling	24-hr Composite Sampling	
Biochemical Oxygen Demand (BOD_5) (mg/L)	50	45	30
Chemical Oxygen Demand (COD) (mg/L)	180	120	125
Total Suspended Solids (TSS) (mg/L)	70	45	50
pH	6-9	6-9	6-9
Total Nitrogen (mg/L)	-	-	10
Total Phosphorus (mg/L)	-	-	2
Oil and Grease (mg/L)	-	-	10
Total Coliform Bacteria MPN([c])/100 ml	-	-	400

([a]) Water Pollution Control Regulation, Table 21.1 Domestic Wastewater Discharges (Class 1: BOD load 5-120 kg/day, Population: 84-2000)

([b]) Table 1.3.1-Indicative Values for Treated Sanitary Sewage Discharges, IFC Environmental, Health, and Safety General Guidelines, April 30, 2007.

([c]) MPN: Most Probable Number

In operation phase rest and maintenance areas and toll booth area will be the sources of wastewater generation. Generated wastewater may contain organic and inorganic pollutants, suspended solids, heavy metals or toxic materials, etc. Wastewater will be either discharged into the local/municipal sewage network or treated prior to discharge to the suitable receiving environment or collected onsite and transported by tanker for disposal at the local sewage treatment works. The following table 8.9 indicates the total amount of wastewater to be generated during the construction phase.

Table 8.9. Amount of wastewater to be produced in operation phase

Location	Estimated Number Personnel/Visitors	Daily Municipal Wastewater Production (m^3/day)
Asian Side		
Operation buildings	325	9.750
Service areas (x5) (visitors)	1.600	24.000
Service areas (x5) (personnel)	800	15.000
Total	**2.725**	**81.750**

There is no planned discharge to the riverbeds (dry or running) that are flowing to drinking water resources close to the project area.

8.3. Potential Impacts

In order to assess potential impacts of the Project on water resources, project is considered in two phases; which are Land Preparation and Construction Phase and Operation Phase. By this way, relevant impacts are evaluated separately for each phase since the project activities and potential releases from these activities are different for each phase.

8.3.1. Land Preparation and Construction Phase

Potential impacts on water resources during land preparation and construction phase are generally expected to be more significant than the ones during operation phase for motorway projects. Main source of land preparation and construction phase impacts of a motorway project is typically suspended sediment in runoff waters from the work sites and accidental spillages of hazardous materials from construction activities and machinery.

8.3.1.1 Impacts on Surface Water

Potential impacts on surface water bodies and quality can mostly be considered as temporary. These impacts can be listed as follows:

- Construction activities on existing surface water bodies such as rivers, creeks, drainage or irrigation channels may permanently demolish these components without proper design and construction management precautions (including reinstating).

- Silty, soiled and high turbidity water would arise from construction activities, which might contaminate surface waters. Main construction activities that may cause these impacts are;
  - excavation,
  - soil stockpiling
  - quarry activities
  - plant and wheel washing
  - road construction
  - washing of finished road surfaces to remove accumulated soil

- Spills of hazardous substances including fuel, oils, lubricants and cement might take place at construction sites, refueling site or storage depot and reach to close by surface and groundwater. These would affect the water quality such that aquatic life (mainly fish) and downstream users might also be affected.

- Bitumen and materials used for waterproofing of concrete surfaces will be used during construction phase of the Project. These materials are also a contamination source for surface water especially when they are mixed with surface runoff upon precipitation and reach a surface water body.

- All wastewaters from construction activities (sanitary or process) pose a risk to the water environment if not treated before discharge.

8.3.1.2 Impacts on Groundwater

The potential impacts on groundwater would be on groundwater levels (table) in the area and the quality of the groundwater source. These can be listed as follows:

- Some deeper excavation works may require permanent dewatering of a groundwater component.
- During earthworks and other soil-related activities; in sections cut into the bedrock or shallow overburden, any fissure permeability is at risk of blockage by infiltrating sediment/fines.
- Especially on areas with shallow overburden, accidental discharges of hazardous materials to the ground have possibility to contaminate aquifers.
- Site clearance, earthwork, spillages/leakages from construction sites and refueling vehicles may contaminate bedrock aquifers.
- All wastewaters from construction activities (sanitary or industrial) pose a risk to the water environment if not treated before discharge.

8.3.2. Operation Phase

Potential impacts on water resources during operation/use of the motorway are generally more limited than construction phase, and there are temporary, one-time and long term impacts.

8.3.2.1. Impacts on Surface Water

Impacts on Surface Water Quality

- Maintenance activities like using de-icing agents may affect surface water quality if they reach any close surface water, but this impact will be temporary.
- During operation of the motorway, spills during road accidents and from filling stations might be of concern. This type of water pollution risk is high within all road sections close to surface water bodies. However, this type of impact would be temporary since accidents and/or spillages should be considered as one-time events.
- Routine deposits (tyre and brake deposits, hydrocarbons from engines, liquid exhaust emissions etc.) of vehicles travelling on motorway and leakage of road body itself (tar soils) and road marking materials have possibility to impact nearby surface water quality. As these events are continuous, such impacts would be considered as permanent.

Structural Impacts on Surface Water

- Construction of viaducts, bridges and culverts might change the hydrological regime with potential impacts on the beds and banks of rivers (scour, erosion, deposition etc.).

- In case of inappropriate design, physical interference of a stream by installation of culverts and roadways have possibility to impact hydrological regime of a stream.

Impacts on Drainage and Flooding

- Final structure of a motorway will lead to an increase on impermeable surface area because of its nature. That situation leads increase on the rate of surface water runoff and high storm water flow rates can lead erosion and flooding.

- During flood times, bridges, culverts and diversion channels may impede flow. This situation cause increase at water level on upstream of relevant structures.

8.3.2.2. Impacts on Groundwater

Impacts on Groundwater Quality

- Runoff from the road pavement is likely to contain some degree of silt/dust and pollutants from atmospheric deposition, vehicle emission, litter and general road maintenance, as well as from possible accidental road spillage incidents. This runoff has possibility to infiltrate to groundwater and contaminate it.

- In areas where groundwater wells are located down-gradient and short distances from fill sections, and at fill sections where the subsoil thickness is shallow surface water runoff has the potential to infiltrate the subsoil and migrate to the groundwater.

Impacts on the Groundwater Table

- Deep cuttings are necessity for Project at some areas. Deep cuttings may have impacts on groundwater regime and also have subsequent impacts on groundwater abstraction wells.

- Groundwater recharge may decrease because of sealing of surfaces of motorway.

8.4. Mitigation Measures

Relevant mitigation measures according to potential impacts identified are described in this section. Impacts of the project should be mitigated by measures to be taken at different phases of project development and implementation. Therefore, mitigation measures to be considered are categorized into three phases namely; design, land preparation and construction, and operation.

8.4.1. Design Phase

- General hydrological considerations/design of the Project will be in accordance with KGM design standards and AASHTO Highway Drainage Principles. In this regard, generally 100-year flood flow will be taken into account on stream passage designs. Minimum dimensions of all culverts will be 2m x 2m except discharge culverts. Culverts will be design with one outlet whenever possible

- Project elements will be located such that risks on groundwater would be minimized. Groundwater use for project activities would be planned to be limited and would be done only after getting relevant permissions from the authorities.

- In case of a need; new or replacement of irrigation structures will be constructed.

- In order to minimize changes in the hydrology and flow of water courses, design of structures will be done accordingly. Design will also ensure an appropriate capacity for culverts through embankments when flood plains are cut off.

- Design will be done in a way to minimize risks of flooding. During operation phase; Emergency Preparedness and Response Plan (See Annex-3), will be used in order to minimize flood events.

- Flow design for the drainage system has been done to meet 500 years recurrent flood conditions in accordance with the views of State Hydraulic Works.

- Stormwater management practices that slow peak runoff flow, reduce sediment load and increase infiltration; including vegetated swales (planted with salt-resistant vegetation), filter strips, terracing, detention ponds or basins, and infiltration trenches will be planned.

- In order to limit the volume of water requiring specialized treatment (during land preparation and construction, and operation phases) segregation of liquid effluents, principally along industrial, sanitary and stormwater categories, will be planned.

- Fish and terrestrial animal passages will be located in design where necessary.

- Appropriate designs and structures, such as viaducts and bridges will be used for stream and river crossings.

- Drainage projects have been developed for the collection of surface runoff along the Motorway by means of ditches and diversion of the collected water to the nearest receiving water bodies. The design criteria for the drainage system are in accordance with motorway standards.

8.4.2. Land Preparation and Construction Phase

8.4.2.1. Mitigation Measures for Surface and Groundwater Quality

- Equipments and vehicles will get their fuels at designated areas.

- In the selection of temporary storage sites for oil, fuel and chemicals, location of the water resources will be taken into consideration.

- Waste oils will be stored in tanks/containers located on impervious surfaces.

- Secondary containment will be provided (on concrete surfaces) for all the storage tanks/barrels containing chemicals including diesel fuels or hazardous liquid wastes. Absorbents will be kept available at storage sites, if necessary. Volume of containment structures allocated for the storage of fuel, oil or other chemicals will be sufficiently greater than the volume of contained liquid.

- Hazardous materials will not be stored within excavated areas. Supervision will be used during handling of all hazardous materials. Impervious bunds and other containment techniques will be used where hazardous materials are handled.

- Wastewater from all construction compounds and associated building will be either discharged into the local/municipal sewage network or treated prior to discharge to the suitable receiving environment or collected onsite and transported by tanker for disposal at the local sewage treatment works.

- All wastewater discharges from all components of construction must comply with relevant legal requirements. Treated water will be reused where possible and feasible.

- Quarry ponds dredging activities will be designed and implemented in construction material quarries to minimize drawdown with consideration of potential impacts to surface and groundwater resource flow and availability.

- When water quality criteria allow, storm water will be managed as a resource for meeting water needs of Project, whenever feasible.

- Drainage water from excavations will be collected and treated to remove contaminants before discharging. Perimeter drains will be constructed around all working areas to collect potentially contaminated run-off and direct it to a system of settlement tanks before discharge in accordance with required permits. Direct discharge of contaminated run-off from work sites will not be allowed.

- In order to provide direct run-off to the collection system; channels, bunds and sandbag barriers will be used.

- In order to remove asphalt residues, biodegradable cleaning agents will be used.

- High sediment generating activities will be avoided and exposed surfaces and stored materials covered, if necessary, to reduce erosion and reaching of sediments to surface waters.

- For any emergency during construction, Emergency Preparedness and Response Plan will be implemented

- Exposure of areas of open ground will be kept at minimum in size and duration.

8.4.2.2. Mitigation Measures for Surface Water Bodies and Channels

- Whenever and wherever possible; construction of bridges, viaducts, retaining walls and other structures will be carried out during lean water season months.

- Fencing will be used at sensitive areas of rivers and drains for protection.

- Isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water will be used during in-stream works.

- In order to protect small drains within construction areas, they will be covered with metal plates which can be passed over by construction machines.

- Stream crossings works will be carried out from the banks above the channel and avoiding direct intervention in the watercourse unless existing bank reinforcement needs to be replaced. The works will be undertaken during periods of low flow and duration of in-stream activities will be restricted.

- Use of grass turf from adjacent areas to cover the soil surface, use of erosion control blankets or mats and other relevant soil erosion prevention measures will be implemented after the finalization of an earth work.

- Groundwater from dewatering will be drained to a near surface water course.

8.4.3. Operation Phase

8.4.3.1. Mitigation Measures for Surface and Groundwater Quality

- Sealed basement and bunds with a capacity of the 100% of the storage capacity of the largest tank will be used at fuel stores and other harmful substance stores.

- For case of any large scale spill, absorbent materials within spill response kits will be used. They kits will be available at relevant centers and locations and will be used by trained personnel.

- Sand layers as filters in seepage pits (detritus basins in the form of a shallow pit connected to drain trenches) would be used allowing hardly any harmful substance to percolate into deeper soil layers or into the groundwater.

- Inspection and maintenance of permanent erosion and runoff control features will be done regularly.

- Oil separators will be installed at fuel stations.

- Motorway will be paved in dry weather to prevent runoff of asphalt or cement materials.

- In need of deicing, mechanical deicing methods (sweepers and plows) will be used firstly, it will be complemented by chemical means if necessary. In addition to that, anti-icing and deicing agents will be selectively applied based on expected pavement temperatures and the use of road weather information systems. Furthermore, employees in the application of anti-icing and deicing agents will be trained to use these at optimum rates and times. Anti-icing and deicing agents will be selected based on the potential environmental impacts of the particular agent.

8.4.3.2. Mitigation Measures for Groundwater Flow Regime

- Measures will be developed to ensure that no indirect impacts on any importantgroundwater resource take place. Where medium to long-term or permanent dewatering is required, the water would not be drained to the Motorway drainage system but to a near surface water course.

- Infiltration will be promoted if water depletion will arise in areas of groundwater wells to ensure the supply, especially in urban settings.

8.5. Summary of Assessment and Residual Impacts

Table 8.10 provides a summary on water resources assessment. Significance of the identified impacts before and after the implementation of mitigation measures are summarized in this table. With proper implementation of good water management practices, water pollution risks would not cause any significant impact on the ecosystem or bring associated risks on health and safety of the community and/or Project personnel.

Table 8.10. Summary of the Assessments: Water Resources

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Surface Water	Land preparation and construction	Disturbance of surface water bodies and irrigation channels due to construction activities	Adverse	Restricted	Long	Low	Irreversible	One-off	Moderate (B)	Medium (2)	Medium B2	• General hydrological considerations/design of the Project will be in accordance with KGM design standards and AASHTO Highway Drainage Principles. • In case of a need; new or replacement of irrigation structures will be constructed. • In order to minimize changes in the hydrology and flow of water courses, design of structures will be done accordingly. • Fish and terrestrial animal passages will be located in design where necessary. • Appropriate designs and structures, such as viaducts and bridges will be used for stream and river crossings.	Low
		Contamination of surface waters with silt/soil	Adverse	Local	Long	Low	Short term reversible	One-off	Moderate (B)	Medium (2)	Medium B2	• Drainage water from excavations will be collected and treated to remove contaminants before discharging. • In order to provide direct run-off to the collection system; channels, bunds and sandbag barriers will be used. • In order to remove asphalt residues, biodegradable cleaning agents will be used. • High sediment generating activities will be avoided and exposed surfaces and stored materials covered, if necessary, to reduce erosion and reaching of sediments to surface waters.	Low
		Contamination of surface waters with hazardous materials	Adverse	Local	Long	Low	Long term reversible	One-off	Moderate (B)	High	Medium B3	• Equipments and vehicles will get their fuels at designated areas. • Hazardous materials will not be stored within excavated areas. • In order to remove asphalt residues, biodegradable cleaning agents will be used. • For any emergency during construction, Emergency Preparedness and Response Plan will be implemented • Exposure of areas of open ground will be kept at minimum in size and duration. • Isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water will be used during in-stream works	Low
		Contamination of surface waters due to waste water discharge	Adverse	Local	Long	Low	Long term reversible	One-off	Moderate (B)	High	High B3	• In order to limit the volume of water requiring specialized treatment (during land preparation and construction, and operation phases) segregation of liquid effluents, principally along industrial, sanitary and stormwater categories, will be planned. • Wastewater from all construction compounds and associated building will be either discharged into the local/municipal sewage network or treated prior to discharge to the suitable receiving environment or collected onsite and transported by tanker for disposal at the local sewage treatment works. • All wastewater discharges from all components of construction must comply with relevant legal requirements. Treated water will be reused where possible and feasible.	Low
		Contamination of drinking water bodies	Adverse	Wide	Long	Low	Long term reversible	One-off	Moderate (B)	High	High B3	• In order to provide direct run-off to the collection system; channels, bunds and sandbag barriers will be used. • For any emergency during construction, Emergency Preparedness and Response Plan will be implemented.	Low
Surface Water	Operation	Contamination of surface waters with de-icing material	Adverse	Local	Short	Low	Short term reversible	Intermittent	Minor (C)	Low	Low C1	• In need of deicing, mechanical deicing methods (sweepers and plows) will be used firstly, it will be complemented by chemical means if necessary. In addition to that, anti-icing and deicing agents will be selectively applied based on expected pavement temperatures and the use of road weather information systems. Furthermore, employees in the application of anti-icing and deicing agents will be trained to use these at optimum rates and times. Anti-icing and deicing agents will be selected based on the potential environmental impacts of the particular agent.	Low
		Contamination of surface waters with hazardous materials due to spills from stations	Adverse	Local	Short	Low	Short term reversible	One-off	Minor (C)	High	Medium C3	• Sealed basement and bunds with a capacity of the 100% of the storage capacity of the largest tank will be used at fuel stores and other harmful substance stores. • For case of any large scale spill, absorbent materials within spill response kits will be used. They kits will be available at relevant centers and locations and will be used by trained personnel. • Sand layers as filters in seepage pits (detritus basins in the form of a shallow pit connected to drain trenches) would be used allowing hardly any harmful substance to percolate into deeper soil layers or into the groundwater. • Oil separators will be installed at fuel stations.	Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
		Contamination of surface waters due to dumped waste from vehicles	Adverse	Local	Long	Low	Long term reversible	Continuous	Moderate (B)	Low	Low B1	• In order to provide direct run-off to the collection system; channels, bunds and sandbag barriers will be used.	Low
		Increase on the rate of surface water runoff and high storm water flow rates can lead erosion and flooding	Adverse	Wide	Long	Moderate	Long term reversible	Continuous	Major (A)	High	High A3	• Motorway will be paved in dry weather to prevent runoff of asphalt or cement materials • Inspection and maintenance of permanent erosion and runoff control features will be done regularly. • In order to minimize changes in the hydrology and flow of water courses, design of structures will be done accordingly. Design will also ensure an appropriate capacity for culverts through embankments when flood plains are cut off. • Design will be done in a way to minimize risks of flooding. During operation phase; Emergency Preparedness and Response Plan will be used in order to minimize flood events. • Flow design for the drainage system has been done to meet 500 years recurrent flood conditions in accordance with the views of State Hydraulic Works.	Low
Groundwater	Land preparation and construction	Permanent dewatering of groundwater resources due to deep excavation	Adverse	Local	Short	Low	Irreversible	One-off	Moderate (B)	High	High B3	• Measures will be developed to ensure that no indirect impacts on any important groundwater resource take place. Where medium to long-term or permanent dewatering is required, the water would not be drained to the Motorway drainage system but to a near surface water course. • Project elements will be located to minimize risks on groundwater. Groundwater use for project activities would be planned to be limited and would be done only after getting relevant permissions from the authorities.	Low
		Contamination of groundwater resources with hazardous substances due to accidents and leakages	Adverse	Local	Short	Low	Irreversible	One-off	Moderate (B)	High	High B3	• Hazardous materials will not be stored within excavated areas. Supervision will be used during handling of all hazardous materials. Impervious bunds and other containment techniques will be used where hazardous materials are handled.	Low
		Blockage of permeable layers by infiltrating sediment/fines.	Adverse	Local	Short	Low	Irreversible	One-off	Moderate (B)	Low	Low B1	• Stormwater management practices that slow peak runoff flow, reduce sediment load and increase infiltration; including vegetated swales (planted with salt-resistant vegetation), filter strips, terracing, detention ponds or basins, and infiltration trenches will be planned. • Quarry ponds dredging activities will be designed and implemented in construction material quarries to minimize drawdown with consideration of potential impacts to surface and groundwater resource flow and availability.	Low
		Contamination of groundwater by wastewater leakage	Adverse	Local	Short	Low	Short term reversible	One-off	Minor (C)	High	Medium C3	• Wastewater from all construction compounds and associated building will be either discharged into the local/municipal sewage network or treated prior to discharge to the suitable receiving environment or collected onsite and transported by tanker for disposal at the local sewage treatment works.	Low
Groundwater	Operation	Contamination of groundwater by possible contaminated runoff from road pavement	Adverse	Local	Long	Low	Irreversible	One-off	Moderate (B)	High	High B3	• Flow design for the drainage system has been done to meet 500 years recurrent flood conditions in accordance with the views of State Hydraulic Works. • Drainage projects have been developed for the collection of surface runoff along the Motorway by means of ditches and diversion of the collected water to the nearest receiving water bodies. The design criteria for the drainage system are in accordance with motorway standards. • Motorway will be paved in dry weather to prevent runoff of asphalt or cement materials.	Low
		Contamination of groundwater resources with hazardous substances due to accidents and leakages	Adverse	Local	Long	Low	Irreversible	One-off	Moderate (B)	High	High B3	• Sealed basement and bunds with a capacity of the 100% of the storage capacity of the largest tank will be used at fuel stores and other harmful substance stores. • For case of any large scale spill, absorbent materials within spill response kits will be used. They kits will be available at relevant centers and locations and will be used by trained personnel. • Sand layers as filters in seepage pits (detritus basins in the form of a shallow pit connected to drain trenches) would be used allowing hardly any harmful substance to percolate into deeper soil layers or into the groundwater. • Oil separators will be installed at fuel stations.	Low
		Infiltration of surface water run-off to groundwater	Adverse	Local	Long	Low	Irreversible	One-off	Moderate (B)	Low	Low B1	• Stormwater management practices that slow peak runoff flow, reduce sediment load and increase infiltration	Low
		Decrease of groundwater recharge due to expending impermeable surface area	Adverse	Local	Long	Low	Irreversible	Continuous	Moderate (B)	Low	Low B1	• Infiltration will be promoted if water depletion will arise in areas of groundwater wells to ensure the supply, especially in urban settings.	Low

CHAPTER 9

ECOLOGY AND BIODIVERSITY

CHAPTER.9. ECOLOGY AND BIODIVERSITY

This chapter of the ESIA report provides a description of the ecological characteristics of Asian side of the North Marmara Motorway Project area and identifies the potential impacts on the biological environment arising from the Project activities. The North Marmara Motorway Project starts at Kinali toll plaza in Silivri district of Istanbul province, crosses the city of Kocaeli and ends at Akyazi toll plaza in Akyazi district of Sakarya province, where the sea crossing is provided by the existing Yavuz Sultan Selim (Istanbul's Third Bosphorus). The Asian part of the Project area covers Kurtkoy-Liman; Liman-Izmit and Izmit-Akyazi sections.

In the scope of the biological studies for the Asian part of the Project biological environment studies which included terrestrial flora and fauna, aquatic flora and fauna, protected areas and key biodiversity areas (KBAs) have been conducted with both desktop studies and field surveys which described in detail in following sections. By the way, the assessment follows the recommendations and requirements of the IFC Performance Standard 6 (PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources.

In order to evaluate the potential impacts of the Project on the biological environment and various species inhabiting natural habitats within and around the project area, both the terrestrial and aquatic ecosystems were studied to identify the existing biological conditions. The Ecology and Biodiversity Chapter was prepared in accordance with two main lines of studies as terrestrial and aquatic on the biological environment.

9.1. Baseline Data Collection

A study area is defined within a 400 m buffer along the length of the route for terrestrial studies. In the scope of the terrestrial field studies some sampling points which represent different habitat types and natural and/or sensitive areas choose by analyzing appropriate satellite imagery available from GoogleTM Earth in 400m buffer and field surveys were carried out in those sampling points. Within the context of aquatic studies, rivers crossing on the motorway route and some streams which choose according to importance by hydrobiology experts were investigated. General information about methodologies described in following topics.

Within the scope of the field studies a review of existing information were undertaken and ecological composition of the Motorway routes in terms of terrestrial and aquatic flora and fauna elements, potential sensitive areas and critical species were identified.

The information gathered included information on:

- Biological components on terrestrial environment,
  - Terrestrial flora and ecosystems,
  - Terrestrial habitats and ecosystems
    - Flora species
  - Terrestrial fauna components
    - Amphibians and reptiles,
    - Aves,
    - Mammals,
- Biological components on aquatic environment,

- Key biodiversity areas,
- Important Bird Areas,
- Important Wetlands (Ramsar Sites)
- Potential sensitive areas.

9.2. Assessment Methodologies and Data Sources

The observation and sampling locations are identified based on the previous knowledge regarding the area, expert's opinion and the available maps, images and information in hand. However a detailed review of data was completed to obtain readily available information on ecological receptors in the study areas. The aim of the data review was to collect existing baseline information on ecological receptors potentially present in the study areas (including designated sites, habitats and species). This was then used to inform the scope and design of the detailed methodologies for the field survey work. The data review also provided contextual information about the status of ecological receptors (e.g. local, regional and global distribution, population size and level of extinction risk) and ecological information about the receptors (e.g. habitat requirements and behaviour of species) to assist with the valuation and assessment of potential impacts. The data review included an extensive review of published scientific literature, websites and other sources.

The ecology assessment has considered relevant Turkish (national) legislation, applicable standards and guidelines for international finance, and international agreements to which Turkey is a signatory. Applicable policy and legislation relevant to the ESIA are presented in Chapter 2 Policy, Legislative and Regulatory Framework with those of particular relevance to ecology summarized below.

Internationally accepted criteria are considered while choosing sampling points in the study area together with the species characteristic and habitat needs. Potential critical habitats in the project area were identified as well. This were done by overlaying the project area with the distribution of species of conservation concern; with sites identified as globally important for migratory species (e.g. IBAs, Ramsar sites); with national parks, protected areas, and key biodiversity areas.

9.2.1. International Agreements

In evaluating the threat/protection status of species; CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), Bern Convention, and IUCN (International Union for Conservation of Nature) Red List Database were used. Additionally, hunting status of all fauna elements was determined according to 2016-2017 Decision of the Central Hunting Commission (CHC) of Turkey.

Species covered in CITES are given under three different appendices according to their conservation status. Appendix I cover the species, which are under the threat of extinction. Trade in the specimens of these species is not allowed except extraordinary circumstances. Appendix II includes species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival. Appendix III includes species, for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country.

Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention) provides a framework for national action and international cooperation

for the conservation and wise use of wetlands and their resources. Turkey became a contracting party in 1994.

BERN Convention aims at conserving and promoting biodiversity, developing national policies for the conservation of wild flora and fauna and their natural habitats, protection of the wild flora and fauna from the planned development and pollution, developing trainings for protection practices, promoting and coordinating the researches made regarding this subject. It has been signed by 26 member states of the European Council (as well as Turkey) with the aim of conserving the wild life in Europe. Species that are protected under the Bern Convention are classified according to the following categories:

- Appendix I: Strictly protected flora species
- Appendix II: Strictly protected fauna species
- Appendix III: Protected fauna species

All the nations, which are party to the BERN Convention, have signed the Convention on Biological Diversity as well. These parties are responsible from ensuring sustainable use of resources in line with their national development trends and conserving threatened species.

To determine the threatening status of species IUCN classifications are also used, which are used in Turkish classification as well. IUCN Red List is published to highlight those species that are facing a risk of extinction. A species may be listed in IUCN Red List after studies on its population decrease. Thus, since IUCN List is based on research (annual updates are being made for species lists of countries), many countries attach more importance to species taking place in IUCN list than species taking place in Bern List.

The IUCN categories were updated in 2001 as ver. 3.1 (previous one was 1994 as ver 2.3) and are provided below:

Table.9.1. International Union for Conservation of Nature (IUCN) Categories

IUCN Red List Categories and Criteria, 1994 (ver. 2.3)		IUCN Red List Categories and Criteria, 2001 (ver. 3.1)	
EX	: Extinct	**EX**	: Extinct
EW	: Extinct in Wild	**EW**	: Extinct in Wild
CR	: Critically Endangered	**CR**	: Critically Endangered
EN	: Endangered	**EN**	: Endangered
VU	: Vulnerable	**VU**	: Vulnerable
LR	: Low Risk		
	cd : conservation dependent	**NT**	: Near Threatened
	nt : near threatened	**LC**	: Least Concern
	lc : least concern		
DD	: Data Deficient	**DD**	: Data Deficient
NE	: Not Evaluated	**NE**	: Not Evaluated

9.2.2. Turkish Legal Requirements

It is the responsibility of the Ministry of Forestry and Water Affairs (MFWA), together with the MoEU and their affiliated organisations to formulate policies concerning the conservation of biodiversity in Turkey, designate and manage protected areas, to develop and implement plans and programmes, to carry out activities in this scope and to provide coordination among all relevant institutions.

The affiliated organisations of the MFWA are the Special Environmental Protection Agency, the General Directorate of Forestry, the General Directorate of the State

Meteorological Service, and the General Directorate of State Hydraulic Works. The provincial organisation of the MFWA consists of the Provincial Directorates of Forestry and Water Affairs, as well as the regional directorates of the affiliated organisations.

The MFWA's unit with primary authority and responsibility for the conservation and sustainable use of biological diversity is the General Directorate of Nature Conservation and National Parks, which is also the CBD focal point. The General Directorate of Nature Conservation and National Parks is the principal unit responsible for the management of protected areas designated under the National Parks Law, for the conservation of wildlife and for the regulation and supervision of terrestrial hunting.

The Ministry of Food, Agriculture and Livestock is another important institution with authority and responsibility in the conservation and sustainable use of biological diversity. Those duties and responsibilities of the Ministry of Food, Agriculture and Livestock, which concern biological diversity, are performed by its central and provincial organisations through the General Directorate of Agricultural Research, the General Directorate of Protection and Control and the General Directorate of Agricultural Production and Development, which are amongst its main service units.

The Central Hunting Commission (CHC) is established under the Terrestrial Hunting Law and includes members from MFWA and General Directorate of Nature Conservation and National Parks, Directorate of Hunting and Wildlife, universities, Ministry of Food, Agriculture and Livestock, non-governmental organisations, hunting associations and Gendarmerie General Command. CHC prepares a resolution every year and this resolution is published in the official gazette. The recent resolution covers the hunting season for 2016-2017. These resolutions define hunting periods, limits (in terms of number of individuals that can be hunted and dates for hunting), areas where hunting is banned, as well as the species that can and cannot be hunted. Thus, CHC resolutions provide some measure of regulation over the exploitation of wildlife within Turkey. In this regard, according to 2016 and 2017 Resolutions of the CHC appendixes are as follows:

- Appendix I; Includes game animals which are protected by the CHC
- Appendix II; Includes game animals which are allowed to be hunted in seasons predefined by CHC

The legislation listed in Chapter 2, provide some areas protection status based on the presence of significant biological diversity, local endemics of importance, and threatened species. These designations include Natural Protected Sites, National Parks, Nature Protection Areas, Wildlife Protection and Development Sites and Specially Protected Areas.

Activities in such designated areas are also covered various regulations, but these areas are not specifically provided a protection status. In Turkey, there is no conservation status for habitats as defined by a specific vegetation as there is provided in European Union (EU) countries where the EU Habitats Directive applies. In Turkey, there is no specific habitat compensation requirement. There is only a policy regarding forested areas, which aims to replant at least as much of the forest area that is lost due to development activities.

There are also laws and regulations that are in effect to protect other environmental components, as well as to minimise pollution, promote sustainable development and management of natural resources. Legislation relating to air quality, environmental management and permitting, health and safety, management of chemicals and other dangerous substances, noise, soil quality, water quality and waste management, also provide management of issues that might have secondary impacts on biodiversity

components. Environmental laws and regulations that do not primarily relate to ecology are referenced in the relevant chapters of the ESIA.

In addition some national to the public were used for to collect existing baseline information. Birds of the study area were assessed according to national threat categories defined in the Red Data Book of Birds of Turkey (Kiziroglu, 2009) according to the categories defined in Table 9.2.

Table 9.2. National Threat Categories for Bird Species

Category A		
A.1.2	(CR)	Critically endangered and breeding species in Turkey
A.2	(EN)	Endangered and breeding species in Turkey
A.3	(VU)	Vulnerable and breeding species in Turkey
A.3.1	(D)	Declining, vulnerable and breeding species in Turkey
A.4	(NT)	Near Threatened, breeding species not facing risk now, but are likely to qualify for threatened category in the near future in Turkey
A.5	(LC)	Least Concern, breeding species that are widespread in Turkey
A.6	(DD)	Data Deficient, breeding species on which there is deficient information in Turkey
A.7	(NE)	Not evaluated, breeding species which have not been evaluated in Turkey
Category B		
B.1.2	(CR)	Critically endangered and non-breeding species in Turkey
B.2	(EN)	Endangered and non-breeding species in Turkey
B.3	(VU)	Vulnerable and non-breeding species in Turkey
B.3.1	(D)	Declining, vulnerable and non-breeding species in Turkey
B.4	(NT)	Near Threatened, non-breeding species not facing risk now, but are likely to qualify for threatened category in the near future in Turkey
B.5	(LC)	Least Concern, non-breeding species that are widespread in Turkey
B.6	(DD)	Data Deficient, non-breeding species on which there is deficient information in Turkey
B.7	(NE)	Not Evaluated, non-breeding species which have not been evaluated in Turkey

In determining threat statuses of flora species identified within the study area Red Data Book for Turkish Plants (Ekim et al., 2000), which was prepared in accordance with 1994 IUCN Red List Categories and Criteria was utilized, and the evaluations were presented in Annex 7/A of this report.

9.2.3. Standards and Guidelines for International Requirements

The Project is committed to implementing the IFC Performance Standards (PS) in order to manage social and environmental risks and impacts. IFC PS6 covers areas of biodiversity conservation, ecosystem services and sustainable management of living resources, which are all fundamental to achieve sustainable development. The objectives of PS6 are outlined as follows:

- To protect and conserve biodiversity;
- To maintain the benefits from ecosystem services; and
- To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.

The requirements of PS6 are applied to projects: (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g. agriculture, animal husbandry, fisheries and forestry) based on the risks and impacts identification process.

Ecosystem Services Review (ESR)

Ecosystem Services Review (ESR) was prepared in relation to the IFC Biodiversity Conservation and Sustainable Management of Living Natural Resources Guidance Note 6 requirements to determine ecosystem services to the Asian part of the North Marmara.

Biodiversity and ecosystems are closely related concepts. Biodiversity is defined by the Convention on Biological Diversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (United Nations 1992:Article 2). Ecosystem services (ES) which are the goods provided by ecosystems upon are the benefits that people obtain from ecosystems (MA 2003). For example, a stand of trees can reduce air pollution, purify the water supply, reduce the likelihood of floods and help regulate the climate by capturing and storing carbon. It might also provide timber for buildings, a space for recreation and improve the aesthetic qualities of the landscape.

The environment provides mankind with the food, water and air that are essential for life and with the minerals and raw materials for industry and consumption. Less obviously, it provides the processes that purify air and water, and which sequester or break down wastes. These services that the environment provides as all ecosystem services which require the existence of living organisms for their delivery, but in many cases it is not the diversity of the organisms that is important, but the presence of a viable population of at least one species representing a particular functional group and the delivery of many ecosystem services requires a non-trivial amount of biodiversity, but not necessarily the maximum amount possible in that environment. Also recreation and health are found in which human culture finds its roots and sense of place are included in ecosystem services. Taking into consideration overall ecosystem services are the many different benefits that ecosystems provide to people (MA, 2005). Therefore, both ecological and sosyo- economic studies support to identification ecosystem services of Motorway Project area in the line with IFC Performance Standards and the initial literature studies.

The overall aim of the ecosystem service concept is to bring a holistic approach to environmental decision-making by valuing the environment in terms of the benefits people obtain from ecosystems. It is practical and pragmatic, focusing on goals that provide greatest environmental benefit at least cost to society and the natural environment with the aim of avoiding taking decisions with unintended secondary consequences that may be costly, increase risk or be detrimental to ecosystems and human well-being. The evaluation of the effects, both desirable and undesirable, of approaches to landscape management on the delivery of ecosystem services allow for a broader assessment of the true costs and benefits of actions and policies.

Ecosystem service principles and/or cost-benefit analyses are enshrined in European environmental protection legislation and policies such as the Environmental Liability Directive (2004/35/EC), the Habitats Directive (92/43/EEC), the Water Framework Directive (2000/60/EC) and the REACH Directive (1907/2006). Recent initiatives such as the United

Nations Millennium Ecosystem Assessment (2004), UK National Ecosystem Assessment (2011)**Error! Bookmark not defined.** and The Economics of Ecosystems and Biodiversity (TEEB, 2010) have built on concepts and methods developed over more than 20 years in the United States to deal with legacy contamination (US Natural Resource Damage Act). Many of the US approaches have informed more recent European initiatives on environmental liability, habitat banking, biodiversity offsetting, life cycle assessment (foot printing), strategic planning, operational risk reduction and now product registration. ES are depicted within four service subset categories as follows:

- *Provisioning Services are ecosystem services* that describe the material or energy outputs from ecosystems. They include food, water and other resources.

- *Regulating Services* are the services that ecosystems provide by acting as regulators eg. regulating the quality of air and soil or by providing flood and disease control.

- *Cultural, Spiritual, and Recreational Services* are provide that benefits which are non-material obtains include recreational facilities and tourism, aesthetic appreciation, inspiration, a sense of place, and educational value.

- *Supporting Services* are necessary for the production of all other ecosystem services such as soil formation nutrient cycling and primary production. They differ from provisioning, regulating, and cultural services in that their impacts on people are either indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people.

In addition, when the projects may affect ecosystem services of relevance to local people, Affected Communities attached to biodiversity and ecosystem services should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process which is one of the key means to understanding impacts on biodiversity and identifying appropriate responses to such impacts as defined in IFC Performance Standard.

The IFC Performance Standards which is in line with the definition provided by the Millennium Ecosystem Assessment are covered divide Ecosystem services into two priority types:

- Priority 1: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and where impacts on such services may adversely affect communities.

- Priority 2: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and on which the project directly depends for its operations.

Within the scope of the Motorway Project, the ecosystem services that are relevant to the Asian part of the Project Area of Influence and categorize them according to either priority 1 or priority 2 were summarized in “9.8. Ecosystem Services within the Project Area“ section.

9.2.4. Significance Criteria

The significance criteria for the impacts on ecology and biodiversity were determined, as high, moderate or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criterias presented in Chapter 4 ("ESIA Methodology") are described the significance criteria used while sensitivity/value criteria to be used in the scope of ecological impact assessment is summarized in Table 9.3. Detailed explanation of the sensitivity components for each ecosystem component is provided in the following sections.

The IFC Performance Standard 6 (IFC, 2012), Biodiversity Conservation and Sustainable Living Revenue Natural Resource Management rules were used to identify Critical Living Area in the study area. IFC criteria for identifying Critical Habitats include:

- Criterion 1: Habitats important for critical and/or endangered species;
- Criterion 2: Habitats of significant importance to endemic and/or restricted species;
- Criterion 3: Habitats containing significant intensive species or migrating species and/or indigenous species in the global sense;
- Criterion 4: Highly threatened and/or unique ecosystems;
- Criterion 5: Key evolutionary processes.

Based on these criteria, sensitivity criteria for ecological components within the scope of the project have been determined as follows:

Table 9.3. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	**Medium (2)**	**Low (1)**
Designed Areas	Internationally Recognised Areas (e.g. UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention)).	Nationally designated areas.	N/A
Habitats	Habitats that trigger critical habitat under the following IFC PS6 Criteria: • Criterion 4: Highly threatened and/or unique; and/or ecosystems • Criterion 5: Key evolutionary processes Habitats that support species of High sensitivity	Areas of habitat that represent >1% distribution within Turkey or are threatened at a national level. Habitats that support species of Medium sensitivity.	Natural habitats that do not meet the criteria for either medium or high sensitivity. Habitats that support species of Low sensitivity.
Species	Species populations that trigger critical habitat under the following IFC PS6 Criteria: • Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species; • Criterion 2: Endemic and/or restricted-range species;and/or • Criterion 3: Migratory and/or congregatory species.	Nationally/regionally important concentrations of a Vulnerable (VU) species, or locally important concentrations of Critically Endangered (CR) and/or Endangered (EN) species. Locally important populations of endemic / rangerestricted species. Populations of migratory species that represent >1 % of the national (Turkish) population.	Locally important populations of Near Threatened (NT) or Vulnerable (VU) species, or locally important populations of species listed on Annexes to the Bern Convention.

9.3. Ecological Researches

Exploration and researches of the Asian side of the Motorway were conducted with experts for both terrestrial and aquatic environment. In this scope biological components on terrestrial environment studies which include terrestrial flora and fauna were carried out in 9-10 March and 5-6 June, 2017 at visited locations and aquatic environment studies conducted in 8-10 March, 2017 at selected rivers.

All ecological researches were conducted with desk based and field studies to determine the baseline conditions in the study area. These baseline data/information collections were provided an overall picture of the conditions and sensitivities in the area that should be considered in assessment of potential impacts and development of relevant mitigation measures for design.

For terrestrial environment studies, it was not be practical to survey the entire route and the survey team therefore were visited locations chosen by experts according to representativeness of each habitat type within the study area. These locations are named as sampling points. These sampling points can revised in pursuant of result of the field surveys observations. Sampling points were chosen to ensure that each of the habitat types displayed in the European Nature Information System (EUNIS) habitat classification were visited so that all of the different habitats were ground truthed in the study area.

Additionally, aquatic studies that cover both desks based and field studies to determine the baseline conditions in the study area, were conducted. River crossing which have well conditioned flow during the field studies along the motorway route were determined and studied according to sufficient methodologies during the aquatic field surveys.

The overall approach to determine the baseline conditions in the context and objectives provided above were include the following data collection and interpretation means:

- Review of pertinent literature and previous works.
- Field studies carried out in the Project area.
- Satellite image interpretation, as available.
- Communication with the inhabitants in the study area during the field studies.
- Consultation with nature conservation administration and related agencies and institutions concerned.

Distribution, population, ecology and reproductive biology of the threatened and endemic plant species likely to occur within study area of interest were studied. The literature survey were intended to give information on identification of endemic, endangered, and rare species and species defined under the national and international conservation classes. Accordingly, species that are under the risk of being affected due to the Project and therefore, require special attention and protection measures were determined.

The species identified during the field studies were recorded in a systematic way so that a species inventory for the baseline conditions are established as well as description of the habitats. Also, Endemic, restricted-range, CR and EN category flora species were determined as the target species within the scope of the study. The most important area for these species is in mostly natural habitats. The project area covers mostly plantation habitats and agricultural lands. Therefore mainly natural habitats were chosen for sampling locations.

Potential target species of each habitat were identified as a result of literature review and the identified target species were confirmed through field studies.

In the scope of the ESIA report, based on the assessed impacts significance relevant measures for mitigating adverse impacts were developed. The importance/sensitivity of the habitats and species were given special attention in reporting and detailed data such as identified species list, their protection status and the extent of the areas were included.

Additionally, determined target species were evaluated on the basis of habitat characteristic. In context of the Asian site of the Motorway critical habitat were assessed along the route according to critical species, sensitive habitats and/or ecosystems.

9.3.1 Definition of the Study Area

The Asian side of the Motorway Project include Section 4, 5, 6. Study area definition was made for both terrestrial and aquatic environment. In this context for terrestrial environment studies, the survey encompassed as much of the habitat along the proposed Motorway route and quarry sites used in the scope of the project as access and topography allowed. At each sampling points and their vicinity the features of the landscape and environment include the dominant habitats and species of note. 200 m buffers either side of the route were used to guide the habitat survey to ensure that a suitable sample of habitat was covered. “Study area” is defined as total 400 m buffer zone for biological studies and camp sites, storage yards[1] and quarry sites.

400 m buffer along the length of the route for terrestrial studies, there were 42 sampling locations were selected by experts according to different habitat types and mainly natural habitats. 27 sampling point of the 42 were located in Asian side of the motorway. In addition stone quarries, camp sites and storage yards which will be used as construction of Motorway were investigated and reported. In the scope of the Asian side of the route terrestrial environment studies were carried out between 9-10 March and 5-6 June, 2017 by experts from national universities. The GPS co-ordinates of the sample locations were ground-truth the habitat classifications then used in the field to conduct surveys. Where necessary, based on professional judgment, sample locations were altered in the field to provide the most representative samples. Selected sampling points locations and designated stone quarry, storage yards and camp sites availabilities within the each sections (4-5-6) in the study area are shown in Table 9.4 and maps of study area and sampling points are given in Figure 9.1.

Table 9.4. Sampling Locations within the each Section of Asian Part

Sections	Sampling points
Section 4	4_1, 4_2, 4_3, 4_4, 4_5, 4_6, 4_7, 4_8
Section 5	5_1, 5_2, 5_3, 5_4, 5_5, 5_6, 5_7, 5_8, 5_9, 5_10, 5_11, 5_12, camp site of section 5 and stone quarry
Section 6	6_1, 6_2, 6_3, 6_4, 6_5, 6_6, 6_7, 7 storage ares, stone quarry, camp sites

For aquatic environment studies, the sampling points in the study area also were evaluated by the use of satellite images (Google Earth) to detect and validate the important aquatic ecosystems. When the field studies were carried out the sampling points within the Project area were selected according to flow ratios which have enough water to sampling. In

[1] Storage areas locations have not been identified yet but alternative locations that evaluated by Project sponsor are defined.

this scope aquatic environment of the Asian side of the motorway were conducted between 8-10 February, 2017 at 19 river cross.

According to the desk based study, available streams were recorded. In this regard, 19 rivers/streams/creeks were selected for sampling within the Asian part of the Project area. These running waters locations in belong to sections are presented in Table 9.5 and the map given in Figure 9.2. GPS referenced photographs and notes were made at both terrestrial and aquatic sampling points to record the habitats, species and landscape features present.

Table 9.5. Running Waters Locations within the each Section of Asian Part

Sections	River name (if avaliable)	District/Province	Basin
Section 4			
AQ4/01	Buyukgol Stream	Istanbul; Topcalirlar	Omerli Dam Basin
AQ4/02	-	Istanbul; Karaagil	Omerli Dam Basin
AQ4/03	-	Istanbul; Kadilli neighborhood	Omerli Dam Basin
AQ4/04	Cumakoy Stream	Kocaeli; Cumakoy	Omerli Dam Basin
AQ4/05	Kiremitli Stream	Kocaeli; Cumakoy	Omerli Dam Basin
AQ4/06	-	Kocaeli Denizli neighborhood	Marmara Basin
AQ4/07	-	Kocaeli; Demirciler	Marmara Basin
Section 5			
AQ5/01	-	Kocaeli; Sevindikli neighborhood	Sevindikli Lake Basin
AQ5/02	-	Kocaeli; Between Karayakuplu-Sipahiler	Sipahiler Pond Basin
AQ5/03	-	Kocaeli; Korucuk neighborhood	Sipahiler Pond Basin
Section 6			
AQ6/01	Bicki Stream	Kocaeli; Sepetci	Marmara Basin
AQ6/02	-	Kocaeli; Cayirkoy	Marmara Basin
AQ6/03	Gedikli Creek	Kocaeli; Bayraktar	Bayraktar Dam Basin
AQ6/04	-	Kocaeli; Karaabdulbaki neighborhood	Marmara Basin
AQ6/05	-	Sakarya; Adapazari; Akmese	Sakarya Basin
AQ6/06	-	Sakarya; Adapazari; Korucuk	Sakarya Basin
AQ6/07	Carksuyu	Sakarya; Adapazari	Sakarya Basin
AQ6/08	Sakarya River	Sakarya; Adapazari; Celebiler	Sakarya Basin
AQ6/09	Mudurnu Stream	Sakarya; Adapazari	Sakarya Basin

9.3.2. Internationally Recognised Areas within the Region of the Project Area

Internationally Recognised Areas are located in the surroundings of the Project Area located in the provinces of Istanbul, Kocaeli and Sakarya. These areas include Key Biodiversity Areas (KBA), Important Plant Areas (IPA[2]) and Important Bird Areas (IBA). KBAs are the most important areas in terms of according to their characteristics in terms of supporting biological components. Considering that all sections of the Project area there are 14 internationally recognized areas have been found. Asian side of the route where include section 4, 5, 6 there are 7 internationally recognized areas.

The Asian side of the Motorway overlaps with two small portions of the Omerli Basin KBA, IPA and Kocaeli Hills KBA. Additionally these, there not have any Ramsar areas within or around the Project area.

The internationally recognized areas which include in the Provinces covered the Asian side of the Project area is shown in Figure 9.3. Distance of the KBAs, IBAs and IPAs from the Asian side of the Project area and the provinces which the KBAs, IBAs and IPAs are located in and summarized as following table:

Table 9.6. KBAs and IBAs Located in vicinity of the Project Area

Internationally Recognised Areas	Province	Distance from the Project Area	
		Related Section	Distance (km)
Istanbul Islands KBA, IBA	Istanbul	Section 4	16,9
Sile Coast KBA, IBA, IPA	Istanbul	Section 4	26,0
Omerli Dam Basin KBA, IPA	Istanbul	Section 4 and 5	0,0
Pendik Valley KBA	Istanbul	Section 4	1,7
Kocaeli Hills KBA	Kocaeli	Section 5 and 6	0,0
Sapanca Lake KBA, IBA	Kocaeli, Sakarya	Section 5	7,4
Sakarya Delta KBA, IBA	Kocaeli, Sakarya	Section 6	20,5

- *Istanbul Islands KBA, IBA* harbours the sub-species of endemic as *Allium rhodopeum ssp*. *Turcicum*. This island is important assembling location for storks in migration period. On the other hand, the island is important breeding area for *Larus cachinannas* but that species is not provided any KBA critation for there. In addition, *Nymphalis xanthomelas* which is required to protection in regional scale supplies a KBA critation. The KBA is located in 16,9 km distance from Section 4.

  Surface Area: 9,458 ha
  Province(s): Istanbul

[2] A4. Congregations
i. The site is known or thought to hold, on a regular basis, ≥ 1% of a biogeographic population of a congregatory waterbird species.
ii. The site is known or thought to hold, on a regular basis, ≥ 1% of the global population of a congregatory seabird or terrestrial species.
iii. The site is known or thought to hold, on a regular basis, ≥ 20,000 waterbirds or ≥ 10,000 pairs of seabird of one or more species.
iv. The site is known or thought to be a 'bottleneck' site where at least 20,000 storks (Ciconiidae), raptors (Accipitriformes and Falconiformes) or cranes (Gruidae) regularly pass during spring or autumn migration.
B1. Congregations
i. The site is known or thought to hold ≥ 1% of a flyway or other distinct population of a waterbird species.
ii. The site is known or thought to hold ≥ 1% of a distinct population of a seabird species.
iii. The site is known or thought to hold ≥ 1% of a flyway or other distinct population of other congregatory species.
iv. The site is a 'bottleneck' site where over 5,000 storks, or over 3,000 raptors or cranes regularly pass on spring or autumn migration.
See Birdlife International website for full list of definitions of IBA criteria (http://www.birdlife.org/datazone/info/ibacriteuro)

District(s): Islands
IBA Criteria met A4iv, B1iv (2004)

- *Sile Coast KBA, IBA and IPA* is a complex of four small islands at the entrance of Sile harbour. The coast is sparsely vegetated with only low grass and scrub vegetation on the higher parts.

  The site qualifies for its breeding population of Shag (175 pairs). All the coast is used for breeding but majority breed on the largest island and the island east of it: the two other islands are mainly used for roosting. Birds nest in crevices or on the barren ground. In addiditon to the Shags, 350 pairs of *Yellow- legend Gull* breed. In contrast to Shags, *Yellow-legged Gulls* often nest in the glass. The islands were declared a protected area in 1992. Sile Coast is located in 26 km north of the Section 4 of the Motorway.

  Surface Area: 4,817 ha
  Province(s): Istanbul
  District(s): Sile
  IBA Criteria met: B1i, B3 (2004)

- *Omerli Dam Basin KBA, IPA* is very rich in terms of various of plant species special acidic lakes. Eleven plant taxons provide it a KBA criterion. Foremost among these Amsonia orientalis, *Circium polycephalum*, *Colchicum micranthum* and *Crocus olivieri ssp. Istanbulensis* are presented. In addition an amphibian species (*Triturus karelinii*) required to protection according to the EU scale is found. Omerli Basin KBA is adjacent to Section 4 and 5. 1252,03 ha of the area are intersected with the Section 4 and 164,84 of the area are intersected with the Section 5.

  Surface Area: 58,237 ha
  Province(s): Istanbul, Kocaeli
  District(s): Sile, Umraniye, Maltepe, Pendik, Gebze, Sultanbeyli, Kartal

- *Pendik Valley KBA* includes shrubberies, oak communities and meadows. The KBA is the most important area for one of the growing endemic and endangered species (*Colchicum micranthum*). Also some raptor bird species such as *Falco tinniculus* and *Buteo buteo* overwinter in Pendik Valley KBA where located in 1,7 km distance from Section 4.

  Surface Area: 2,854 ha
  Province(s): Istanbul
  District(s): Pendik, Gebze Tuzla

- *Kocaeli Hills KBA* is covered with relatively well-preserved high-maquis assemblages extending from the coast to the inside. *Hippolais olivetorum* is provided the area a KBA criterion. Kocaeli Hills KBA is adjacent to Section 5 and Section 6. 233,80 ha of the area are intersected with the Section 5 and 2,51 ha of the area are intersected with the Section 6.

Surface Area: 28,049 ha
Province(s): Kocaeli
District(s): Gebze, Korfez, Izmit, Derince

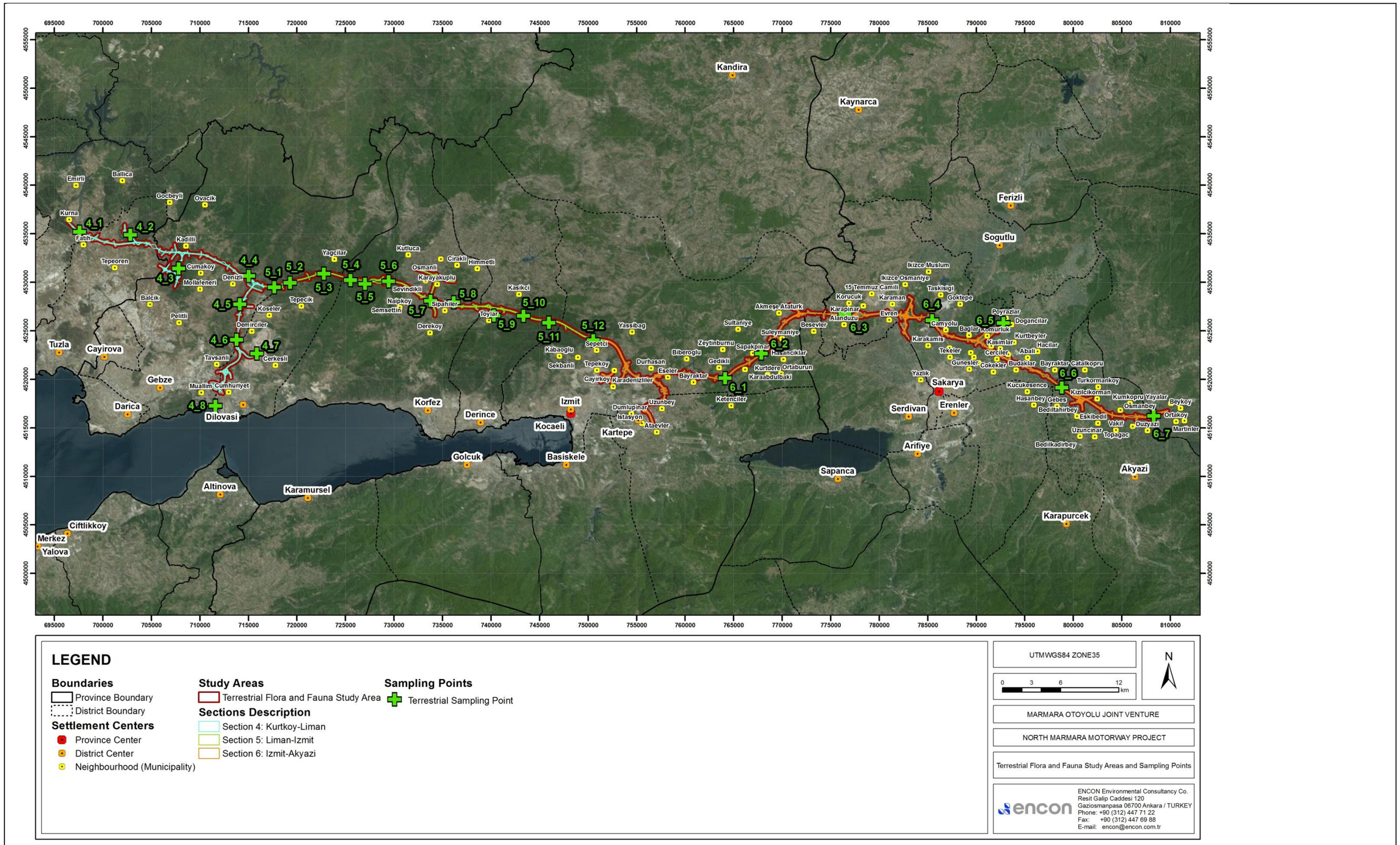
- *Sapanca Lake KBA and IBA* harbors wintering birds in high numbers. The high population bird species are *Fulica atra* and *Aythya ferina.* Sapanca Lake is located in 7,4 km South of the Asia part (Section 5) of the Project area.

  A freshwater lake (max. depth 61 m) formerly connected to the Sea of Marmara and fed by the Sakarya river. Arable land, fruit orchards and extensive Populus plantations surround the lake. Narrow reedbeds (Phragmites) fringe most of its shores; only at the eastern end does substantial marsh vegetation occur. Lake water is abstracted for industrial use. The site is important for wintering wildfowl.

  Surface Area: 7,749 ha
  Province(s): Sakarya Kocaeli
  District(s): İzmit, Adapazarı, Sapanca
  IBA Criteria met: A1, A4i, A4iii, B1i (2004)

- *Sakarya Delta KBA abd IBA is* consist of floodplain forestland, freshwater lakes and coast ecosystems. Important part of the area is sand dunes which have approximate 5 meters elevation. There are floodplain forestland south of the sand dunes. The Pendik Valley KBA is very rich area in terms of plant, bird, mammal, herptile and fish species. Some endangered on a global scale species' healthy populations such as *Silene sangaria* and *Verbacum degenil* are found in there. In addition, the area is important wintering area for Brantaa ruficollis and Melanitta fusca. On the other hand, ten fish taxons provide there a KBA criterion. The KBA is located in 20,5 km distance from Section 6.

  Surface Area: 34,224 ha
  Province(s): Sakarya Kocaeli
  District(s): Sile, Umraniye, Maltepe, Pendik, Gebze, Sultanbeyli, Kartal
  IBA Criteria met: B1i (2004)



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- Terrestrial Flora and Fauna Study Area

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

Sampling Points
- Terrestrial Sampling Point

UTMWGS84 ZONE35

N

0 3 6 12 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Terrestrial Flora and Fauna Study Areas and Sampling Points

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Figure 9.1. Terrestrial Flora and Fauna Study Areas and Sampling Points

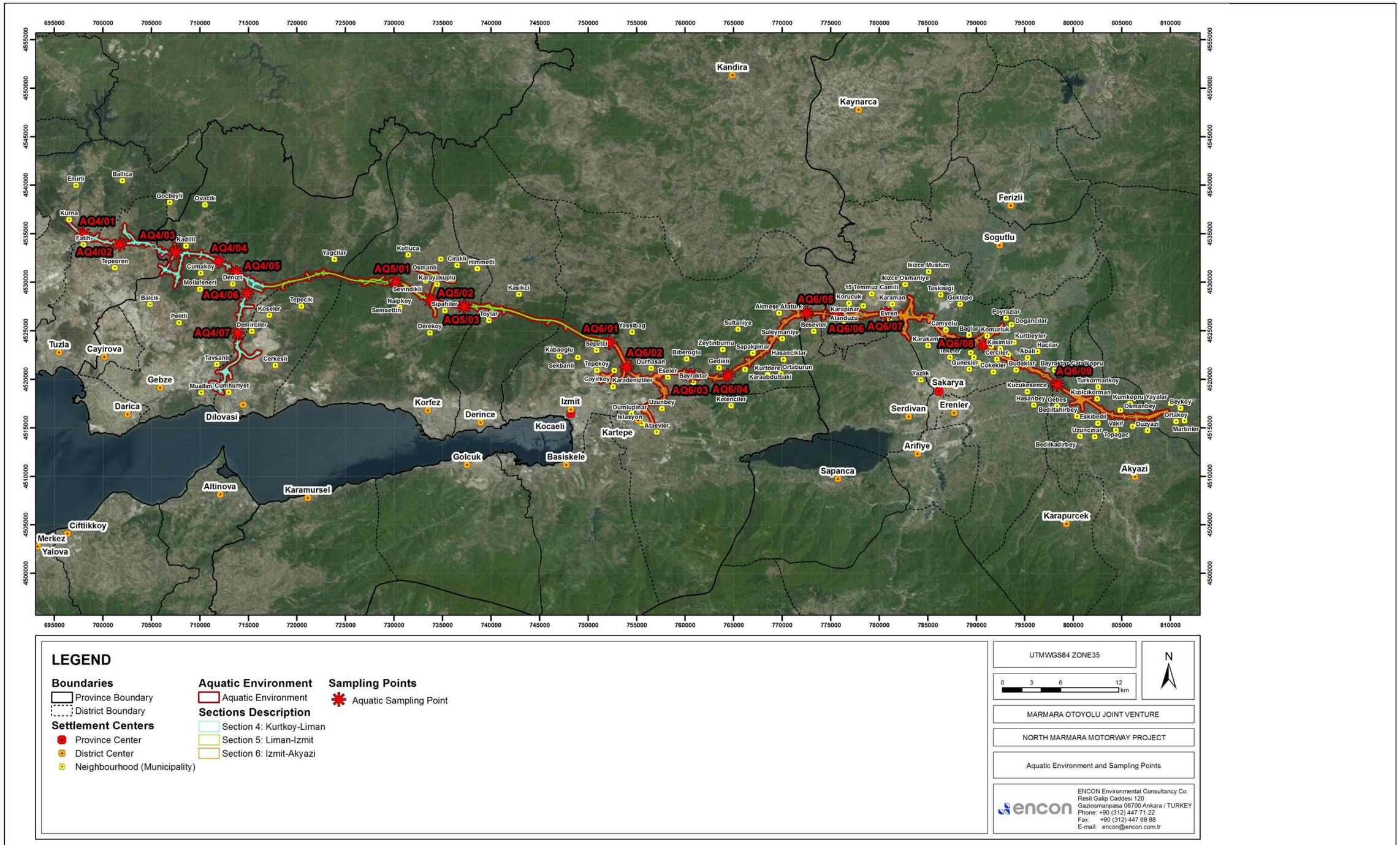
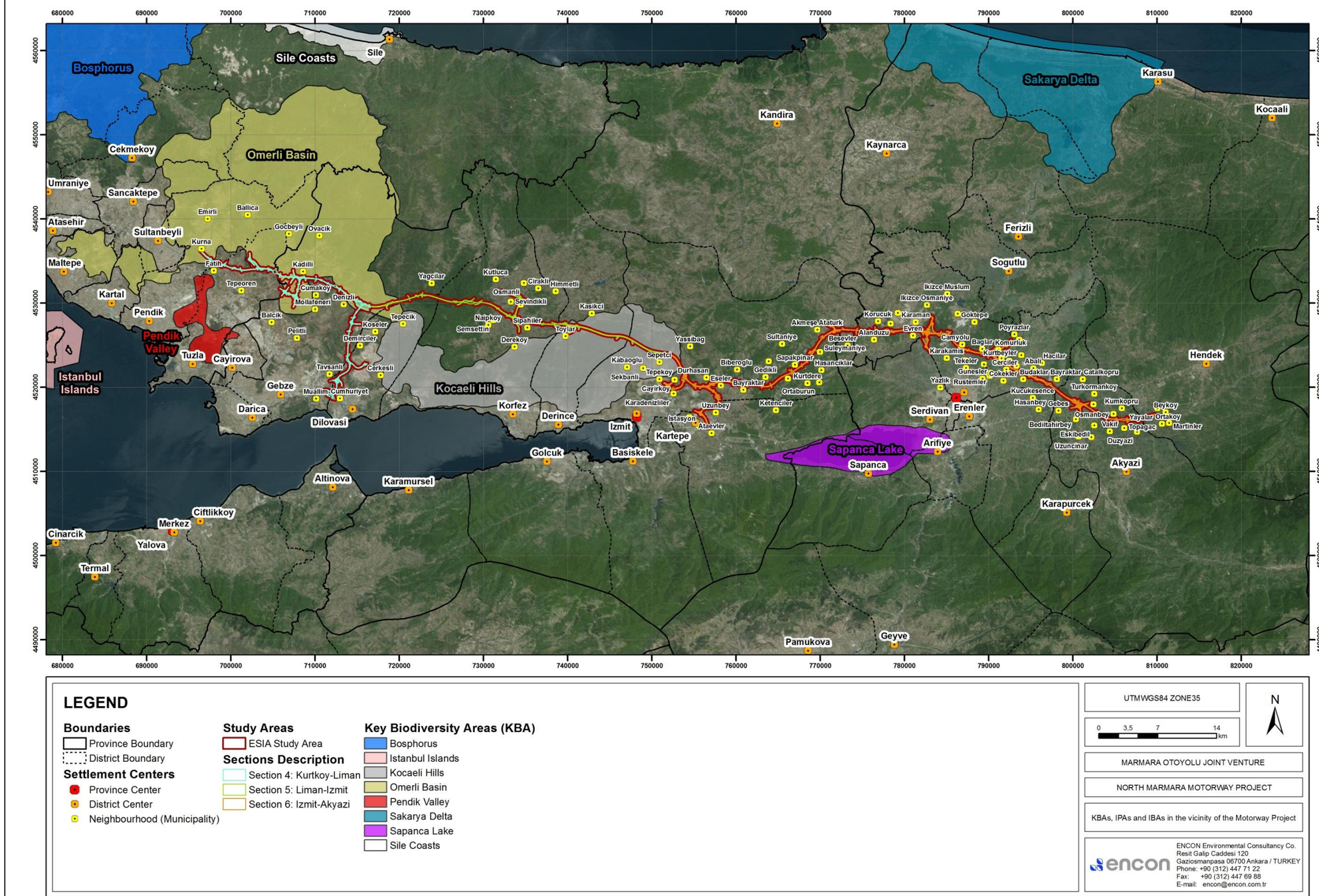


Figure 9.2. Aquatic Flora and Fauna Study Areas and Sampling Points



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- ESIA Study Area

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

Key Biodiversity Areas (KBA)
- Bosphorus
- Istanbul Islands
- Kocaeli Hills
- Omerli Basin
- Pendik Valley
- Sakarya Delta
- Sapanca Lake
- Sile Coasts

UTMWGS84 ZONE35

N

0 3,5 7 14 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

KBAs, IPAs and IBAs in the vicinity of the Motorway Project

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Figure 9.3. Key Biodiversity Areas in the vicinity of the Motorway Project

9.4. Methodologies

9.4.1. Terrestrial Flora and Ecosystems

In this section terrestrial flora and ecosystem structures and habitat features were revealed at Asian side of the Motorway Project area. Within the scope of the terrestrial flora studies, the flora and vegetation types within the study area were identified and to serve as a basis for determination of the impacts of the Project on biological resources and to develop appropriate mitigation measures, where necessary. The aim of the baseline studies for terrestrial flora species and vegetations were to collect data throughout the field surveys in order to explain the environmental conditions of in the study area through selected sensitivity elements. In this context, floristic studies were conducted including both desk based and field studies to determine the baseline conditions in the study area.

The objectives of the desktop study were to review and organize the existing information on terrestrial flora, habitats and ecosystems within the study area. Therefore, species of conservation concern (SCC) potentially, natural habitats potentially and critical habitats potentially present in the study area were determined before the field study and examined during field visits. Terrestrial flora studies were carried out light on the following key baseline issues:

- Determining the species of terrestrial flora present in the Project area, their distribution and conservation status (such as critically endangered species, endangered species, as well as any endemic species),
- Defining natural and critical terrestrial habitats and ecosystems present in the Project area, their distribution and the list of species associated to each habitat.

This baseline data/information collection were provide an overall picture of the conditions and sensitivities in the area that were considered in assessment of potential impacts and development of relevant mitigation measures for design, construction and operation phases of the Project. Terrestrial flora and ecosystem studies were investigate as following to part:

- Terrestrial habitats and ecosystems,
- Terrestrial flora.

Terrestrial Habitats and Ecosystems

Terrestrial habitats within baseline study area are categorized as modified, natural or critical habitats according to IFC (2012). As the definition of critical habitats is dependent on the presence of endemic, threatened, restricted-range species. As a result, distribution of the endemic, threatened, restricted-range species and EUNIS Level 3 habitat distribution within the Project area were obtained and mapped.

The habitat classification follows the EUNIS habitat type classification, a comprehensive pan-European system that facilitates the harmonized description and collection of data across Europe, including Turkey, through the use of habitat identification criteria. The preliminary habitat distribution in the study area is determined based on EUNIS Level 3 habitat type classification. A variety of habitat types were determined by analyzing appropriate satellite imagery and aerial photos (most of the territory of the Republic of Turkey is covered by satellite imagery available through Google Earth). Since there are different habitat types within the study area, the European Nature Information System (EUNIS) habitat classification is used to determine the number of different habitat types.

The habitats within the Asian side of the Motorway determined with desktop studies according to EUNIS Habitat Classifications used satellite imagery. After the field studies which conducted in 26th February and 9-10 March and 5-6 June habitat types were verified and revised by expert observations. Maps of habitat types are given in Annex 7/D. Habitat types determined to exist within the Asian side of the study area and their related codes as following table and their descriptions according to the situations in the Project area are found in “Findings” topic.

Table 9.7. The List of EUNIS Level 3 Habitat Types and Their Distributions within the Asian Side

Habitat Code	Habitat Type	Sections
C 1.2	Permanent mesotrophic lakes, ponds and pools	Section 5, Section 6
E 3.4	Moist or wet eutrophic and mesotrophic grassland	Section 5, Section 6
E 1.3	Mediterranean xerophilous meadow	Section 4,
F 5.2	Maquis	Section 4,
F 5.3	Pseudomaquis	Section 4, Section 6
G 1.2	Mixed riparian forests	Section 4, Section 5, Section 6
G 3.F	Highly artificial coniferous plantations	Section 4, Section 5,
G 1.A	Meso and Eutrophic Mixed Decidiuous Forests	Section 4, Section 5,
G 1.C	Highly artificial broadleaved deciduous forestry plantations	Section 6
G 1.5	Broad-leaved acidic marsh forest	Section 6
I 1.2	Agricultural lands	Section 4, Section 5, Section 6
I 1.5	Roadsides and field sides (ruderal lands)	Section 4, Section 6
J 2.3	Rural industrial and commercial sites still in active use	Section 6

Terrestrial Flora

The floristic components of each habitat type in the study area were identified. In this regard, the selected sampling point were taken as the start point for the survey and site survey at that location were completed by walking around the sampling point.

The flora lists were 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, local Turkish names (if available), phytogeographic regions, endemism, threat categories for endemic and rare species, habitats and their relative abundance in the area. List of flora species were include phytogeographic regions, endemism levels, national and international threat statuses, habitats of occurrence and relative abundance. Samples collected in the area were identified according to the “Flora of Turkey and the East Aegean Islands” by P.H. Davis. For determination of the categories of endemic species and endangered species, Red Data Book of Turkish Plants (Ekim et al., 2000) was taken as a reference. Threat categories were revised according to IUCN 2001 due to the fact that Red Data Book of Turkish Plants is prepared with respect to IUCN 1994.

The samples were not taken for well-known species in study area. However, 1-2 samples of species, which cannot be diagnosed as known species, were taken and they were turned to herbarium material for identification. The information gathered during the surveys in the study area was recorded in field observation forms.

Upon the completion of the field studies, Field Survey Forms were reviewed and they were the basis for establishing the baseline data. The flora survey forms which noted during the field studies are given in Annex 7/B.

Flora and vegetation findings were evaluated separately for each section (4-5-6). Species given to the Floristic list are based on the findings and observations obtained during the field studies.

9.4.2. Terrestrial Fauna

The main objective of fauna studies is to identify the fauna elements (amphibians, reptiles, birds and mammals) of the study area, define the habitats these fauna elements inhabit, and make evaluations on faunal and ecological characteristics of the study area. Terrestrial fauna file studies were conducted in 400 m length buffer which determined by experts with desktop studies according to represented to different habitat types. There are 27 sampling points which were based on during the site visits for fauna species and several camp sites, storage yards and quarries were studied in this determined study area. During the terrestrial fauna field studies three different expert investigated and reported each fauna groups as amphibian-reptiles, birds and mammals for each section (4-5-6).

Beside of these, objectives of terrestrial fauna surveys within the study area were described as follows;

- To determine the characteristics and importance of the project area in terms of terrestrial fauna species,
- To determine the important and sensitive habitats and critical fauna species,
- To determine the protection status of the fauna species according to national and international conventions, decisions and requirements.
- To determine population densities of these species according to project sub-areas,
- To determine potential impacts of motorway project on terrestrial fauna components.
- To determined mitigation measures to minimize- offset- eliminate impacts on terrestrial fauna components.

Fauna studies include mammals (Mammalia), birds (Aves), reptiles (Reptilia), and amphibian (Amphibia) groups. Field Survey Forms for fauna groups were reviewed and they were the basis for establishing the baseline data. The information obtained by conducting a 30-45 minute survey at each point is written on the survey forms. Following sections explain as each fauna groups:

Amphibian- Reptilia

In the context of the amphibians and reptiles searching were carried out with desk studies and field surveys for identification of species on study area. Desk studies were included literature review with the purpose of the amphibian and reptile inventory with the study area and determination of the amphibian and reptile species of international concern.

Field studies were carried out by the means of various methods for the identification of amphibian and reptile species, their habitats and sensitivity. Especially, rives cross with the motorway route and the water bodies within the study area were investigated for amphibians. Identification of reptile species were conducted in wetlands, rocky habitats and shrubberies.

Appropriate habitats have been explored to determine amphibian species (salamanders and frogs) in the vicinity. During these studies, appropriate habitats were observed for nutrition, sheltering and rearing of amphibians, and observations were intensified especially in the riparian zones and areas where and water flow were less or stagnant. In this context, the bottoms of plants and stones in these areas were checked and the individuals found were caught by using catching scoop and released without any damage after the species were identified and the photographs were taken.

Reptile species (turtles, lizards and snakes) in Turkey are poikilotherms, which have body temperature dependent to the environment. They lose their activity when the temperature is low and they have to hibernate in these conditions. After finding suitable habitats in field studies for the revelation of reptile fauna, reptile species can usually be seen under rocks or while hunting or sunbathing outside.

- Field studies for herptile species were conducted between 26th February, 9-10 March and 5-6 June, 2017.

- If the reptiles are seen in the field in an appropriate position, they can be photographed or, if the possibility of catching them is detected, they are usually caught directly by hand, and in some cases, can be caught by the loop method.

- Collecting and killing were not carried out during reptile field studies.

- For some water-dependent turtle species and snake species, catching can also be carried out by using usual fish nets or fish nets called pinter.

- The photographs of the habitats in which the reptile species were identified had taken and the sample numbers of the detected species and time zone and the coordinates of the detection spot were recorded with the help of a GPS.

- National and international conservation criteria have been taken into consideration when assessing the reptilian species identified in the project. Species of reptiles have been evaluated according to the latest version of IUCN (International Union for the Conservation of Nature and Natural Resources) list. Also to be included Bern and CITES lists, the status of being endemic and the abundance in the area were assessed.

- By the aim of gathering the best results from the surveys, the most suitable sampling technique was applied within the project area. The results of the survey

will be used to, along with relative abundance and where possible, population abundance estimates.

- Field Survey Forms were reviewed and they were the basis for establishing the baseline data. Amphibians and reptiles survey form which noted during the field survey template is shown in Annex 7/B

Birds (Aves)

Within the scope of the field studies for birds, protection status, native or migrant situations of these species and whether habitats are used by water birds were detected. It were identified to habitat types which can be used as breeding, wintering, stopover or resting area frequently by native or migrant species within study area or its close vicinity. On the other hand, whether potential impacts of motorway projects construction affected habitats, which are used by, native or migrant species were determined during the field surveys.

If there is any negative effect, potential impacts are evaluated as completely or as much as possible, precautions are to be taken in order to be removed and points are to be considered were assessed.

Birds which are at the top of the food pyramid flee to the alternative area quickly owing to affected by negative changes in the environment. Birds are used as indicator species in their monitoring reviews from ecological changes because of their mobility. For this reason, fauna surveys were focused on birds, and population densities, species diversity and patterns of habitat use were scrutinized to determine the basic conditions.

Habitats at each point determined during the field study were examined in detail, species of birds were recorded and field notes were processed into field forms. Ornithological findings were evaluated separately for each section. Bird species given in the ornithological list were prepared according to the observations obtained during the study.

The bird species lists were systematically prepared based on the names of the ordo, family species names. The bird species list also includes the number of birds found in each sampling point and the data source (observation-questionnaire). Turkish and English names of birds, hazard and protection categories in IUCN, Bern, Cites and the Red List of Birds of Turkey are also given in detail in the table.

- Direct observation was made in determining the species of birds, as well as traces and signs (birds, feathers, pellets, etc.) of suitable birds.

- Point and line transect methods were used. Transect method was consisted of terrestrial fauna sampling points of motorway route along which visual and audial observations are conducted. In terms of the line transect method, two observers walked along 500 m in each sampling points of the motorway route and recorded observations. Point trancest method was applied as walked along the motorway route during 7 minutes and observer was waited for a minute for the birds to recover from being disturbed by the observer. Later, birds were recorded for a five minute period according to the birds seen or heard from the point count station.

- No hunting-gathering-killing was done during the identification of bird species in the area during field work. Observations made directly (using advanced optical instruments) have been utilized for species identification of birds.

- For the identification of birds in the identification of fauna elements, no trapping by using nets or other kind of trapping were used. Line methods have been applied in the identification of birds.

- Maps and satellite images have been used for field studies.

- A GPS was also used in mapping studies for determining elevations and geographical coordinates.

- During the fieldwork, some species were photographed and added to the report.

- Field survey forms for birds which used for recording during the field surveys are given in Annex-7/B.

Mammals (Mammalia)

A priority of determining the mammalian biodiversity was taken into consideration the habitat types. According to EUNIS level 3 habitat classifications, sampling locations were determined for mammal species identification. Sampling points for mammalian species were selected according to habitat types determined to represent each different habitat. It was consider to selected points are represented as natural areas. As a result of the desktop studies, 27 sampling points were selected within 400 legth buffer in study area.

A species lists for the study area, photos were base on scale, and relevant locations were provided after each observation. Any information gathered from the local people, hunters, and/or any literature study on fauna species within the area were also used for the preparation of the mammal species list. Also, field surveys forms (Annex-7/B) which were used during the field studies are supported to preparing the species list.

In order to identify the diversity of the mammals in the area various methods were used for different groups. These methods are given below.

- The location and area of extent for each colony identified during the survey has located with GPS and characteristics were recorded including number and type of holes, number of animals observed.

- Sherman live trap were applied for most terrestrial small mammals. Traps were located within each different habitat type in sufficient number.

- Phototrapping is the most efficient method for mammals especially large size mammal species. Phototraps (Bushnell trophycam) were untilized in forested habitats and forest opening. During the field studies, sufficient number of phototraps were placed in appropriate habitats.

- Presence of habitats suitable for fauna species, nests, nestlings and tracks of species, excrete and food wastes, horn and bone remains were checked for and evaluated.

- Direct and indirect observations, using advanced optical tools, were made for the identification of species.

Bat Activity Survey

At the beginning of the field study for bats cave structures (if available) or the other potential structures used by bats were determined within the study area.

The large area of woodland onsite means that it is not practical to assess every tree for roosting bats. During the initial site visits, it appears that the majorities of trees are relatively small and have few features that were not support roosting bats. However, during the survey visits, any older and larger trees, natural holes, walls and roofs of unused buildings, roofs of buildings in residential areas used with that are potentially used by bats were searched.

For the identification of bat species, study of the bat roosts and nurseries were the main method to be used. To provide an indication of the bat species active within the study area bat detector was used. Bats' sounds were recorded through bat detectors (Pettersson d500x) during these surveys after the sun goes down. The sounds were analyzed with Bat sound and/or BatExplorer programmes.

9.4.3. Aquatic Environment

The general objectives of these studies are the identification of aquatic species in the project area on biological resources and to develop appropriate mitigation where necessary.

Aquatic ecosystems are composed of the following organisms; phytoplanktonic organisms at the producer level (free or attached algae), zooplanktonic and benthic organism that feed on these, which are primary and secondary consumers, and tertiary consumer fish species, which depending on their food preference can feed on either zooplanktonic and benthic organisms or smaller fish.

In this context, the main links of the aquatic food chain are algae (attached or free forms, phytoplanktonic organisms), zooplanktonic organisms, benthic organisms, and fish. Changes in aquatic systems can cause changes on these organisms.

Within the scope of the aquatic studies carried out specific for the Project, fish species, which is expected to be affected by the Project activities, has taken into consideration. Fish samples, which constitute an important indicator of aquatic vertebrates, were sampled with a Samus 725 mp electro shocker where the current rate and water depth are low. At higher depths and where flow rate is higher a casting net was used. Sampled fish species were taken to the laboratory after fixated with 4% formaldehyde and 96% alcohol.

The fish species that exist in the planned Project area were identified during field studies between 8-10 February, 2017 by experts and in accordance with the literature review.

The goal of this study was evaluate aquatic ecosystems of the project area. In this context, following studies were carried out:

- Defining the existing fish species inhabiting the aquatic ecosystems in the study area.
- Determining the endemism status of species.

- Evaluating the existing species according to the Bern Convention and the Red List of International Union for Conservation of Nature (IUCN).
- Defining the status of globally threatened species and restricted-range species within the aquatic ecosystems both within the Project Area and the adjacent catchments.
- Defining and listing the target species within the aquatic ecosystems that might be affected from the construction and operation activities of the project.

Within the scope of the aquatic desktop studies, 19 sampling stations, river/stream/creek names and provinces are presented in Table 9.8, below (see Figure 9.2).

Table 9.8. River Crossings on the Project Area

Sections	River name (if avaliable)	District/Province	Basin
Section 4			
AQ4/01	Buyukgol Stream	Istanbul; Topcalirlar	Omerli Dam Basin
AQ4/02	-	Istanbul; Karaagil	Omerli Dam Basin
AQ4/03	-	Istanbul; Kadilli village	Omerli Dam Basin
AQ4/04	Cumakoy Stream	Kocaeli; Cumakoy	Omerli Dam Basin
AQ4/05	Kiremitli Stream	Kocaeli; Cumakoy mevkii	Omerli Dam Basin
AQ4/06	-	Kocaeli Denizli village	Marmara Basin
AQ4/07	-	Kocaeli; Demirciler	Marmara Basin
Section 5			
AQ5/01	-	Kocaeli; Sevindikli village	Sevindikli Lake Basin
AQ5/02	-	Kocaeli; Between Karayakuplu-Sipahiler	Sipahiler Pond Basin
AQ5/03	-	Kocaeli; Korucuk village	Sipahiler Pond Basin
Section 6			
AQ6/01	Bicki Stream	Kocaeli; Sepetci	Marmara Basin
AQ6/02	-	Kocaeli; Cayirkoy	Marmara Basin
AQ6/03	Gedikli Creek	Kocaeli; Bayraktar	Bayraktar Dam Basin
AQ6/04	-	Kocaeli; Karaabdulbaki village	Marmara Basin
AQ6/05	-	Sakarya; Adapazari; Akmese	Sakarya Basin
AQ6/06	-	Sakarya; Adapazari; Korucuk	Sakarya Basin
AQ6/07	Carksuyu	Sakarya; Adapazari	Sakarya Basin
AQ6/08	Sakarya River	Sakarya; Adapazari; Celebiler	Sakarya Basin
AQ6/09	Mudurnu Stream	Sakarya; Adapazari	Sakarya Basin

9.5. Findings for Ecology and Biodiversity

9.5.1. Section 4: KURTKOY-LIMAN (km 129+650- km 151+500)

Within the scope of the ecology and biodiversity studies of Section 4 there were 8 sampling points selected. Ecological features for Section 4 are described as follows according to field studies which based on 8 sampling points.

This part of the project area is under the influence of the Mediterranean and Osianic climates. The area has habitat types consisting of deciduous mixed forests, pseudomaquis, maquis, riparian, meadows and conifer plantations. At the same time, there are also agricultural areas in the region densely. Wheat farming is mainly carried out in agricultural areas.

9.5.1.1. Terrestrial Flora and Ecosystems

As a result of the field studies which conducted on March and June there are 145 species and sub-species belonging to 50 families along Section 4 (see Annex 7/A-Table 1.a). Two of these species are regional endemic as *Cirsium polycephalum* and *Crocus pestalozzae* which spread only Marmara region and *Campanula lyrata subsp. Lyrata* is widespread endemic species in Turkey.

In addition, the planned motorway to pass very close to east border of Ballikayalar Natural Park. Especially, sampling point 4_5 and 4_6 are located adjacent border of Ballikayalar Natural Park. This area is also the 1st Degree Natural Site and is protected by two ministries in the national sense. However these sampling points (4_5 and 4_6) are not included habitat types and important species which provide to Natural Park speciality for Ballikayalar natural Park. Also, intersection of the motorway and the Natural Park is quite limited area.

Vegetation

Eight different 3rd level EUNIS habitat types were identified in Section 4. Each of these habitat types has different types of vegetation. An important part of Section 4 lostits naturalness. Photographs of the habitat within the project area is shown in Annex 7/C, and maps of habitat types are given in Annex 7/D. Natural habitats are usually not continuous but intermittent. The types of habitat and vegetation found in this area are as follows:

E1.3: Mediterranean xerophilous meadow: This type of habitas subsist very little space in the Project area. The areas where has this type of habitats are decreased because of overgrazing and conversion of these areas into agricultural areas. This type of habitat is represented only in forests and maquis openings around Dilovasi. Characteristic species of this vegetation are *Poa bulbosa, Cynodon dactylon, Pallenis spinosa, Eryngium campestre, Globularia trichosantha, Galium incanum, Onobrychis armena* and *Asparagus acutifolius.* Critical species have not been identified in this habitat.

F5.3: Pseudomaquis: Pseudomaquis formation is generally quite healthy in the north of the Marmara region. Deciduous oak species spread within the evergreen bush communities which were healthy. The dominant specis of the habitat are *Arbutus unedo, Cistus creticus, Phillyrea latifolia, Erica manipuliflora, Erica arborea.* The deciduous *Quercus infectoria, Quercus frainetto* and *Quercus petraea* are found in the evergreen bush communities. The overall coverage of the bush layer of this habitat is 100% and their height change between 1-3 meters. *Salvia virgata, Piptatherum miliaceum, Psoralea bituminosa, Crocus biflorus subsp*. *biflorus* are spread in underbrush.

G1.2: Mixed riparian forests: This habitat type develops along strems which have high groundwater. The dominant tree species vary with respect to streams. *Ulmus minor*

dominates some streams and *Fraxinus angustifolia* dominates some streams. The characteristic tree species of this habitat type are *Ulmus minor, Fraxinus angustifolius* and *Salix alba. Rubus sanctus* and *Prunus spinosa* are found in the underbrush and herbaceous species that water demand is high are *Juncus inflexus, Carex pendula, Pulicaria dysenterica, Plantago lanceolata, Dipsacus laciniatus.*

G1.A: Meso and Eutrophic Mixed Decidiuous Forests: Mixed deciduous forests are the most typical representatives of the North Marmara forests. They are in the klimax phase as long as these forests do not have an anthropogenic effect. The deciduous tree species of this habitat are *Quercus frainetto, Quercus petraea, Quercus cerris*. *Arbutus unedo, Ruscus aculeatus, Phillyrea latifolia, Ligustrum vulgare, Jasminum fruticans* are found as bush species. *Dactylis glomerata, Oenanthe pimpinelloides, Ranunculus ficaria, Sanguisorba minor* are found as herbaceous species. The dominance of tree species varies from local to local.

G3.F: Highly artificial coniferous plantations: The conifer plantation in the Marmara region is quite common. *Pinus pinea* plantation areas were formed in this section. The natural flora composition of plantation site is suitable for pre-plant habitat. However, the natural flora elements were cut off and the tree species became scrubby as the plantation was made. Flora diversity is similar to deciduous forests.

I1.2: Agricultural areas: Agricultural areas are limited in this area where is very close to the settlements and so that settlements and industry is more in Sectio 4. Wheat farming is mainly carried out in agricultural areas. In some areas fruit gardens are also found. There are fruit trees such as quince, plum, hazelnut in the fruit gardens.

I1.5: Roadsides and field sides (ruderal lands): The habitat represents the old road sides and field sides on the route. Characteristic species of this habitat are predominantly nitrophiles. Common species of habitat are *Ailanthus altissima, Calamintha nepeta, Ainsworthia trachycarpa, Rosa canina, Eryngium campestre, Salvia virgata Sanguisorba minor*.

Threaten Status and Endemism of the Flora Species

As a result of the field studies there are three endemic species (*Cirsium polycephalum, Crocus pestalozzae, Campanula lyrata subsp. lyrata*).

Cirsium polycephalum spreads in Marmara region mainly Istanbul. The areas in which it grows are generally forest opening, frigana and steppe habitats. Such habitats in the region are decreasing day by day. Although the population is good nowadays, the loss of population is increasing continuously due to the excess of habitat losses so that this species is categorized as “CR: Critically Endangared” according to IUCN Red List.

Crocus pestalozzae spread in restricted areas in the Marmara and western Black Sea regions. This specis that preferred low-altitude under-forest and forest openings is evaluated as VU: Vulnarable” for IUCN.

Campanula lyrata subsp. lyrata which is widely spread in Tukey and has many habitat adaptation is categorized as " LC: Least Concern" according to IUCN Red List. Determined critical flora species locations are shown in Figure 9.4.

9.5.1.2. Terrestrial fauna

Amphibians and Reptiles

A total of 16 Amphibian (5 species belong to 2 ordo and 4 families) and Reptilian (11 species belong to 2 ordo and 6 families) species were observed in Section 4 as a result of habitat-based field studies in 8 locations. Systematic information on these species, international conservation status, habitat information of species and abundance ratios of individuals belonging to species are given in Annex 7/A-Table 2.a. One of the amphibian species identified as a result of habitat-based field studies along the project route was a tailed frog, and 4 were tailless frog species. Again, a total of 11 reptilian species identified as a result of habitat-based field studies along the project route were 2 turtles, 5 lizards and 4 snake species. Photographs of these species and their habitats are given in Annex 7/C.

When the amphibian species observed in the project route are evaluated in terms of IUCN conservation criteria, it is seen that only *Bufotes variabilis* is classified in the category of DD. *Bufotes variabilis* spreads almost all of Turkey and also spreads from Greece to east; Cyprus, Syria, Lebanon, Israel, Jordan and western Arabia, as well as Iraq, Iran, Caucasus and Russia throughout Kazakhstan. The other 4 species are in LC (least concern) category. According to Bern criteria, *Pelophylax ridibundus* is in the list of Annex-3 and the other 4 species are in the list of Annex-2. None of the amphibian species identified in Section 4, is found in Cites lists. These tailed and tailless frog species were observed in Eunis coded habitat types of G1.2; I1.2; I1.5; E1.3; F5.2; G1.A; G3.F and F5.3 during field studies. Among these species, *Pelophylax ridibundus* was abundant, *Bufotes variabilis* was moderately abundant, *Triturus karelini, Hyla orientalis* and *Bufo bufo* species were rarely observed. *Hyla orientalis* is distributed in all regions except Southeast and Eastern Anatolia Regions in Turkey. *Bufo bufo* has a wide distribution area especially in the Black Sea, Marmara, Aegean and Mediterranean coasts in our country. *Triturus karelini* is distributed in Turkey, on the shores of the Black Sea Region, in the Thrace and Marmara Regions and in the Aegean Region up to Denizli. Outside of Turkey, it is distributed in Northern Iran, in the Caucasus and in the Balkans to Greece and Albanian. None of the frog species detected in Section 4 are endemic to our country, but are widely spread species.

According to IUCN criteria, *Emys orbicularis* is included in NT and *Testeco graeca* is included in VU category. The water-borne tortoise species, *Emys orbicularis*, has spread in Central and Southern Europe, North Africa and Western Asia. It spread to a large part of Thrace and Anatolia in Turkey. During field studies on this species, which is completely water dependent, it has rarely been observed in Eunis coded habitat types of G1.2 and G1.A. *Emys orbicularis* is evaluated as Near Threatened (NT) according to IUCN criteria. It is also listed in Annex-2 according to BERN criteria. *Testudo graeca* is a wide-spread turtle species which spreads in large regions of Thracia and Anatolia. It spreads in Turkey, Southern Europe, North Africa and Southwest Asia. It is completely dependent on the land and it was observed abundantly in Eunis coded habitat types of I1.2; I1.5; F5.2; F5.3; G1.A; G1.2 and G3.F during the field studies. This species is listed on the Annex-2 according to Bern Convention. This tortoise species is listed in the same time in CITES Appendix 2. Other reptile species identified in Section IV are the least risky species listed in LC category. According to the Bern criteria, *Anguis fragilis* and *Natrix natrix* are listed in Annex 3, the other 9 reptilian species are listed in Annex 2. These reptilian species were observed in Eunis coded habitat types of I1.2; I1.5; F5.2; F5.3; E1.3; G1.A; G1.2 and G3.F during the field studies. Among these species, *Lacerta viridis* was abundant, *Testudo graeca, Lacerta trilineata, Anguis fragilis, Natrix natrix, Natrix tessellata* had a moderate density, *Emys orbicularis, Pseudopus apodus, Ablepharus kitaibelii, Platyceps collaris* and *Dolichophis*

caspius species were rarely observed. None of the reptilian species identified in Section IV are endemic to our country, but are widely distributed species. Important sampling points and habitats for amphibian-reptile species are shown in Figure 9.4.

Birds

This part of the Project area is under the influence of the Mediterranean and Osianic climates and the area has habitat types mixed forest, maquis, pseudo- maquis riparian, meadow and conifer plantations. At the same time, there are also dense agricultural areas in the region.

As a result of the studies carried out during the period of March and June 2017, a total of 43 bird species belonging to 12 ordo, 26 families were detected from the area (Annex 7/A-Table 3.a). These bird species are widely spread bird species of Thrace and Anatolia and are not endemic. 14 bird species belong to the non-Passerine group and 29 of them belong to the Passerine group.

The national and international danger classes of birds identified in the project area are given in Annex 7/A- Table 3.a. According to the IUCN Red List, the bird species those have been identified in the project area are in the category "LC: Least Concern" and no bird species classified as dangerous and/or threatened (CR-EN-VU).

27 of the bird species are listed as strictly protected fauna species in Annex 2 of the European Wild & Nature Habitats Agreement (Bern Convention). In addition, 12 species, together with a few exceptions, "protected fauna species" covering most of the species not included in Annex 2, are listed in Annex 3 of the Bern Convention. The remaining 4 species are not included in any conservation class of the Bern Convention (Annex 7/A- Table 3.a. From this point of view, 39 of 43 bird species detected in the field are protected species according to the criteria of the Bern Convention. But according to the Bern Convention, 90% of the Turkish ornithofauna seem to be species that need protection. This is why the Berne Convention aims to protect the species of birds precisely against the risk of a fall in the populations of European bird species. However, depending on its rich ecosystem, its location on migration routes, its diverse climatic characteristics and various habitat types for bird species, and the vast majority of the diversity and density of the Western Paleartic bird population, Turkey is not at a high risk as it is in the European ornithological system.

The national red list categories of birds identified in the field are shown in Annex 7/A-Table 3.a (Kiziroğlu, 2008-2009). Accordingly, 32 bird species on the project sites are located in the national scale, in danger categories (A.1.2-A.2-A.3). However, in 2008-2009, Kiziroğlu evaluated 300 of about 500 bird species in the fauna of Turkey in different categories of danger. In this case, the protection approach was based on the whole of Europe. However, these bird species are widely spread bird species in many parts of Turkey, including the Thrace region where the project site is located.

The population density of bird species has been recorded as very low and has been found to be between 1 and 10 in most populations except for crows, stallions and mussels. There are no bird species and/or habitats in flocks and/or colonies on the project sites.

Photographs of the bird species within the project area is shown in Annex 7/C. Important sampling points and habitats for bird species are shown in Figure 9.4.

Mammals

This part of the project area is under the influence of the Mediterranean and Osianic climates, and the area has habitat types mixed forest, maquis, pseudo- maquis riparian, meadow and conifer plantations. At the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

As a result of the studies carried out during the period of February-2017 on the Pendik-Kurna and Dilovası-Köseler route, a total of 22 mammal species belonging to 7 ordo, 15 families were detected from the area (Annex 7/A-Table 4). These mammal species are widely spread bird species of Thrace and Anatolia and are not endemic.

Of the 22 mammal species, 8 belong to medium and large-sized mammals and 14 belong to small mammals.

IUCN: The national and international danger classes of mammals identified in the project area are given in (Annex 7/A-Table 4). According to the IUCN Red List, the mammal species those have been identified in the project area are in the category "LC: Least Concern" and no mammal species classified as dangerous and/or threatened (CR-EN-VU).

BERN: 6 of the mammal species are listed as strictly protected fauna species in Annex 2 of the European Wild & Nature Habitats Agreement (Bern Convention). In addition, 6 species, together with a few exceptions, "protected fauna species" covering most of the species not included in Annex 2, are listed in Annex 3 of the Bern Convention. The remaining 10 species are not included in any conservation class of the Bern Convention (Annex 7/A-Table 4). Photographs of the habitat within the project area are shown in Annex 7/C. Important sampling points and habitats for mammal species are shown in Figure 9.4.

9.5.1.3. Aquatic environment

Streams / rivers located within the boundaries of Istanbul and Kocaeli Provinces are flow within Omerli Dam Lake Basin and Tuzla Basin. Rivers /Streams /creeks existing in the project area are given in Annex 7/A- Table 5.a and the photographs are in Annex 7/C. AQ4/01; AQ4/02, AQ4/03 are located in Tuzla Basin in İstanbul, AQ4/04, AQ4/05, AQ4/06, AQ4/07 are located in Omerli Basin Lake Basin in Kocaeli. 5 species (*Carassius gibelio, Gobio sp., Petroleuciscus borysthenicus, Rhodeus amarus, Squalius aritotelis*) belonging to the Cyprinidae family were found at the sampling points.

AQ4/01: AQ4/01 is known as Buyukgol Stream. The sampling point AQ1 / 01 is located in Topcayirlar site. The width of the stream is about 7 m., the depth is about 40-70 cm. The bottom of the stream is composed of graveled -clay, coastal vegetation is consist of annual and perennial herbaceous plant. Inside vegetation of the stream is intense and *Gobio sp*. and *Petroleuciscus borysthenicus* from Cyprinidae family are determined within the AQ4/01 point (Annex 7/A- Table 5.a).

AQ4/02: The sampling point AQ4/ 02 is located in Akfirat sites. The width of the stream is about 5 m., the depth is about 30-60 cm. The bottom of the stream is composed of mainly stone and coastal areas have sandy structure. Coastal vegetation consists of annual and perennial herbaceous plant. The flow rate is moderate. As result of the field studies *Gobio sp.* and *Squalius aristotelis* from Cyprinidae family were identified.

AQ4/03: The sampling point AQ4/ 03 is located Kadilli village. The width of the stream is about 2 m., the depth is about 30-40 cm. There are some pond areas within the stream. The bottom of the stream is composed of stony- gravelled and coastal areas have sandy structure. Coastal vegetation consists of annual and perennial herbaceous plant. The flow rate is low. As result of the field studies *Gobio sp.* and *Squalius aristotelis* from Cyprinidae family were identified.

AQ4/04: The sampling point AQ4/ 04 is located Cumakoy village in Kocaeli. The stream is one of the rivers feeding the Omerli Dam Lake. The stream which named as Cambaz and Degirmendere derive from Denizli Pond. The width of the stream is about 5 m., the depth is about 30-50 cm. The bottom of the stream is composed of stony- gravelled and coastal areas have sandy structure. Coastal vegetation consists of annual and perennial herbaceous plant. Inside vegetation of the stream is intense and the flow rate is low. As result of the field studies *Gobio sp., Petroleuciscus borysthenicus, Rhodeus amarus* and *Squalius aristotelis* from Cyprinidae family were identified.

AQ4/05: The sampling point AQ4/05 is located upside of Cumakoy village in Kocaeli. The stream is one of the rivers feeding the Omerli Dam Lake. The stream which named as Kiremitli derive from Denizli Pond. The width of the stream is about 3 m., the depth is about 20-60 cm. The bottom of the stream is composed of stony- gravelled and coastal areas have clay structure. Coastal vegetation consists of annual and perennial herbaceous plant and trees. Inside vegetation of the stream is moderate and the flow rate is low. As result of the field studies *Carassius gibelio*, *Gobio sp., Petroleuciscus borysthenicus, Rhodeus amarus* and *Squalius aristotelis* from Cyprinidae family were identified.

AQ4/06: The sampling point AQ4/ 06 is located Dilovasisite in Kocaeli Province. The width of the stream is about 3 m., the depth is about 20-60 cm. The bottom of the stream is composed of stony- gravelled and coastal areas have clay structure. Coastal vegetation consists of annual and perennial herbaceous plant and trees. Inside vegetation of the stream is intense and the flow rate is low. As result of the field studies *Gobio sp* from Cyprinidae family was identified.

AQ4/07: The sampling point AQ4/ 07 is located Dilovasisite in Kocaeli Province. The width of the stream is about 3 m., the depth is about 20-50 cm. The bottom of the stream is composed of stony- gravelled and coastal areas have sandy structure. Coastal vegetation consists of annual and perennial herbaceous plant and trees. Inside vegetation of the stream is intense and the flow rate is low. Sampling was conducted from the upper region due to constructions of the motorway. As result of the field studies *Gobio sp* and *Poetroleuciscus borysthenicus* from Cyprinidae family were identified.

9.5.2. Section 5: LIMAN-IZMIT (km 151+000- km 188+300)

Within the scope of the ecology and biodiversity studies of Section 5 there were 12 sampling points, one stone squarry area, one camp site were studied. Ecological features for Section 5 are described as follows according to field studies which based on 12 sampling points, one stone squarry area and one camp site.

This part of the Project area has deciduous mixed forest, riparian, lake and lake sides, wet meadows and conifer plantations due to the influence of Oseyanic climate partly. At the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

9.5.2.1. Terrestrial Flora and Ecosystems

As a result of the field studies totally 154 species and subspecies belonging to 57 families were identified (see Aneex 7/A Table 1.b). Among these species, four of them are regional endemic species (*Galanthus plicatus subsp. byzantinus, Ornithogalum pascheanum, Hypericum aviculariifolium subsp. byzantinum* and *Crocus pestalozzae*). They spread only Marmara region. Photographs of the flora species within the project area is shown in Annex 7/C.

Vegetation

Six different 3rd level EUNIS habitat types were identified in Section 5. Photographs of the habitat types within the project area are shown in Annex 7/C and maps of habitat types are given in Annex 7/D. Each of these habitat types has different types of vegetation. Section 5 (especially between Koseler- Sepetci neighbourhoods) is the most natural part of the North Marmara Motorway Project area. The natural habitats are usually not continuous but intermittent. The types of habitat and vegetation found in this area are as follows:

C1.2: Permanent mesotrophic lakes, ponds and pools: There are some ponds on the Section 5. Evolution of vegetation is weak in both lakes and pons due to the lakes and ponds are not too old. *Juncus effusus* and *Poa trivialis* spread on the shores of the lake.

E3.4: Moist or wet eutrophic and mesotrophic grassland: This types of habitat occupy very little space. This habitat is usually found in pond shores and in moist valley bases. These habitats which are wet in winter and spring months, get dry in the summer. Flora is not rich due to overgrazing. However, vegetation overlap is high. Characteristic species of the habitat are *Cynodon dactylon, Alopecurus arundinaceus, Cichorium intybus, Bellis perennis.* There not any critical species with in this habitat type.

G1.2: Mixed riparian forests: This habitat type develops along strems which have high groundwater. Dominant tree species are changes to stream type. Some stream coasts have *Fraxinus angustifolia,* some of streams have *Ulmus minor.* Characteristic tree species of these habitats are *Ulmus minor, Fraxinus angustifolius* and *Salix alba. Rubus sanctus* and *Prunus spinosa are found* as bush species and *Juncus inflexus, Carex pendula, Pulicaria dysenterica, Plantago lanceolata, Dipsacus laciniatus* are found as *herbaceous plant* which have high water demand.

G1.A: Meso and Eutrophic Mixed Decidiuous Forests: Mixed deciduous forests are the most typical representatives of the North Marmara forests. They are in the klimax phase as long as these forests do not have an anthropogenic effect. The deciduous tree species of this habitat are *Quercus frainetto, Carpinus betulus, Fagus orientalis, Quercus petraea, Quercus cerri. Arbutus unedo, Erica arborea, Ruscus aculeatus, Phillyrea latifolia, Ligustrum vulgare, Jasminum fruticans* are widespread as bush species. *Dactylis glomerata, Viola sieheana, Primula vulgaris, Trachystemon orientale, Helleborus orientalis, Oenanthe pimpinelloides, Ranunculus ficaria, Sanguisorba minor* are found as herbaceous species. Locations of dominant tree species are changes as region types. Sometimes *Fagus orientalis* is dominant and sometimes *Quercus* species are dominant. The mixed forests are extremely rich in organic matter.

G3.F: Highly artificial coniferous plantations: The conifer plantation in the Marmara region is quite common. *Pinus pinaster* and *Pinus pinea* plantation areas were formed in this section. The natural flora composition of plantation site is suitable for pre-plant

habitat. However, the natural flora elements were cut off and the tree species became scrubby as the plantation was made. Flora diversity is similar to deciduous forests.

I1.2: Agricultural areas: Agricultural areas are limited in this area. Because this is the most natural part of the Project area. Agricultural areas are often found in areas close to settlements and forest openings. Wheat farming is mainly carried out in agricultural areas. In some areas fruit gardens are also found. There are fruit trees such as quince, plum, hazelnut in the fruit gardens.

Threaten Status and Endemism of the Flora species

As a result of the field studies there are four regional endemic species (*Galanthus plicatus subsp. byzantinus, Ornithogalum pascheanum, Hypericum aviculariifolium subsp. byzantinum, Crocus pestalozzae*) which spread only Marmara region and west of Black Sea region. *Ornithogalum pascheanum* is categorized as "EN: Endangered" according to IUCN Red List.

Galanthus plicatus subsp. byzantinus, Hypericum aviculariifolium subsp. byzantinum and *Crocus pestalozzae* are evaluated as "VU: Vulnerable" for IUCN. These species which are regional endemic, are predominantly distributed under the deciduous forest habitat and floodplain forestland. For this reason, the habitats to which these endemic species spread are also critical habitats. Determined critical flora species locations are shown in Figure 9.4.

9.5.2.2. Terrestrial Fauna

Amphibians and Reptiles

A total of 23 Amphibian (6 species belong to 2 ordo and 4 families) and Reptilian (17 species belong to 2 ordo and 7 families) species were observed in Section V as a result of habitat-based field studies in 14 locations. Systematic information on these species, international conservation status, and habitat information of species and abundance ratios of individuals belonging to species are given in Annex 7/A-Table 2.b. All of the amphibian species identified as a result of habitat-based field studies along the project route were tailless frog species. Again, a total of 17 reptilian species identified as a result of habitat-based field studies along the project route were 3 turtles, 7 lizards and 7 snake species. Photographs of these species and their habitats are given in Annex 7/C.

When the amphibian species observed in the project route are evaluated in terms of IUCN conservation criteria, it is seen that only *Bufotes variabilis* is classified in the category of DD. *Bufotes variabilis* has a wide distribution area on national and global scale. The other 5 species are in LC (least concern) category. According to Bern criteria, *Pelophylax ridibundus*is is in the list of Annex-3 and the other 5 species are in the list of Annex-2. None of the amphibian species identified in Section V, is found in Cites lists. These tailless frog species were observed in Eunis coded habitat types of G1.A; G3.F; E3.4; I1.2; G1.2 and C1.2 during field studies. Among these species, *Pelophylax ridibundus* was abundant, *Bufotes variabilis* and *Rana dalmatina* were moderately abundant*, Hyla orientalis*, *Bufo bufo* and *Pelobates syriacus* were rarely observed. *Hyla orientalis* is distributed in all regions except Southeast and Eastern Anatolia Regions in Turkey. *Bufo bufo* has a wide distribution area especially in the Black Sea, Marmara, Aegean and Mediterranean coasts in our country. *Pelobates syriacus* is distributed in Turkey in large parts of Thrace and Anatolia. Outside of

Turkey, it spreads in Syria, Israel and Transcaucasia. None of the frog species detected in Section 5 are endemic to our country, but are widely spread species.

According to IUCN criteria, *Emys orbicularis* is included in NT and *Testeco graeca* is included in VU category. The water-borne tortoise species, *Emys orbicularis*, has spread in Central and Southern Europe, North Africa and Western Asia. It spread to a large part of Thrace and Anatolia in Turkey. During field studies on this species, which is completely water dependent, it has rarely been observed in Eunis coded habitat type of C1.2. *Emys orbicularis* is evaluated as Near Threatened (NT) according to IUCN criteria. It is also listed in Annex-2 according to BERN criteria. *Testudo graeca* is evaluated as VU according to IUCN criteria. *Testudo graeca* is a wide-spread turtle species which spreads in large regions of Thracia and Anatolia. It is completely dependent on the land and it was observed abundantly in Eunis coded habitat types of G1.A; G3.F; I1.2 and G1.2 during the field studies. This species is listed on the Annex-2 according to Bern Convention. This tortoise species is listed in the same time in CITES Appendix 2. Other reptile species identified in Section V are the least risky species listed in LC category. According to the Bern criteria, *Anguis fragilis* and *Natrix natrix* are listed in Annex 3, the other 9 reptilian species are listed in Annex 2. These reptilian species were observed in Eunis coded habitat G3.F; E3.4; G1.2; C1.2; G1.A and I1.2 during the field studies. Among these species, *Lacerta viridis* was abundant, *Testudo graeca, Lacerta trilineata, Natrix natrix, Natrix tessellata, Dolichophis caspius* had a moderate density, *Emys orbicularis*, *Mauremys rivulata, Podarcis tauricus, Podarcis muralis, Anguis fragilis, Pseudopus apodus, Ablepharus kitaibelii, Elaphe sauromates, Coronella austriaca, Zamenis longissimus* and *Platyceps najadum* species were rarely observed.

Emys orbicularis is distributed in most parts of Thrace and Anatolia in Turkey, *Mauremys rivulata* is found in Middle and Western Black Sea, Thrace, Aegean and Mediterranean regions. *Podarcis tauricus*, a lizard species found in the area belonging to the family Lacertidae, has spread in the eastern and southern parts of the Sea of Marmara and Trakya Region in Turkey. Outside of Turkey, it is distributed in some of the islands in Aegean Sea, in Crimea and Balkans. *Podarcis muralis*, another species belonging to the same genus, is spreading to the west of Turkey to start from Central Black Sea Region and Ankara. This species is located in the southern and central regions of Europe except Turkey. *Pseudopus apodus*, one of the legless lizards belonging to the Anguidae family found in the area, is distributed in Eastern, North and Western Anatolian regions and Thrace in Turkey. Outside of Turkey, it spreads from Iraq, Iran, Balkans, Crimea, Caucasus to Turkmenistan. *Anguis fragilis*, the other legless lizard species, spreads in the North and Northwest Anatolia region of Turkey. Outside of Turkey, it is spreading in most of Western Asia and Europe. *Ablepharus kitaibelii* spreads in Thrace, West, South and Central Anatolia regions in Turkey. Outside of Turkey, it is distributed in Aegean Sea Islands, Balkans and Southwest Asia. *Elaphe sauromates*, one of the rarely detected snake species in the field, has spread all over Turkey, which is a convenient living environment. Outside of Turkey, it is distributed in Southeast Europe and West Asia. *Zamenis longissimus*, rarely observed in the project, is spreading along with all Black Sea coast along with Thrace. It spreads in central and southern Europe and western Asia outside Turkey. *Coronella austriaca*, one of the rarely detected snake species in the field, also spreads in the northern, western and central Anatolian Regions in our country. Outside of Turkey, it spreads in Caucasus, Balkans, Italy, Spain, Sweden and Norway. The last snake species rarely seen in the field is *Platyceps najadum*. With such a widespread distribution in Turkey, it spreads in the southern part of the Balkan peninsula, Syria, Iraq, Iran, Armenia, Azerbaijan, and Georgia. Most of the reptile species rarely observed in Section 5 (*Emys orbicularis* - NT) are evaluated in LC (Low Risk) status according to IUCN criteria. None of the reptilian species identified in Section 5 are endemic to our country, but are widely distributed species. Important sampling points and habitats for amphibian-reptile species are shown in Figure 9.4.

Birds

For this part of the project area to develop under the influence of the Oseyanic climate partly, it has habitat types of leafy mixed forest, riparian, in-lake and coastal-lake, wet meadows and conifer plantations. At the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

As a result of the studies carried out during the period of February-March and June 2017, a total of 38 bird species belonging to 12 ordo, 21 families were detected from the area (Annex 7/A-Table 3.b). These bird species are widely spread bird species of Marmara Region and Anatolia and are not endemic.13 of 38 bird species belong to the non-Passerine group and 25 of them belong to the Passerine group.

The national and international danger classes of birds identified in the project area are given in Annex 7/A-Table 3.b. According to the IUCN Red List, the bird species those have been identified in the project area are in the category "LC: Least Concern" and no bird species classified as dangerous and/or threatened (CR-EN-VU).

28 of the bird species are listed as strictly protected fauna species in Annex 2 of the European Wild & Nature Habitats Agreement (Bern Convention). In addition, 6 species, together with a few exceptions, "protected fauna species" covering most of the species not included in Annex 2, are listed in Annex 3 of the Bern Convention. The remaining 4 species are not included in any conservation class of the Bern Convention (Annex 7/A-Table 3.b). From this point of view, 34 of 38 bird species detected in the field are protected species according to the criteria of the Bern Convention. But according to the Bern Convention, 90% of the Turkish ornithofauna seem to be species that need protection. This is why the Berne Convention aims to protect the species of birds precisely against the risk of a fall in the populations of European bird species. However, depending on its rich ecosystem, its location on migration routes, its diverse climatic characteristics and various habitat types for bird species, and the vast majority of the diversity and density of the Western Paleartic bird population, Turkey is not at a high risk as it is in the European ornithological system.

The national red list categories of birds identified in the field are shown in Annex 7/A-Table 3.b (Kiziroğlu, 2008-2009). Accordingly, 26 bird species on the project sites are located in the national scale, in danger categories (A.1.2-A.2-A.3). However, in 2008-2009, Kiziroğlu evaluated 300 of about 500 bird species in the fauna of Turkey in different categories of danger. In this case, the protection approach was based on the whole of Europe. However, these bird species are widely spread bird species in many parts of Turkey, including the Thrace region where the project site is located.

The population density of bird species has been recorded as very low and has been found to be between 1 and 10 in most populations except for crows, stallions and mussels. There are no bird species and/or habitats in flocks and/or colonies on the project sites. Photographs of the bird species within the project area is shown in Annex 7/C. Important sampling points and habitats for bird species are shown in Figure 9.4.

Mammals

This part of the project area is under the influence of the Mediterranean and Osianic climates, and the area has habitat types mixed forest, maquis, pseudo- maquis riparian, meadow and conifer plantations. At the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

As a result of the studies carried out during the period of February-2017 on the Dilovası-Köseler ve Kocaeli-Sepetçi route, a total of 27 mammal species belonging to 7 ordo, 15 families were detected from the area (Annex 7/A-Table 4). These mammal species are widely spread bird species of Thrace and Anatolia and are not endemic.

Of the 27 mammal species, 9 belong to medium and large-sized mammals and 18 belong to small mammals.

The national and international danger classes of mammals identified in the project area are given in (Annex 7/A-Table 4). According to the IUCN Red List, the mammal species those have been identified in the project area are in the category "LC: Least Concern" and no mammal species classified as dangerous and/or threatened (CR-EN-VU).

7 of the mammal species are listed as strictly protected fauna species in Annex 2 of the European Wild & Nature Habitats Agreement (Bern Convention). In addition, 6 species, together with a few exceptions, "protected fauna species" covering most of the species not included in Annex 2, are listed in Annex 3 of the Bern Convention. The remaining 14 species are not included in any conservation class of the Bern Convention (Annex 7/A-Table 4). Photographs of the mammal species within the project area is shown in Annex 7/C. Important sampling points and habitats for mammal species are shown in Figure 9.4.

9.5.2.3. Aquatic Environmet

The strams which is within the boundaries Section 5 is located in Cayirköy, Dereköy neighborhoods and Sipahiler Lake. Streams existing in the project area are given in Annex 7/C. However AQ5/01 was not accessible due to the slippery and gutter roads and this sampling point was not invastigated. As a result of the field study, two species belonging to family Cyprinidae (*Carassius gibelio, Squalius sp)* were identified (Annex 7/A-Table 5.b).

AQ5/02: AQ5/02 is located in outlet water of Sipahiler Pond which between Karayakuplu and Sipahiler neighborhoods. The width of the stream is about 1,5 m., the depth is 20-50 cm. The bottom of the stream is composed of gravelled-clay, coastal vegetation consists of annual and perennial herbaceous plant species. As a result of the *Carassius gibelio* from Cyprinidae family species have been identified.

AQ5/03: AQ5 / 03 is located in Derekoy sides. The width of the stream is about 1 m., the depth is 30-40 cm. The bottom of the stream is rocky-stony and there are sandy areas in the coastals. Coastal vegetation consists of annual and perennial herbaceous plants. The dlow rate is low. As a result of the study *Crassius gibelio* and *Squalius aistotelis* from Cyprinidae family were identified.

9.5.3. Section 6: IZMIT-AKYAZI (km 188+184- km 251+111)

Within the scope of the ecology and biodiversity studies of Section 6, 7 sampling points, 7 storage area, stone quarry and camp site were investigated. Ecological features for Section 6 are described as follows according to field studies which based on 7 sampling points 7 storage area, stone quarry and camp site.

This part of the project area has deciduous mixed forest, pseudomaquis, lake, riparian, wet meadows, broad-leaved acidic marsh forests and broad-leaved deciduous plantations due to the influence of Oseyanic climate partly. At the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

Around the point 6_7 has a natural floodplain forestland habitat structure. Such habitats are critical and protected because they have very limited areas around the world. It has vital importance that planning of a motorway access road that will not harm this habitat, which harbor the rather old *Fraxinus angustifolia* forests and this area is very important habitat for fauna species.

9.5.3.1. Terrestrial Flora and Ecosystems

As a result of the field studies whch conducted in March and June in Section 6, totally 141 species and sub species belonging to 54 families were identified (Annex 7/A-Table 1.c). Among these species 2 of them is an endemic species (*Ornithogalum pascheanum, Campanula lyrata subsp. lyrata*). *Ornithogalum pascheanum* which spread only Marmara region is regional endemic and *Campanula lyrata subsp. lyrata* which spread to almost every region except the Black Sea region in Turkey is widespread endemic species. Photographs of the flora species within the project area is shown in Annex 7/C.

Vegetation

Ten different 3rd level EUNIS habitat types were identified in Section 6. Photographs of the habitat types within the project area are shown in Annex 7/C and maps of habitat types are given in Annex 7/D. Each of these habitat types has different types of vegetation. Section 6 forms the easternmost section of the Motorway. This section is mainly composed of agricultural areas. Therefore, forests generally have intermittent spread. The types of habitat and vegetation found in this area are as follows:

C1.2: Permanent mesotrophic lakes, ponds and pools: There are some ponds on the Section 6. Evolution of vegetation is weak in both lakes and pons due to the lakes and ponds are not too old. *Phragmites australis, Thypha angustifolia, Carex pendula, Juncus effusus* spread on the shores of the lake.

E3.4: Moist or wet eutrophic and mesotrophic grassland: This types of habitat occupy very little space. This habitat is usually found in forest openings and in moist valley bases. These habitats which are wet in winter and spring months, get dry in the summer. Flora is not rich due to overgrazing. However, vegetation overlap is high. Characteristic species of the habitat are *Cynodon dactylon, Dipsacus laciniatus, Cichorium intybus, Sanguisorba minor, Tussilago farfara, Bellis perennis.* There not any critical species with in this habitat type.

F5.3: Pseudomaquis: Pseudomaquis formation is generally quite healthy in the north of the Marmara region. Deciduous oak species spread within the evergreen bush communities which were healthy. The dominant specis of the habitat are *Arbutus unedo, Cistus creticus, Phillyrea latifolia, Erica manipuliflora, Erica arborea.* The deciduous *Quercus infectoria, Quercus frainetto* and *Quercus petraea* are found in the evergreen bush communities. The overall coverage of the bush layer of this habitat is 100% and their height change between 1-3 meters. *Salvia virgata, Piptatherum miliaceum, Psoralea bituminosa, Crocus biflorus subsp*. *biflorus* are spread in underbrush.

G1.2: Mixed riparian forests: This habitat type develops along strems which have high groundwater. Dominant tree species are changes to stream type. Some stream coasts have *Fraxinus angustifolia,* some of streams have *Ulmus minor.* Characteristic tree species of these habitats are *Ulmus minor, Fraxinus angustifolius* and *Salix alba. Rubus sanctus* and *Prunus spinosa* are found as bush species and *Juncus inflexus, Carex pendula, Pulicaria dysenterica, Plantago lanceolata, Dipsacus laciniatus* are found as herbaceous plant which have high water demand*.*

G1.A: Meso and Eutrophic Mixed Decidiuous Forests: Mixed deciduous forests are the most typical representatives of the North Marmara forests. They are in the klimax phase as long as these forests do not have an anthropogenic effect. The deciduous tree species of this habitat are *Quercus frainetto, Carpinus betulus, Fagus orientalis, Quercus petraea, Quercus cerri. Arbutus unedo, Erica arborea, Ruscus aculeatus, Phillyrea latifolia, Ligustrum vulgare, Jasminum fruticans* are widespread as bush species. *Dactylis glomerata, Viola sieheana, Primula vulgaris, Trachystemon orientale, Helleborus orientalis, Oenanthe pimpinelloides, Ranunculus ficaria, Sanguisorba minor* are found as herbaceous species. Locations of dominant tree species are changes as region types. Sometimes *Fagus orientalis* is dominant and sometimes *Quercus* species are dominant. The deciduous mixed forests are extremely rich in organic matter.

G1.C: Highly artificial broadleaved deciduous forestry plantations: Monoculture plantation of high groundwater habitat tree is *Fraxinus angustifolia subsp. oxycarpa* which also distributed naturally in the region. Tree hoths are covered with *Hedera helix*. *Cornus sanguinea, Prunus divaricate, Frangula alnus* are found under these trees which are 50-60 years old and 15-20 meters in height. Also *Arum italicum* and *Carex pendula* are found there. This habitat is largely similar to natural floodplain forestland.

G1.5: Broadleaved swamp woodland on acid peat: Floodplain forestland that has high groundwater habitat tree is *Fraxinus angustifolia subsp. oxycarpa* which also distributed naturally in the region. Tree hoths are covered with *Hedera helix.* These forests which are estimated to be 50-100 years old, have suffered considerable damage due to the sensitivity of their habitat. *Prunus divaricata, Rubus sanctus* are found under these trees and *Arum italicum, Scilla bithynica, Primula vulgaris, Ranunculus constantinopolitanus* spred as herbaceous plant. These habitats are very fragile both in turkey and in the temperate zone.

I1.2: Agricultural areas: Agricultural areas are coverd large areas in Section 6. Wheat farming is mainly carried out in agricultural areas. In some areas fruit gardens are also found. There are fruit trees such as quince, plum, hazelnut in the fruit gardens.

I1.5: Roadsides and field sides (ruderal lands): *Salix alba* and *Pyrus amygdaliformis var. Amygdaliformis* are found as tree species and *Rubus sanctus, Prunus divarica* spread as bush species within this habitat that lost its naturalness. The species that are distributed in the field are cosmopolitan species.

J2.3: Rural industrial and commercial sites still in active use: Some areas where the road route passes include industrial areas at low and medium scales. This habitat type has completely lost its naturalness.

Threaten Status and Endemism of the Flora species

As a result of the field studies there is two endemic species (*Ornithogalum pascheanum, Campanula lyrata subsp. lyrata*) were identified. *Ornithogalum pascheanum* which is regional endemic species spread under deciduous forests and floodplain forestlands. *Ornithogalum pascheanum* is evalueded as "EN: Endangered" according to IUCN Red List. *Campanula lyrata subsp. Lyrata* which is widespread endemic spreads to almost every region except the Black Sea region in Turkey. It is categorized as "LC: Least Concern" by IUCN. Determined critical flora species locations are shown in Figure 9.4.

9.5.3.2. Terrestrial Fauna

Amphibians and Reptiles

A total of 25 Amphibian (7 species belong to 2 ordo and 5 families) and Reptilian (18 species belong to 2 ordo and 7 families) species were observed in Section 6 as a result of habitat-based field studies. Systematic information on these species, international conservation status, habitat information of species and abundance ratios of individuals belonging to species are given in Annex 7/A Table 2.c. One of the amphibian species identified as a result of habitat-based field studies along the project route was a tailed frog, and 6 were tailless frog species. Again, a total of 18 reptilian species identified as a result of habitat-based field studies along the project route were 3 turtles, 9 lizards and 6 snake species. Photographs of these species and their habitats are given in Annex 7/C.

When the amphibian species observed in the project route are evaluated in terms of IUCN conservation criteria, it is seen that only *Bufotes variabilis* is classified in the category of DD. *Bufotes variabilis* has a wide distribution area on national and global scale. The other 6 species are in LC (least concern) category. According to Bern criteria, *Pelophylax ridibundus*is is in the list of Annex-3 and the other 6 species are in the list of Annex-2. None of the amphibian species identified in Section 6, is found in Cites lists. These tailless frog species were observed in Eunis coded habitat types of G1.A; E3.4; G1.2; C1.2; I1.2; J2.3; G1.C; G1.5; F5.3 during field studies. Among these species, *Pelophylax ridibundus*, *Rana dalmatina, Bufo bufo* and *Bufotes variabilis* were moderately abundant*, Bombina bombina, Hyla orientalis* and *Triturus karelinii* were rarely observed. Although *Bombina bombina* has a narrow distribution in Turkey only near Trakya and Adapazarı, it spreads in most of Europe continent except Turkey. *Triturus karelinii* spreads widely on the shores of the Black Sea Region in Turkey, in Thrace and Marmara regions and in Aegean Region to the vicinity of Denizli. Outside of Turkey, it is distributed in northern Iran, along with Caucasus, in Balkans up to Greece and Albanian. *Hyla orientalis* shows widespread distribution in all regions except Southeast and Eastern Anatolia Regions in Turkey. 3 species of frogs that are rarely seen in the field are also in the LC category according to IUCN. None of the frog species detected in Seciton 6 are endemic to our country, but are widely spread species.

When reptile species observed in Section 6 are evaluated in terms of protection criteria it is seen that according to IUCN criteria, *Emys orbicularis* is included in NT and

Testeco graeca is included in VU category. *Emys orbicularis* is a widespread species on a global and national scale. During field studies on this species, which is completely water dependent, it has been observed in Eunis coded habitat type of C1.2. *Emys orbicularis* is evaluated as Near Threatened (NT) according to IUCN criteria. It is also listed in Annex-2 according to BERN criteria. *Testudo graeca* is evaluated as VU according to IUCN criteria. Although *Testudo graeca* is narrowly distributed on a global scale, our country has a wide distribution area in almost every region except Eastern Black Sea coast. It was observed in Eunis coded habitat types of G1.A; G1.C and I1.2 during the field studies. This species is listed on the Annex-2 according to Bern Convention. This tortoise species is listed in the same time in CITES Appendix 2. Other reptile species identified in Section VI are the least risky species listed in LC category. According to the Bern criteria, *Anguis fragilis, Natrix natrix, Eirenis modestus* are listed in Annex 3, the other 15 reptilian species are listed in Annex 2. These reptilian species were observed in Eunis coded habitat G1.A; G1.2; G1.5; C1.2; I1.5; I1.2; G1.C and F5.3 during the field studies. Among these species, *Testudo graeca, Lacerta viridis, Lacerta trilineata, Pseudopus apodus, Ophisops elegans, Natrix natrix, Natrix tessellata* had a moderate density, *Emys orbicularis*, *Mauremys rivulata, Podarcis tauricus, Podarcis muralis, Podarcis siculus, Anguis fragilis, Ablepharus kitaibelii, Elaphe sauromates, Zamenis longissimus*, *Eirenis modestus* and *Dolichophis caspius* were rarely observed. Freshwater turtle species *Emys orbicularis* and *Mauremys rivulata* are widely spread species on global and national scale. *Podarcis tauricus*, one of the three lizard species of the Lacertidae family rarely observed in the area, has spread in the eastern and southern parts of Sea of Marmara and Trakya Region in Turkey. Outside of Turkey, it is distributed in some of the islands in Aegean Sea, in Crimea and Balkans. *Podarcis muralis*, another species belonging to the same genus, is spreading to the west of Turkey, starts from Central Black Sea and Ankara. This species is located in the southern and central regions of Europe except for Turkey. *Podarcis siculus*, the third genus of the same genus, spreads in Turkey in Istanbul and in some islands in Marmara Sea with Adapazarı, Zonguldak and Samsun. It spreads to the south of Europe outside Turkey. *Anguis fragilis*, a rarely observed legless speices of the Anguidae family, has spread in North and Northwest Anatolia region of Turkey. Outside of Turkey, it is spreading in most of Western Asia and Europe. *Ablepharus kitaibeli*, the last lizard species rarely found in the area belonging to Scincidae family, is widely distributed in Thrace, West, South and Central Anatolia Regions in Turkey. Outside of Turkey, it is distributed in Aegean Sea Islands, in Balkans and Southwest Asia. *Elaphe sauromates*, one of the rarely detected snake species in the field, has a wide distribution area in Turkey. *Zamenis longissimus*, rarely observed in the project, is spreading in all Black Sea coast along with Thrace. It spreads in central and southern Europe and western Asia outside Turkey. *Erenis modestus*, one of the rarely detected snake species, can be seen in almost every region except Thrace in our country. Outside of Turkey, it is distributed in Iran, Armenia, Azerbaijan, Georgia and Russia. The last snake species rarely observed in the field is *Dolichophis caspius*. This snake species spread in Central and Western Anatolia Regions and Thrace in Turkey. Outside of Turkey, it is distributed in Balkans, Southern Russia and Caucasus on the Black Sea shores. Most of the reptile species rarely observed in Section 6 (*Emys orbicularis* - NT) are evaluated in LC (Low Risk) status according to IUCN criteria. None of the reptilian species identified in Section 6 are endemic to our country, but are widely distributed species. Important sampling points and habitats for herptile species are shown in Figure 9.4.

Birds

This part of the Project area has deciduous mixed forest, pseudo- maquis, in-lake and coastal-lake, wet meadow, riparian, broad-leaved acidic marshy forest and broad-leaved forest plantation habitat types for its development under the influence of Oseyanic climate. At

the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

As a result of the studies carried out during the period of March and June 2017, total of 41 bird species belonging to 12 ordo, 21 families were detected from the area (Annex 7/A Table 3.c). These bird species are widely spread bird species of Thrace and Anatolia and are not endemic. 16 of 41 belong to the non-Passerine group and 25 of 41 belong to the Passerine group.

The national and international danger classes of birds identified in the project area are given in Annex 7/A Table 3.c. According to the IUCN Red List, the bird species those have been identified in the project area are in the category "LC: Least Concern" and no bird species classified as dangerous and/or threatened (CR-EN-VU).

24 of the bird species are listed as strictly protected fauna species in Annex 2 of the European Wild & Nature Habitats Agreement (Bern Convention). In addition, 12 species, together with a few exceptions, "protected fauna species" covering most of the species not included in Annex 2, are listed in Annex 3 of the Bern Convention. The remaining 5 species are not included in any conservation class of the Bern Convention (Annex 7/A Table 3.c). From this point of view, 36 of 41 bird species detected in the field are protected species according to the criteria of the Bern Convention. But according to the Bern Convention, 90% of the Turkish ornithofauna seem to be species that need protection. This is why the Berne Convention aims to protect the species of birds precisely against the risk of a fall in the populations of European bird species. However, depending on its rich ecosystem, its location on migration routes, its diverse climatic characteristics and various habitat types for bird species, and the vast majority of the diversity and density of the Western Paleartic bird population, Turkey is not at a high risk as it is in the European ornithological system.

The national red list categories of birds identified in the field are shown in Annex 7/A Table 3.c (Kiziroğlu, 2008-2009). Accordingly, 27 bird species on the project sites are located in the national scale, in danger categories (A.1.2-A.2-A.3). However, in 2008-2009, Kiziroğlu evaluated 300 of about 500 bird species in the fauna of Turkey in different categories of danger. In this case, the protection approach was based on the whole of Europe. However, these bird species are widely spread bird species in many parts of Turkey, including the Thrace region where the project site is located.

The population density of bird species has been recorded as very low and has been found to be between 1 and 10 in most populations except for crows, stallions and mussels. There are no bird species and/or habitats in flocks and/or colonies on the project sites. Photographs of the bird species within the project area is shown in Annex 7/C. Important sampling points and habitats for bird species are shown in Figure 9.4.

Mammals

This part of the project area has habitat types of leafy mixed forest, pseudo- maquis, in-lake and coastal-lake, wet meadow, riparian, broad-leaved acidic marshy forest and broad-leaved forest plantation habitat types for its predominantly under the influence of Osianic climate. At the same time, there are also dense agricultural areas in the region. Wheat farming is mainly carried out in agricultural areas.

As a result of the studies carried out during the period of March and June 2017 on the Dilovası-Köseler ve Kocaeli-Sepetçi route, a total of 25 mammal species belonging to 7 ordo, 14 families were detected from the area (Annex 7/A-Table 4). These mammal species are widely spread bird species of Thrace and Anatolia and are not endemic.

Of the 25 mammal species, 9 belong to medium and large-sized mammals and 16 belong to small mammals.

The national and international danger classes of mammals identified in the project area are given in (Annex 7/A-Table 4). According to the IUCN Red List, the mammal species those have been identified in the project area are in the category "LC: Least Concern" and no mammal species classified as dangerous and/or threatened (CR-EN).

6 of the mammal species are listed as strictly protected fauna species in Annex 2 of the European Wild & Nature Habitats Agreement (Bern Convention). In addition, 6 species, together with a few exceptions, "protected fauna species" covering most of the species not included in Annex 2, are listed in Annex 3 of the Bern Convention. The remaining 13 species are not included in any conservation class of the Bern Convention (Annex 7/A-Table 4).

Important sampling points and habitats for mammal species are shown in Figure 9.4.

9.5.3.3. Aquatic Environmet

The strams/rivers which are located in Kocaeli and Sakarya borders flow into Marmara Sea and Sakarya River Basin. Streams existing in the project area are given in Annex 7/C.

As a result of the filed and litrature studies (*Erk'akan, 1981; Erk'akan, 1983a; Erk'akan, Ekmekçi, & Nalbant, 1999; Turan, Kottelat, Ekmekçi & İmamoglu, 2006a; Özuluğ & Freyhof, 2011*) 29 species belong to 9 family (Atherinidae, Balitoridae, Cobitidae, Cyprinidae, Esocidae, Gobiidae, Percidae, Siluridae) were determined as *Atherina boyeri, Alburnoides sp, Alburnus escherichii, Barbus escherichii,, Capoeta baliki, Capoeta sieboldii, Chondrotoma angoranse, Carassius gibelio, Cyprinus carpio, Gobio sp, Gobio sakaryaensis, Rhodeus amarus, Phoxinus phoxinus, Pseudorasbora parva, Squalius aristotelis, Squalius pursakensis, Tinca tinca, Vimba vimba, Cobitis simplicispina, Oxynemacheilus angorae, Oxynemacheilus banarescui, Gambusia holbrooki, Neogobius fluviatilis, Sander lucioperca, Esox lucius, Silurus glanis.* 11 of this species *(A. escherichii, B. escherichii, C. baliki, C. sieboldii, C. angorense, O. angorae, O. banarescui, C. simplicispina, G. sakaryaensis, S. aristotelis, S. pursakensis*) are endemic species for Turkey. In addition, *O. banarescui* which is found in Sakarya River Basin is categorized as "NT: Near Threaten" by IUCN. The othr species is "LC: Least Concern" according to IUCN. P*. parva, C. gibelio* and *G. holbrooki* are invasive species and *C.carpio, E. lucius, S. lucioperca* and *T. tinca* which are exotic species are put into Sakarya River system for various purposes such as fishing, mosquito struggling, recreation, etc.. Determined fih species are given in Annex 7/A-Table 5.c.

AQ6/01: AQ6/01 which is known as Bicki stream is located in Kocaeli province. The width of the stream is about 3 m., the depth is 30-60 cm. Bicki stream is the main course that feeds the Bicki Pond. The bottom of the stream is composed of gravelled-stony, there are sandy areas in the coastals. As a result of the studies *Squalius aristotelis* from Cyprinidae family species have been identified.

AQ6/02: AQ6/02 is located in Kocaeli province. The width of the stream is about 1 m., the depth is 30-40 cm. The bottom of the stream is composed of gravelled-stony, there are sandy areas in the coastals. As a result of the studies *Squalius aristotelis* from Cyprinidae family species have been identified.

AQ6/03: AQ6/03 is located in Gedikli neighborhood of Kocaeli province. The width of the stream is about 5 m., the depth is 30-50 cm. The bottom of the stream is composed of gravelled-stony, there are clay areas in the coastals. As a result of the studies *Squalius aristotelis, Rhodeus amarus* and *Gobio sp.* from Cyprinidae family species have been identified.

AQ6/04: AQ6/04 is located in Gedikli neighborhood and Karabdülbaki neighborhood of Kocaeli province. The width of the stream is about 2 m., the depth is 30-50 cm. The bottom of the stream is composed of gravelled-stony, there are clay areas in the coastals. As a result of the *Phoxinus phoxinus, Rhodeus amarus* from Cyprinidae family species have been identified.

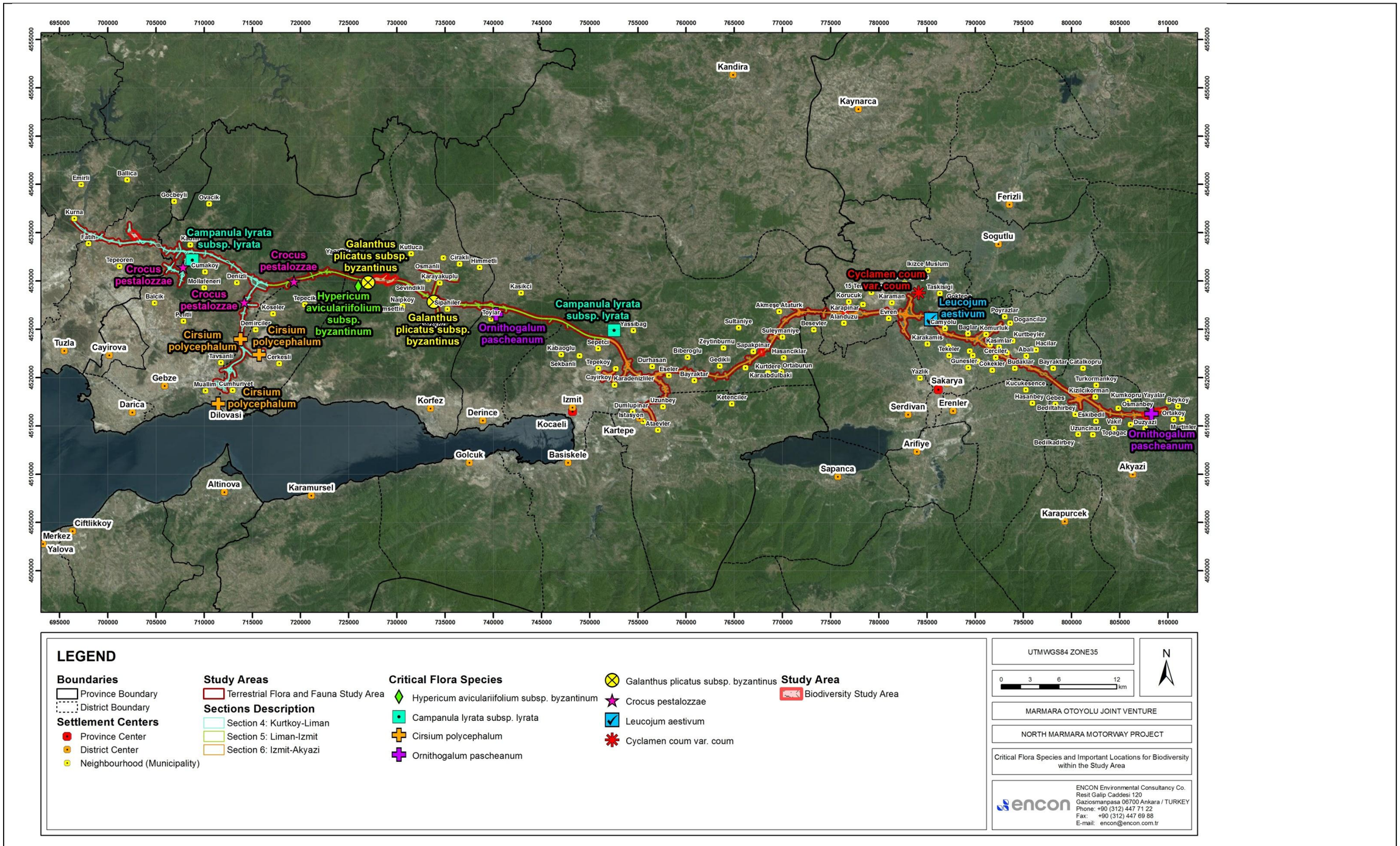
AQ6/05: AQ6/05 is located on Kocaeli- Adapazri road. The width of the stream is about 3 m., the depth is 30-70 cm. The bottom of the stream is composed of gravelled-stony, there are sandy areas in the coastals. As a result of the studies *Squalius pursakensis, Rhodeus amarus* and *Gobio sakaryaensis, Alburnus escherichii* from Cyprinidae family and *Oxynoemacheilus angorae* from Balitoridae family have been identified.

AQ6/06: AQ6/06 is located in Korucuk in Sakarya. The width of the stream is about 1,5 m., the depth is 30-50 cm. The bottom of the stream is composed of gravelled-stony, there are clay areas in the coastals. The flow rate is low. No fish species have been identified in the stream which is very dirty.

AQ6/07: AQ6/07 which is in Sakarya River Basin is located in Evrenkoy neighborhood in Sakarya. The width of the river is about 10 m., the depth is 40 cm within the coastal and over 70 cm in middle of the river. Measurements could not be done in the middle of the river due to it was suddenly deepened. The bottom of the stream is composed of gravelled-stony-clay. As a result of the studies which were conducted in middle of the river*, Capoeta baliki* and *Squalius pursakensis* from Cyprinidae family have been identified.

AQ6/08: AQ6/08 is located between Sakarya-Adapari. It named as Sakarya River. The width of the river is about 20 m., the depth is 30-40 cm within the coastal. It was not possible to study in the middle regions because of the high flow. The bottom of the stream is composed of gravelled-stony-clay. As a result of the studies which were conducted in middle of the river*, Alburnus escherichii, Barbus escherichii, Carassius gibelio, Capoeta baliki, Pseudorasbora parva, Squalius pursakensis* from Cyprinidae family and *Oxynoemacheilus angorae* from Balitoridae family have been identified.

AQ6/09: AQ6/09 is located between Sakarya-Adapari. It named as Mudurnu Stream. Mudurnu stream which is a section of Sakarya River has been rehabilitated and the its natural structure has changed. The width of the river is about 20 m., the depth is 40-50 cm within the coastal. It was not possible to study in the middle regions because of the high flow. The bottom of the stream is composed of gravelled-stony and mostly clay. As a result of the studies which were conducted in middle of the river*, Capoeta baliki* and *Pseudorasbora parva* from Cyprinidae family have been identified.



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Study Areas
- Terrestrial Flora and Fauna Study Area

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

Critical Flora Species
- Hypericum avicullariifolium subsp. byzantinum
- Campanula lyrata subsp. lyrata
- Cirsium polycephalum
- Ornithogalum pascheanum
- Galanthus plicatus subsp. byzantinus
- Crocus pestalozzae
- Leucojum aestivum
- Cyclamen coum var. coum

Study Area
- Biodiversity Study Area

UTMWGS84 ZONE35

N

0 3 6 12 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Critical Flora Species and Important Locations for Biodiversity within the Study Area

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Figure 9.4. Critical Species and Important Locations for Biodiversity within the Study Area

9.6. Impact Assesment

The construction and operation of the Motorway Project will involve a wide range of activities that have the potential to affect ecology. Impacts of project activities can be further divided into the target group of biological elements as terrestrial and aquatic. Important impacts of Motorway construction and operation activities on biological environment are mainly habitat fragmentation. Habitat fragmentation can be described as the splitting of natural habitats and ecosystems into smaller, more isolated patches (cost). The process of fragmentation is connected to many different factors, of which the direct loss and isolation of natural habitat are the most important. (*cost341*).

The ecological effects of transportation include disturbance in terms of noise and visual nuisance and pollution, which act to reduce the suitability of adjacent areas for wildlife. The infrastructure itself contributes significantly towards habitat fragmentation by creating barriers to animal movement. This may result in the isolation and extinction of vulnerable species. The steady increase in the number of animal casualties associated with roads and to a lesser extent with drowned animals in waterways, provides a further indication of the fragmentation effect. Fauna mortality, in particular, has helped raise the public perception of the problem, due to the inherent link to traffic safety. Finally, devaluation of the landscape and nature for human recreation can make an important negative economic factor (c*ost341*).

During the planning, construction or upgrading of transportation infrastructure, all possible efforts must be made to maintain or restore ecological structures and connect habitats and populations. Particular attention should be paid to rivers, streams, riparian forests, wooded corridors, networks of hedges and dikes etc., which provide ecological corridors for growth, expansion of range and/or migration of wildlife populations and can often be the last refuge for many species in an intensively man-used landscape (c*ost341*).

Best practice dictates that project planning and design should aim to avoid ecological damage, especially to protected or sensitive habitats and/or species. The avoidance of fragmentation should be considered before resorting to mitigation measures. Following articles are general principles to consider against the habitat fragmentation:

- The fragmentation of natural habitats by transportation infrastructure is a problem, which can only be solved through acceptance of the issue at a policy level. Only an interdisciplinary approach involving planners, economists, engineers, ecologists and landscape architects etc., can provide the necessary tools for successfully addressing fragmentation. Public involvement is also essential to ensure the success of the chosen solutions.
- Habitat connectivity is a vital property of landscapes and is especially important for sustaining animal movement across the landscape. The preservation of habitat connectivity should be a strategic goal in the environmental policy of the transport sector.
- Avoiding and mitigation should be applied from the start of the planning process.

The construction and operation of the Project will involve a wide range of activities that have the potential to affect ecology. The relevant activities of the Project likely to give rise to impacts on receptors are summarised in Table 9 9, along with the likely pathway of the impacts.

Table 9.9. Potential Impacts of the Project on Biological Environment

Phase of the Project Activities	Activity	Potential Impact
Construction	Vegetation clearance	Damage or loss of habitats Loss of important plant species Direct incidental killing of fauna Loss of habitat for faunal species Increase in noise, visual and vibration which may cause disturbance or displacement of fauna Invasive species Loss of ecosystem services
	Camp sites, storage areas and quarries	Damage or loss of habitat Increase in noise, visual and vibration which may cause disturbance or displacement of fauna
	Construction of culverts, bridges and viaducts	Damage or loss of habitat Increase in noise, and vibration and disturbance on fauna Disruption of ecological connectivity Loss of ecosystem services
	Presence of site preparation and construction vehicles	Increase in noise, visual and vibration which may cause disturbance or displacement of fauna Damage or loss of flora and /or fauna
Opretation	Operational traffic	Increase in noise, visual and vibration which may cause disturbance or displacement of fauna Damage and/or loss of fauna Barrier effects Ecosystem Services

9.6.1. Receptors

9.6.1.1. Internationally Recognised Areas

The sensitivity of Internationally Recognised Areas is provided in Table 9.10. IFC PS6 states that internationally and/or nationally recognised areas of high biodiversity value are likely qualify as critical habitat. These include KBAs, IBAs and IPAs. Therefore, all of the KBA within and in the vicinity of the Project Area are considered to be of high sensitivity.

Table 9.10. Sensitivity Evaluation of Internationally Recognised Areas (all sections)

Site	Nearest Section	Rationale	Sensitivity
Istanbul Islands KBA, IBA	Section 4	IFC PS6: Internationally recognised area	High
Sile Coast KBA, IBA, IPA	Section 4	IFC PS6: Internationally recognised area	High
Omerli Basin KBA, IPA	Section 4 and 5	IFC PS6: Internationally recognised area	High
Pendik Valley KBA	Section 4	IFC PS6: Internationally recognised area	High
Kocaeli Hills KBA	Section 5	IFC PS6: Internationally recognised area	High
Sapanca Lake KBA, IBA	Section 5	IFC PS6: Internationally recognised area	High
Sakarya Delta KBA, IBA	Section 6	IFC PS6: Internationally recognised area	High

9.6.1.2. Terrestrial Habitats

The sensitivity of habitats is evaluated in Table 9.11. Seven habitats qualify as critical habitat under IFC PS6 Criterion 4 Highly threatened and/or unique ecosystems and habitat that support species of high sensitivity.

Table 9.11. Terrestrial Habitat Sensitivity Evaluation (all sections)

Habitat	Section	Rationale	Sensitivity
C 1.2- Permanent mesotrophic lakes, ponds and pools	Section 5, Section 6	Habitat that support species of High sensitivity	Low
E 3.4- Moist or wet eutrophic and mesotrophic grassland	Section 5, Section 6	Habitat that support species of High sensitivity	High
E 1.3- Mediterranean xerophilous meadow	Section 4,	Habitat that support species of Low sensitivity	Low
F 5.2- Maquis	Section 4,	Habitat that support species of high sensitivity	High
F 5.3- Pseudomaquis	Section 4, Section 6	Habitat that support species of high sensitivity	High
G 1.2- Mixed riparian forests	Section 4, Section 5, Section 6	IFC PS6 Criterion 4: Highly threatened and/or unique ecosystems Habitat that support species of High sensitivity	High
G 3.F- Highly artificial coniferous plantations	Section 4, Section 5,	Habitat that support species of High sensitivity	Low
G 1.A- Meso and Eutrophic Mixed Deciduous Forests	Section 4, Section 5,	IFC PS6 Criterion 4: Highly threatened and/or unique ecosystems Habitat that support species of High sensitivity	High
G 1.C- Highly artificial broadleaved deciduous forestry plantations	Section 6	Habitat that support species of High sensitivity	High
G 1.5- Broad-leaved acidic marsh forest	Section 6	IFC PS6 Criterion 4: Highly threatened and/or unique ecosystems Habitat that support species of High sensitivity	High

9.6.1.3. Threatened and Red List Terrestrial flora and FaunaSpecies of Section 4

Terrestrial Flora

The sensitivity of threatened and endemic plant species are provided in Table 9.12. Three species are assessed as High sensitivity due to them meeting either IFC PS6 criterion 1: Critically Endangered (CR) and/or Endangered (EN) species, and / or criterion 2: Endemic and/or restricted-range species.

Table 9.12. Terrestrial Flora Species Sensitivity Evaluation (Section 4)

Species	Rationale	Sensitivity
Cirsium polycephalum	IFC PS6 Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species Criterion 2: Endemic and/or restricted-range species	High
Crocus pestalozzae	IFC PS6 Criterion 2: Endemic and/or restricted-range species	High
Campanula lyrata subsp. lyrata	IFC PS6 Criterion 2: Endemic and/or restricted-range species	High

Amphibian –Reptilian

The sensitivity of amphibian and reptile species within the Project Area is provided in Table 9.13. With the exception of spur-thighed tortoise and european pond turtle all

amphibian and reptile species are low sensitivity. Spur-thighed tortoise is not common on a global scale and evaluated as “VU: Vulnerable”, european pond turtle is “NT: Near Threaten” according to IUCN red List is assessed as moderate sensitivity.

Table 9.13 Amphibian- Reptile Species Sensitivity Evaluation (Section 4)

Species	Rationale	Sensitivity
Spur-thighed tortoise	National important population of Vulnerable (VU) species Locally important populations of species listed on Annexes to the Bern Convention.	Medium
European Pond Turtle	National important population of Near Threaten (NT) species Locally important populations of species listed on Annexes to the Bern Convention.	Medium
Green Toad	Locally important populations of species listed on Annexes to the Bern Convention.	Low
Common Toad		Low
The European tree frog		Low
Southern Crested Newt		Low
The Balkan green lizard		Low
The green lizard		Low
The European legless lizard		Low
The European copper skink		Low
The dice snake		Low
Taurus whip snake		Low
The Caspian whipsnake		Low

Birds

There is not any critical bird species and habitat in the Mortorway route, as well as breeding bird species in flocks and/or colony. The sensitivity of bird species within the Project Area is provided in Table 9.14.

Table 9.14. Bird species Sensitivity Evaluation (Section 4)

Species	Rationale	Sensitivity
Little grebe Grey Heron Common Kestrel Northern Long-eared Owl Syrian Woodpecker Crested Lark Meadow Pipit White Wagtail Winter Wren European Robin Black Redstart Stonechat Isabelline Wheatear Eurasian Blackbird Field fare Coomon firecrest Common Chiffchaff Long-tailed Tit Coal Tit Blue Tit Great Tit	Locally important populations of species listed on Annexes to the Bern Convention.	Low

Mammals

The sensitivity of terrestrial mammal species within the Project Area is provided in Table 9.15. With terrestrial mammals are assessed as either negligible or low sensitivity.

Table 9.15 Terrestrial Mammal Species Sensitivity Evaluation (Section 4)

Species	Rationale	Sensitivity
Crocidura suaveolens	Locally important populations of species listed on Annexes to the Bern Convention	Low
Rhinolophus ferrumequinum		
Rhinolophus hipposideros		
Myotis myotis		
Miniopterus schreibersii		
Sciurus anomalus		

Aquatic Environment

The sensitivity of freshwater fish species and aquatic habitats within Section 4 evaluated as negligible.

9.6.1.4. Threatened and Red List Terrestrial flora and FaunaSpecies of Section 5

Flora Species

The sensitivity of threatened and endemic plant species within the Project Area is provided in Table 9.16. Four species are assessed as High sensitivity due to them meeting either IFC PS6 criterion 1: Critically Endangered (CR) and/or Endangered (EN) species, and / or criterion 2: Endemic and/or restricted-range species for critical habitat.

Table 9.16 Terrestrial Flora Species Sensitivity Evaluation (Section 5)

Species	Rationale	Sensitivity
Galanthus plicatus subsp. byzantinus	IFC PS6 Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species Criterion 2: Endemic and/or restricted-range species	High
Ornithogalum pascheanum	IFC PS6 Critically Endangered (CR) and/or Endangered (EN) species Criterion 2: Endemic and/or restricted-range species	High
Hypericum aviculariifolium subsp. byzantinum	IFC PS6 Criterion 2: Endemic and/or restricted-range species	High
Crocus pestalozzae	IFC PS6 Criterion 2: Endemic and/or restricted-range species	High

Amphibian and Reptiles

The sensitivity of herptile species within the Project Area is provided in Table 9.17. With the exception of spur-thighed tortoise all amphibian and reptile species are low sensitivity. Spur-thighed tortoise is not common on a global scale and evaluated as “VU: Vulnerable” according to IUCN red List is assessed as moderate sensitivity.

Table 9.17 Amphibian and Reptile Species Sensitivity Evaluation (Section 5)

Species	Rationale	Sensitivity
Spur-thighed tortoise	National important population of Vulnerable (VU) species Locally important populations of species listed on Annexes to the Bern Convention.	Medium
European Pond Turtle	National important population of Near Threaten (NT) species Locally important populations of species listed on Annexes to the Bern Convention.	Medium
Green Toad	Locally important populations of species listed on Annexes to the Bern Convention.	Low
Common Toad		Low
The European tree frog		Low
The agile frog		Low
Eastern Spadefoot		Low
The Balkan green lizard		Low
The green lizard		Low
Balkan wall lizard		Low
Common wall lizard		Low
The European legless lizard		Low
The European copper skink		Low
The dice snake		Low
East-Four-lined Ratsnake		Low
The Caspian whipsnake		Low
Aesculapian Ratsnake		Low
Smooth snake		Low
Dahl's whip snake		Low

Birds

There is not any critical bird species and habitat in the Mortorway route, as well as breeding bird species in flocks and/or colony. An appraisal of the sensitivity of bird species within the Project Area is provided in Table 9.18.

Table 9.18. Bird Species Sensitivity Evaluation (Section 5)

Species	Rationale	Sensitivity
Little Egret Little grebe Grey Heron Mallard Common Kestrel Common Sandpiper Little Owl Syrian Woodpecker Meadow Pipit White Wagtail Winter Wren European Robin Black Redstart Stonechat Isabelline Wheatear	Locally important populations of species listed on Annexes to the Bern Convention.	Low

Species	Rationale	Sensitivity
Eurasian Blackbird Common Chiffchaff Common firecrest Long-tailed Tit Coal Tit Blue Tit Great Tit Eurasian Jay		

Mammals

The sensitivity of terrestrial mammal species within the Project Area is provided in Table 9.19. With terrestrial mammals are assessed as either negligible or low sensitivity.

Table 9.19. Mammal Species Sensitivity Evaluation (Section 5)

Species	Rationale	Sensitivity
Crocidura suaveolens	Locally important populations of species listed on Annexes to the Bern Convention.	Low
Rhinolophus ferrumequinum		
Rhinolophus hipposideros		
Myotis myotis		
Miniopterus schreibersii		
Sciurus anomalus		
Felis slivestris		

Aquatic Environment

The sensitivity of freshwater fish species within the Project Area is provided in Table 9.20. With the exception of chub all freshwater fish species are considered to be either of negligible sensitivity. Chub is endemic species. On the other hand, all aquatic habitats within Section 5 are evaluated as negligible.

Table 9.20. Freshwater Fish Species Sensitivity Evaluation (Section 5)

Species	Rationale	Sensitivity
Chub	Locally important populations of endemic / rangerestricted species.	Medium

9.6.1.5. Threatened and Red List Terrestrial flora and FaunaSpecies of Section 6

Flora Species

The sensitivity of threatened and endemic plant species within the Project Area is provided in Table 9.21. Two species is assessed as High sensitivity due to them meeting either IFC PS6 criterion 1: Critically Endangered (CR) and/or Endangered (EN) species for critical habitat.

Table 9.21.Terrestrial Flora Species Sensitivity Evaluation (Section 6)

Species	Rationale	Sensitivity
Ornithogalum pascheanum	IFC PS6 Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species Criterion 2: Endemic and/or restricted-range species	High
Campanula lyrata subsp. lyrata	Criterion 2: Endemic and/or restricted-range species	High

Amphibian and Reptiles

The sensitivity of herptile species within the Project Area is provided in Table 9.22. With the exception of spur-thighed tortoise and european pond turtle all amphibian and reptile species are low sensitivity. Spur-thighed tortoise is not common on a global scale and evaluated as “VU: Vulnerable” and european pond turtle is “NT: Near Threaten” according to IUCN red List is assessed as moderate sensitivity.

Table 9.22.Amphibian and Reptile Species Sensitivity Evaluation (Section 6)

Species	Rationale	Sensitivity
Spur-thighed tortoise	National important population of Vulnerable (VU) species Locally important populations of species listed on Annexes to the Bern Convention.	Medium
European Pond Turtle	National important population of Near Threaten (NT) species Locally important populations of species listed on Annexes to the Bern Convention.	Medium
Green Toad	Locally important populations of species listed on Annexes to the Bern Convention.	Low
Common Toad		Low
The European tree frog		Low
The agile frog		Low
Fire-belied toad		Low
Southern Crested Newt		Low
The green lizard		Low
The Balkan green lizard		Low
Balkan wall lizard		Low
Common wall lizard		Low
Italian wal lizard		Low
Snake-eyed lizard		Low
The European legless lizard		Low
The European copper skink		Low
The dice snake		Low
The Caspian whipsnake		Low
Aesculapian Ratsnake		Low
East-Four-lined Ratsnake		Low

Birds

There is not any critical bird species and habitat in the Mortorway route, as well as breeding bird species in flocks and/or colony. The sensitivity of bird species within the Project Area is provided in Table 9.23.

Table 9.23.Bird Species Sensitivity Evaluation (Section 6)

Species	Rationale	Sensitivity
Little Egret Grey Heron Mallard Common Kestrel Little Owl Northern Long-eared Owl Syrian Woodpecker Meadow Pipit White Wagtail European Robin Black Redstart Stonechat Isabelline Wheatear Eurasian Blackbird Field fare Common Chiffchaff Coomon firecrest Long-tailed Tit Coal Tit Blue Tit Great Tit Greenfinch Goldfinch Corn Bunting	Locally important populations of species listed on Annexes to the Bern Convention.	Low

Mammals

The sensitivity of terrestrial mammal species within the Project Area is provided in Table 9.24. With terrestrial mammals are assessed as either negligible or low sensitivity.

Table 9.24. Mammal Sensitivity Evaluation (Section 6)

Species	Rationale	Sensitivity
Crocidura suaveolens	Locally important populations of species listed on Annexes to the Bern Convention.	Low
Rhinolophus ferrumequinum		
Rhinolophus hipposideros		
Myotis myotis		
Sciurus anomalus		
Felis slivestris		

Aquatic Environment

The sensitivity of freshwater fish species within the Project Area is provided in Table 9.25. 11 endemic species are determined in Section 6. All these endemic species have locally important populations. On the other hand, all aquatic habitats within Section 5 are evaluated as negligible.

Table 9.25. Freshwater Fish Species Sensitivity Evaluation (Section 6)

Species	Rationale	Sensitivity
Sakarya Stone loach	Locally important populations of endemic / range restricted species.	Medium
Paphlagonian Sportive Loach		
Galatian Spined Loach		
Sakarya Bleak		
Sakarya Barbel		
Nipple-lip scraper		
Western fourbarbel scraper		
Blacksea nase		
Sakarya Gudgeon		

Species	Rationale	Sensitivity
Tuzla Chub		
Sakarya Chub		

9.6.2. Construction Phase Impacts on Ecology

The construction phase of the Project will require the removal of the majority of vegetation within the Project Area. This is a direct adverse impact that is permanent and irreversible. The loss of vegetation will also cause fragmentation to the remaining areas of habitats in Project Area. Construction activities including vegetation clearance and topsoil stripping, creation of camp sites, storage areas and quarries, creation of culverts, bridges and viaducts, presence of site preparation and construction vehicles has the potential to cause indirect adverse impact to surrounding habitats from runoff and dust.

On the other hand cuttings and embankments change landscape topography, and often induce large-scale changes in hydrology. Cuttings may increase soil erosion and drain aquifers. Embankments may change the water regime producing either drier or wetter conditions. These changes will affect vegetation, e.g. in wetlands and riparian habitats.

The effects determined for each section within the context of construction activities are summarized below:

The Impact of Habitat Loss

The assessment of the habitat effect (lifting of the vegetation cover) concerns the value of the structural component as the habitat for the fauna of the vegetation cover, and the species composition of the removed vegetation cover is not considered. The species components of the plant cover and the threatened conditions have been evaluated by plant specialists. Regarding the total area of the study area and of similar habitats in the area, the loss of habitats is very small and represents a small fraction of these habitats available for fauna. Also, as can be understood from fieldwork, lost habitats will not create a barrier that affects the distribution of species. Although the habitat under new roads will be permanently lost, new viaducts, bridges, culverts will return to a situation suitable for use as transition areas for mammals.

Aquatic effect

Violation of the vegetation cover and the natural environment of the region will be cause degradation or destruction of habitats in these regions. The construction of motorway will affect rivers that are damaged by excavation and blasting, the construction of artificial structures, the smoothing of beds of stream flows and the activities of flood areas. Construction and excavation works in mainstream, floodplain and coastal areas of waterways have effects on aquatic organisms, water-supported habitats and fauna species. Contamination of pollution during activities and increasing water blurring will inevitably occur. If the mitigation measures will not be taken, this contamination can result in reduction or destruction settlement of the basin gradual and natural biosynthetic reservoirs.

Noise and Dust Influence

The effects of the consturraction activities will include dust, noise and vibration. These effects may soon lead to effects on indigenous mammalian species, but none of these effects

will have a lasting effect on species. After the construction activity is over, it is expected that the composition of the fauna species will return to its original state in time.

The effects and the importance criteria for the effects for each section are given below.

9.6.2.1. Internationally Recognised Areas

The magnitude of the construction impacts for internationally recognised areas which are intersecting with the project area are evaluated for just greater than 3% of the intersection area. The smallest of 3% hectare is assessed as being negligible. Within the scope of the Project, only Omerli Dam Basin and Kocaeli Hills are intersected with Motorway. Intersections of these both areas are less than %3 ha. Therefore, all the internationally recognised areas as assessed as being negligible. Magnitudes of construction impacts for internationally recognised areas are explaned as follows:

Istanbul Islands KBA, IBA is located in 16,9 km distance from Section 4. There will not be habitat loss within the Sile Coast due to the Motorway construction activities. Also, there will not be predicted any adverse indirect impacts from changes in airquality. Therefore, the magnitude of the impacts to Istanbul Islands during the contruction phase is assessed as being negligible due to the distance to Project area.

Sile Coast KBA, IBA and IPA is located in 26 km north of the Motorway of Section 4. There will not be habitat loss within the Sile Coast due to the Motorway construction activities. Also, there will not be predicted any adverse indirect impacts from changes in airquality. Therefore, the magnitude of the impacts to Istanbul Islands during the contruction phase is assessed as being negligible due to the distance to Project area.

Omerli Dam Basin KBA, IPA is adjacent to Section 4 and Section 5. Although the Omerli Dam Lake is adjacent to the project area, 58,237 (As the total impact areas at the route section over the tunnels (not including cut-cover tunnels) will not change (for example the forestlands over the tunnel route will be totally conserved) and the land use under the viaducts will only be impacted by the foundations, which would be negligible when compared to the entire length of the structure, the sections between the starting and ending points of these structures have been eliminated from the study area to avoid misinterpretations.) hectare of the Omerli Dam Basin KBA, IPA which has 1252,03 hectare area will be affected by Section 4. In this case, only 2,15 % part of the KBA will be affected. Also, 164,84 ha of the areas will be affected by Section 5, so that 0,28% part of the KBA will be affected. This is a relatively small area and an intersection of the area is less than %3 ha, so that it is considered as negligible.

Pendik Valley KBA is located in 1.7 km south of the Asian part of Project area. There will not be habitat loss within the KBA due to the Motorway construction activities. Also, there will not be predicted any adverse indirect impacts from changes in airquality. Therefore, the magnitude of the impacts to Pendik Valley during the contruction phase is assessed as being negligible due to the distance to Project area.

Kocaeli Hills KBA is is adjacent to Section 5. Although the Kocaeli Hills KBA is adjacent to the Project area, 28053,68 hectare of the Kocaeli Hills which has 233,20 (As the total impact areas at the route section over the tunnels (not including cut-cover tunnels) will not change (for example the forestlands over the tunnel route will be totally conserved) and the land use under the viaducts will only be impacted by the foundations, which would be

negligible when compared to the entire length of the structure, the sections between the starting and ending points of these structures have been eliminated from the study area to avoid misinterpretations.) hectare area will be affected by Section 5. In this case, only 0,83 % part of the KBA will be affected. Also, 2,51 ha of the areas will be affected by Section 6, so that 0,01 % part of the KBA will be affected. This is a relatively small area and an intersection of the area is less than %3 ha, so that it is considered as negligible.

Sapanca Lake KBA and IBA is located in 7.4 km south of the Section 5. There will not be habitat loss within the KBA due to the Motorway construction activities. Also, there will not be predicted any adverse indirect impacts from changes in airquality, release of invasive species or disturbance during the construction phase due to the distance. Therefore, the magnitude of the impacts to Sapanca Lake during the contruction phase is assessed as being negligible due to the distance to Project area.

Sakarya Delta KBA abd IBA is located in 20,5 km distance from Section 6. There will not be habitat loss within the Sakarya Delta due to the Motorway construction activities. Also, there will not be predicted any adverse indirect impacts from changes in airquality, release of invasive species or disturbance during the construction phase due to the distance. Therefore, the magnitude of the impacts to Sakarya Delta during the contruction phase is assessed as being negligible due to the distance to Project area.

9.6.2.2. Terrestrial Habitats within the Project Area

Eight sensitive habitats are determined during the filed studies. Important impacts due to the construction phase of Motorway Project are habitat fragmentation. The loss of vegetation will also cause fragmentation to the remaining areas of habitats in the vicinity of the Project Area. For this reasonthe quality of the habitat and the biodiversity of the habitat will be adversely affected.

The construction phase of the Project will require the removal of the majority of vegetation and it is a direct adverse impact that is permanent and irreversible. The area of each habitat affected is set out in Table 9.26.

Construction activities including vegetation clearance and topsoil stripping, creation of camp sites, storage areas and quarries, construction of culverts, bridges and viaducts and presence of site preparation and construction vehicles has the potential to cause indirect adverse impact to surrounding habitats from runoff and dust. Without mitigation, runoff has the potential to introduce silt, nutrients and chemical contaminants, non-native species. Construction activities, the importation of fill and the movement of people and vehicles can introduce invasive species that may impact the remaining adjacent habitats prior to the implementation of mitigation measures.

Table 9.26. Magnitude of Construction Impacts to Habitat Types

Habitat	Section	Magnitude
C 1.2- Permanent mesotrophic lakes, ponds and pools	Section 5, Section 6	Low (Adverse)
E 3.4- Moist or wet eutrophic and mesotrophic grassland	Section 5, Section 6	Low(Adverse)
E 1.3- Mediterranean xerophilous meadow	Section 4,	Low (Adverse)
F 5.2- Maquis	Section 4,	Low (Adverse)
F 5.3- Pseudomaquis	Section 4, Section 6	Low (Adverse)
G 1.2- Mixed riparian forests	Section 4, Section 5, Section 6	Low (Adverse)
G 3.F- Highly artificial coniferous plantations	Section 4, Section 5,	Low (Adverse)

Habitat	Section	Magnitude
G 1.A- Meso and Eutrophic Mixed Decidiuous Forests	Section 4, Section 5,	Low (Adverse)
G 1.C- Highly artificial broadleaved deciduous forestry plantations	Section 6	Low (Adverse)
G 1.5- Broad-leaved acidic marsh forest	Section 6	Low (Adverse)

9.6.2.3. Impacts on Ecological Components within the Section 4

Terrestrial Flora

In the Section 4, 3 endemic species (*Cirsium polycephalum, Crocus pestalozzae, Campanula lyrata subsp. lyrata*) were determined. Among these species, *Cirsium polycephalum* is evaluated as "CR" according to IUCN.

Table 9.27. Magnitude of Construction Impacts to Flora Species

Species	Magnitude
Cirsium polycephalum	High (Adverse)
Crocus pestalozzae	High (Adverse)
Campanula lyrata subsp. lyrata	High (Adverse)

Terrestrial fauna

Amphibians-Reptiles

The construction phase of the Project will remove of the majority of vegetation within the Project Area including the entire habitat that supports amphivbian and reptile species. The removal of vegetation will cause direct mortality of individuals present. These are direct adverse impacts that are permanent and irreversible. The removal of vegetation will also cause fragmentation to the remaining areas of habitats in the vicinity of the Project Area.

All of amphibian and reptilian species identified in Section 4 are widely spread species on the global and national scale. According to IUCN criteria, all except *Testudo graeca* (VU) and *Emys orbicularis* (NT) are considered as least risky level in LC status. Although *Testudo graeca* are not common on a global scale, in Turkey it is a wide-spread turtle species spreading in most parts of Thrace and Anatolia except the eastern Black Sea shores. As a matter of fact, in Section 4, this species was identified in 7 different EUNIS habitat types. *Emys orbicularis* an indigenous tortoise species, is considered as Near Threatened (NT) according to IUCN criteria. This water turtle species, which is widely spread on national and global scale, has been detected only in sampling point 4_4 during the field studies. The road route passes through the edge of the small lake in the sampling point 4_4.

Table 9.28 Magnitude of Construction Impacts to Amphibian and Reptiles

Species	Magnitude
Spur-thighed tortoise	Medium
European Pond Turtle	Medium
Green Toad	Low
Common Toad	
The European tree frog	
Southern Crested Newt	

Species	Magnitude
The Balkan green lizard	
The green lizard	
The European legless lizard	
The European copper skink	
The dice snake	
Taurus whip snake	
The Caspian whipsnake	

Birds

The deciduous forest habitats, riparian habitats and wet meadows in natural habitats on the route are susceptible for birds as feeding, breeding and sheltering areas. For this reason, the water regime of riparin and wet meadow habitats outside of the motorway route which motorway construction can affect must be protected. Otherwise, if water regime of these sensitive habitats are diminish and / or discontinue, the feeding and sheltering habitats for birds will disappear that are directly and / or indirectly dependent on the aquatic environment.

Although there are no critical bird species- habitat and there are no bird colonies for breeding in the motorway route, habitat loss for bird species will occur due to the construction and operation activities of the Project. It is anticipated that the bird species will not be destroyed due to their flying abilities to alternative habitats.

Table 9.29. Significance of Construction Impacts to Birds

Species	Magnitude
Little grebe Grey Heron Common Kestrel Northern Long-eared Owl Syrian Woodpecker Crested Lark Meadow Pipit White Wagtail Winter Wren European Robin Black Redstart Stonechat Isabelline Wheatear Eurasian Blackbird Field fare Coomon firecrest Common Chiffchaff Long-tailed Tit Coal Tit Blue Tit Great Tit	Low

Mammals

Section 4 of the proposed Motorway project is mainly composed of residential areas, industrial zones and agricultural areas, and it is seen as natural structure of some areas were totally lost.

Miniopterus schreibersii is in the category "NT" (Near Threatened) and Nannospalax xanthodon is in the category "DD" (Data Deficient = Insufficient data about populations). There are no mammalian taxa that are categorized as endangered by the IUCN (CR-EN).

According to IUCN, the bat species, which is in the category of "NT", is a species dependent on caves, means generally winters and rests in a cave. However, there was no cave ecosystem in which this species could rest, winter and/or reproduce within the motorway route and area of influence. However, it was taken on the species list because it was thought that the area could be used for feeding. Therefore, there will not be any adverse effects on the bat resting areas considered to use the project sites for feeding during road construction works.

Nannospalax xanthodon is found at all sampling points within the motorway route. Due to taxonomic problems, it is considered to be separated into several species. Thus, according to IUCN, it is in the category "DD". It is a species that has wide distribution in Anatolia and wide habitat preference. There will also be escapes due to noise and vibrations during construction activities, and it is a fact that some of them will be disappeared. However, this species that can even use roadside landscapes as a living space will reach the climax again after construction. As a result, the individuals who escaped and disappeared during the activities will be replaced by new individuals after the activity.

In addition, the planned motorway passes very close to east border of Ballikayalar Natural Park. Especially, sampling point 4_5 and 4_6 are located adjacent border of Ballikayalar Natural Park. This area is also the 1st Degree Natural Site and is protected by two ministries in the national sense. However these sampling points (4_5 and 4_6) are not included habitat types and important species which provide to Natural Park speciality for Ballikayalar natural Park. Also, intersection of the motorway and the Natural Park is quite limited area.

Other habitats are often fragmented bushes and degraded forest habitats and had relatively low species richness. In addition, other sampling points belonging to Section 4, which is a connection road to Yavuz Sultan Bridge, are seen as residential and industrial areas. This and other similar areas are so numerous in the immediate vicinity so that the effects of construction work will not to be irreversible in these areas.

Table 9.30. Significance of Construction Impacts to Mammals

Species	Magnitude
Crocidura suaveolens	Low (Adverse)
Rhinolophus ferrumequinum	
Rhinolophus hipposideros	
Myotis myotis	
Miniopterus schreibersii	
Sciurus anomalus	
Crocidura suaveolens	

Freshwater Habitats and Species

The effects will be negligible since there is no critical species or habitat within the Section 4.

9.6.2.4. Impacts on Ecological Components within the Section 5

Terrestrial Flora

In the Section 5, 4 regional endemic species (*Galanthus plicatus subsp. byzantinus, Ornithogalum pascheanum, Hypericum aviculariifolium subsp. byzantinum, Crocus pestalozzae*) were identified. Among these species, *Crocus pestalozzae* is evaluated as "EN", *Galanthus plicatus subsp. byzantinus, Ornithogalum pascheanum, Hypericum avicularіifolium subsp. byzantinum* are categorized as "VU". All four species of Trakya population are in good condition today.

Unless mitigated for, the removal of vegetation will cause direct mortality of individuals present. These are direct adverse impacts that have the potential to be permanent and irreversible. The removal of vegetation will also cause fragmentation to the remaining areas of habitats in the vicinity of the Project Area.

Construction activities including vegetation clearance and topsoil stripping, creation of camp sites, storage areas and quarries, creation of culverts, bridges and viaducts, presence of site preparation and construction vehicles has the potential to cause indirect adverse impact to surrounding habitats from runoff and dust. Construction activities, the importation of fill and the movement of people and vehicles can introduce invasive species and disease that may impact the remaining adjacent plant populations.

Table 9.31. Magnitude of Construction Impacts to Threatened and Red List Plant Species

Species	Magnitude
Galanthus plicatus subsp. byzantinus	High (Adverse)
Ornithogalum pascheanum	High (Adverse)
Hypericum avicularіifolium subsp. byzantinum	High (Adverse)
Crocus pestalozzae	High (Adverse)

Terrestrial Fauna

Amphibians-Reptiles

The construction phase of the Project will remove of the majority of vegetation within the Project Area including the entire habitat that supports amphivbian and reptile species. The removal of vegetation will cause direct mortality of individuals present. These are direct adverse impacts that are permanent and irreversible. The removal of vegetation will also cause fragmentation to the remaining areas of habitats in the vicinity of the Project Area.

All of amphibian and reptilian species identified in Seciton 5 are widely spread species on the global and national scale. According to IUCN criteria, all except T*estudo graeca* and *Emys orbicularis* species are considered as least risky level in LC status. *Testudo graeca* which is a terrestrial turtle species, has VU status and *Emys orbicularis* has NT status according to IUCN. Although *Testudo graeca* are not common on a global scale, it is a wide-spread turtle species in Turkey spreading in most parts of Thrace and Anatolia except the eastern Black Sea shores. It is common to many habitat types as well as steppe and agricultural fields. *Emys orbicularis* a water turtle species, which is widely spread on national and global scale, has been detected only in sampling point 5_8 during the field

studies. The road route passes through the edge of the small lake in the sampling point 5_8. In the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible.

Table 9.32. Magnitude of Construction Impacts to Amphibians and Reptiles

Species	Magnitude
Spur-thighed tortoise	Medium
European Pond Turtle	Medium
Green Toad	Low
Common Toad	
The European tree frog	
The agile frog	
Eastern Spadefoot	
The Balkan green lizard	
The green lizard	
Balkan wall lizard	
Common wall lizard	
The European legless lizard	
The European copper skink	
The dice snake	
East-Four-lined Ratsnake	
The Caspian whipsnake	
Aesculapian Ratsnake	
Smooth snake	
Dahl's whip snake	

Birds

Although there are no critical bird species- habitat and there are no bird colonies for breeding in the motorway route, habitat loss for bird species will occur due to the construction and operation activities of the Project. It is anticipated that the bird species will not be destroyed due to their flying abilities to alternative habitats.

Table 9.33. Magnitude of Construction Impacts to Birds

Species	Magnitude
Little Egret	Low
Little grebe	
Grey Heron Mallard	
Common Kestrel	
Common Sandpiper	
Little Owl	
Syrian Woodpecker	
Meadow Pipit	
White Wagtail	
Winter Wren	
European Robin	
Black Redstart	
Stonechat	
Isabelline Wheatear	
Eurasian Blackbird	
Common Chiffchaff	
Common firecrest	
Long-tailed Tit	
Coal Tit	
Blue Tit	
Great Tit	
Eurasian Jay	

Mammals

Among the identified species, *Miniopterus schreibersii* is in the category "NT" (Near Threatened) and Nannospalax xanthodon is in the category "DD" (Data Deficient = Insufficient data about populations). There are no mammalian taxa that are categorized as endangered by the IUCN (CR-EN).

According to IUCN, the bat species, which is in the category of "NT", is a species dependent on caves, means generally winters and rests in a cave. However, there was no cave ecosystem in which this species could rest, winter and/or reproduce within the motorway route and area of influence. However, it was taken on the species list because it was thought that the area could be used for feeding. Therefore, there will not be any adverse effects on the bat resting areas considered to use the project sites for feeding during road construction works.

Nannospalax xanthodon is found at all sampling points within the motorway route. Due to taxonomic problems, it is considered to be separated into several species. Thus, according to IUCN, it is in the category "DD". It is a species that has wide distribution in Anatolia and wide habitat preference. There will also be escapes due to noise and vibrations during construction activities, and it is a fact that some of them will be disappeared. However, this species that can even use roadside landscapes as a living space will reach the climax again after construction. As a result, the individuals who escaped and wasted during the activities will be replaced by new individuals after the activity.

Within Section 5 and its close vicinity, there are no important and special wintering and/or reproduction habitats for those of critical importance. There are no critically endemic species of mammals that are endangered and/or protected at the project site and in the close vicinity, internationally and nationally, and the mammal species that are detected are cosmopolitan species. Moreover, the number of species and number of individuals determined are relatively low.

Table 9.34. Magnitude of Construction Impacts to Terrestrial Mammals

Species	Magnitude
Crocidura suaveolens	Low (Adverse)
Rhinolophus ferrumequinum	
Rhinolophus hipposideros	
Myotis myotis	
Miniopterus schreibersii	
Sciurus anomalus	
Felis slivestris	

Freshwater Habitats and Species

Within the scope of the Project, some bridges on motorway will be established. Those construction activities will be cause some impacts on fish fauna. Therefore, in order not to adversely impact the species in the area significant mitigation measures against those impacts will be in place.

During the construction phase of the bridges that will be constructed increasing of sediment and/or turbidity in the waterbed can be a problem. Excessive sediment formation in

rivers can cause fish deaths by blocking their gills. Additionally, the effects of construction activities on river habitats will be as follows.

- To be changed water temperature,
- To be decreased sissolved oxygen,
- To be changed electrical conductivity,
- To be changed pH balance.

Table 9.35. Magnitude of Construction Impacts to Freshwater Fish Species

Species	Magnitude
Chub	Low

9.6.2.5. Impacts on Ecological Components within the Section 6

Terrestrial Flora

In the Section 6, 2 endemic species (*Ornithogalum pascheanum, Campanula lyrata subsp. lyrata*) were identified. *Ornithogalum pascheanum* which is regional endemic species is evaluated as “EN” according to IUCN Red List. Although *Campanula lyrata subsp. Lyrata* is widespread endemic species, it found quite rare in the Project area.

Table 9.36. Magnitude of Construction Impacts to Flora Species

Species	Magnitude
Ornithogalum pascheanum	High
Campanula lyrata subsp. lyrata	High

Terrestrial Fauna

Amphibians-Reptiles

All of amphibian and reptilian species identified in Seciton 6 are widely spread species on the global and national scale. According to IUCN criteria, all except *Testudo graeca* (VU) and *Emys orbicularis* (NT) are considered as least risky level in LC status. Although *Testudo graeca* are not common on a global scale, in Turkey it is a wide-spread turtle species spreading in most parts of Thrace and Anatolia except the eastern Black Sea shores. This terrestrial turtle species can be seen in many habitat types.

Emys orbicularis, a water dependent turtle species, is considered as Near Threatened (NT) according to IUCN criteria. This water turtle species, which is widely spread on national and global scale, has been detected only in sampling point 6_4 during the field studies.

Table 9.37. Magnitude of Construction Impacts to Amphibians and Reptiles

Species	Magnitude
Spur-thighed tortoise	Medium
European Pond Turtle	Medium
Green Toad	Low
Common Toad	
The European tree frog	
The agile frog	
Fire-belied toad	

Species	Magnitude
Southern Crested Newt	
The green lizard	
The Balkan green lizard	
Balkan wall lizard	
Common wall lizard	
Italian wal lizard	
Snake-eyed lizard	
The European legless lizard	
The European copper skink	
The dice snake	
The Caspian whipsnake	
Aesculapian Ratsnake	
East-Four-lined Ratsnake	

Birds

Although there are no critical bird species- habitat and there are no bird colonies for breeding in the motorway route, habitat loss for bird species will occur due to the construction and operation activities of the Project. It is anticipated that the bird species will not be destroyed due to their flying abilities to alternative habitats.

Table 9.38. Magnitude of Construction Impacts to Birds

Species	Magnitude
Little Egret Grey Heron Mallard Common Kestrel Little Owl Northern Long-eared Owl Syrian Woodpecker Meadow Pipit White Wagtail European Robin Black Redstart Stonechat Isabelline Wheatear Eurasian Blackbird Field fare Common Chiffchaff Coomon firecrest Long-tailed Tit Coal Tit Blue Tit Great Tit Greenfinch Goldfinch Corn Bunting	Low

Mammals

A total of 25 mammal species, 9 medium and large-sized and 16 small mammal species, were identified. Among these species, *Nannospalax xanthodon* is in the category "DD" (Data Deficient = Insufficient data about populations). There are no mammalian taxa that are categorized as endangered by the IUCN (CR-EN).

Nannospalax xanthodon is found at all sampling points within the motorway route. Due to taxonomic problems, it is considered to be separated into several species. Thus, according to IUCN, it is in the category "DD". It is a species that has wide distribution in Anatolia and wide habitat preference. There will also be escapes due to noise and vibrations

during construction activities, and it is a fact that some of them will be wasted. However, this species that can even use roadside landscapes as a living space will reach the climax again after construction. As a result, the individuals who escaped and wasted during the activities will be replaced by new individuals after the activity.

Within Section 6 and its close vicinity, there are no important and special wintering and/or reproduction habitats for those of critical importance. There are no critically endemic species of mammals that are endangered and/or protected at the project site and in the close vicinity, internationally and nationally, and the mammal species that are detected are cosmopolitan species. Moreover, the number of species and number of individuals determined are relatively low.

Table 9.39. Magnitude of Construction Impacts to Terrestrial Mammals

Species	Magnitude
Crocidura suaveolens	Low (Adverse)
Rhinolophus ferrumequinum	
Rhinolophus hipposideros	
Myotis myotis	
Sciurus anomalus	
Felis slivestris	

Freshwater Habitats and Species

Within the scope of the Project, some bridges on motorway will be established. Those construction activities will be cause some impacts on fish fauna. Therefore, in order not to adversely impact the species in the area significant mitigation measures against those impacts will be in place.

During the construction phase of the bridges that will be constructed increasing of sediment and/or turbidity in the waterbed can be a problem. Excessive sediment formation in rivers can cause fish deaths by blocking their gills. Additionally, the effects of construction activities on river habitats will be as follows.

- To be changed water temperature,
- To be decreased sissolved oxygen,
- To be changed electrical conductivity,
- To be changed pH balance.

Table 9.40. Magnitude of Construction Impacts to Freshwater Fish Species

Species	Magnitude
Sakarya Stone loach	Low
Paphlagonian Sportive Loach	
Galatian Spined Loach	
Sakarya Bleak	
Sakarya Barbel	
Nipple-lip scraper	
Western fourbarbel scraper	
Blacksea nase	
Sakarya Gudgeon	
Tuzla Chub	
Sakarya Chub	

9.6.3. Operaiton Phase Impacts on Ecology

Since the construction period effects are long-term effects (see Table 9.41), the duration of the operation period is also included. Therefore, the magnitude of impacts will also be valid for the operating period.

During operation phase there will be a number of potential impacts for ecological componants along the Motorway route. These impacts are included to operational traffic and the noise and visual disturbance, damage and or loss of fauna, barrier effect, changes in air quality and surface and ground water quality that may arise. Relating air quality and surface and ground water quality are described in Chapter 10 and Chapter 11 respectively.

It should be noted that after construction the baseline may have shifted considerably from those conditions pre-construction. As such impacts on species have been predicted adopting a precautionary approach that assumes species are still present along the Motorway.

Barrier effects: The barrier effect of roads is probably their greatest negative ecological impact. The dispersal ability of individual organisms is one of the key factors in species survival. The ability to move around a landscape in search of food, shelter or to mate, are negatively impacted by barriers that cause habitat isolation. Impacts on individuals affect population dynamics and often threaten species survival. The only way to avoid the barrier effect is to make infrastructure more permeable to wildlife by means of fauna passages, adapting engineering works or by the management of traffic flows. Carefully selecting the route of the road through the landscape can minimise the barrier problem.

The barrier effect due to the habitat fragmentation effect is the most important negative effect for small and large mammal species. The ability to move around a landscape in search of food, shelter or to mate, are negatively impacted by barriers that cause habitat isolation. Impacts on individuals affect population dynamics and often threaten species survival. The barrier effects can investigate in two points as follow:

- **Physical barrier**: For most of the larger mammals, transport infrastructure becomes a complete barrier only if fenced or if traffic intensity is high. For smaller animals, especially invertebrates, the road surface itself and road verges impose a considerably stronger barrier, either because the substrate is inhospitable or disturbance is too great.

- **Behavioural barrier:** Many larger wildlife species are known to avoid areas near roads related to the degree of human disturbance (traffic density, secondary development). Wild reindeer in Norway, for example, under-utilise their grazing resources within 5 km of roads. Other animals, such as small mammals and some forest birds, exhibit behavioural avoidance patterns particularly associated with crossing large open spaces.

Table 9.41. The relationship between road traffic density and the barrier effect on mammals (*cost341*)

Traffic density	Permeablity
Road with traffic below 1000 vehicles/day	Permeable to most wildlife species
Roads with 1000 to 4000 vehicles/day	Permeable to some species but avoided by more sensitive species.
Roads with 4000 to 10000 vehicles/day	Strong barrier, noise and movement will repel many individuals. Many trying to cross the road become road casualties
Motorways with traffic levels above 10000 vehicles/day	Impermeable to most species.

Planned motorway traffic flow range between 74.633- 181.488 according to Feasibility Report prepared for the North Marmara Motorway Project. Within the scope of the Motorway Project traffic flow can be impermeable for mammal species. However, planned culvents which will be used as animal pass will prevent to mortality due to the traffic flow.

Traffic mortality will be considered responsible for just a small proportion (1-4%) of the total mortality of common species (rodents, rabbits, foxes, sparrows, blackbirds, etc.). However, unless mitigation measures are taken, for more sensitive species, traffic can be a major cause of mortality and a significant factor in local population survival.

If mitigation measures are not taken for noise control, noise impacs would be disturbed a large area of terrestrial habitats. Whilst smaller species of mammal may not be significantly affected by disturbance, larger and more reclusive species such as wild cat are likely to avoid the vicinity of the motorway.

Artificial lighting can affect to bats. Lights can also attract insects (mercury lamps) and, in turn, increase the local densities of bats along roads resulting in increased bat mortality. Road lights often attract insects and as a consequence bats or nocturnal birds which hunt them.

Fauna casualties: Mortality is probably the best-known impact of traffic on wildlife. Millions of individuals of a wide range of wildlife species are killed on roads mostly. Large numbers of fauna casualties may not necessarily imply a threat to populations, but indicate that the species involved are locally abundant and widespread.

Disturbance and pollution: Road development and operation alter the ecological characteristics of adjacent habitats, which may induce changes in the way they are used by wildlife. Many of these changes can affect habitat quality at a significant distance from the infrastructure development. The following are the main types of disturbance associated with transport infrastructure.

Chemical pollution: A wide range of pollutants are derived from road traffic and the road surface. Motor exhausts give rise to, for example, carbon monoxide, nitrogen oxides, sulphur dioxide, hydrocarbons including polycyclic aromatic hydrocarbons (PAH), dioxins and particles. Vehicles are sources of heavy metals such as lead, zinc, copper and cadmium. Sodium and chloride pollution comes from de-icing salt. The chemicals pollute surface and groundwater, soil and vegetation along roads. Compounds containing nitrogen and sulphur contribute to acidification and eutrophication. Pollutants can cause damage or disturbance to biological functions at several organisational levels, from cells through individuals to populations.

Noise and vibration: The disturbance from noise is mainly influenced by the type of traffic, traffic intensity, road surface properties, topography, rail type and the structure and type of the adjacent vegetation. Geological and soil characteristics influence the magnitude and spread of vibrations. Some species avoid noise-disturbed areas. For example, in the Netherlands, bird densities were shown to decline where the traffic noise exceeded 50 dBA, whereas birds in woodland were sensitive to noise levels as low as 40 dBA. Some species breed in normal densities in disturbed areas but with lower breeding success.

Lighting and visual disturbances: Artificial lighting can affect growth regulation in plants, disturb breeding and foraging behaviour in birds or influence the behaviour of

nocturnal amphibians. Lights can also attract insects (mercury lamps) and, in turn, increase the local densities of bats along roads resulting in increased bat mortality.

9.7. Mitigation Measures

The following section details the mitigation measures are detailed the following sections to avoid, reduce and offset potential impacts for ecology and biodiversity from the Project. These measures are described under two headings: the construction phase and the operation phase.

9.7.1. Construction Phase

The general measures to be taken to the effects on the biologic environment from the Project activities during the construction phase are given below. "Mitigation measures for Ecology and Biodiversity within the Sections" topic is provided as measures for ecological compounds for each Section (4-5-6).

9.7.1.2. General Mitigations

General mitigation measures will be implemented during the construction phase to protect ecological receptors as follow:

- Study areas will be clearly defined before vegetation clearance where construction activities will be taking place,
- Access roads will be clearly defined before the onset of construction activities in order not to harm flora elements that are outside the construction sites,
- Project construction sites and access roads will be separated from other areas with appropriate signboards, signs and fences. Therefore, staff and vehicle access to the area will be limited to the construction site,
- Vegetation clearance will take place gradually, so fauna elements will be allowed to leave construction sites,
- During vegetation clearance, equipment will be selected so as not to harm plant roots,
- Intrusion of any invasive flora species into the project area and its surroundings will be prevented. For this purpose, especially vehicles used for vegetation clearance and/or plant transfer will be checked beforehand,
- Construction waste generated due to project activities will first be stored at designated storage areas and then disposed. Solid waste will not be allowed to be left at natural habitats,
- Measures to reduce noise are provide in Chapter 11 Noise for details,
- Measures to reduce dust and air pollution are provide in Chapter 10 Air Quality and Climate Change for details,

- Project workers will not be allowed to bring any live animals or plants into the construction site to avoid the risk of pest/invasive species establishing in the Project Area,

9.7.1.3. Mitigation Measures for Ecology and Biodiversity within the Sections

Sections 4

The deciduous forest habitats, maquis and pseudomaquis found on the route are susceptible. Especially, these types of habitats are found in sampling point 4_1, 4_2 and 4_4 (km 131+200, km 137+200; 1+300, 149+600). For this reason, the construction will be constructed without damage to the habitats which outside the motorway route.

In order to minimize of the critical species' population losses, bulbs of *Crocus pestalozzae* (endemic) will be collected and transported to areas that will not be affected by the activity in March-April. Other endemic *Cirsium polycephalum* is a thorny species and has no landscape value. For this reason, seeds of the species will be collected in August-September and planted in appropriate habitats.

According to IUCN criteria, all except *Testudo graeca* (VU) and *Emys orbicularis* (NT) are considered as least risky level in LC status. Although *Testudo graeca* are not common on a global scale, in Turkey it is a wide-spread turtle species spreading in most parts of Thrace and Anatolia except the eastern Black Sea shores. As a matter of fact, in Section 4, this species was identified in 7 different EUNIS habitat types. *Emys orbicularis*, an indigenous tortoise species, is considered as Near Threatened (NT) according to IUCN criteria. This water turtle species, which is widely spread on national and global scale, has been detected only in 4_4 (km 149+600) during the field studies. The road route passes through the edge of the small lake in the sampling point 4_4. In the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible.

It is important that in the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible.

The deciduous forest habitats, riparian habitats and wet meadows in natural habitats on the route are susceptible to feeding, breeding and breeding areas for birds. For this reason, the water regime of riparian and wet meadow habitats outside of the road route, which road construction can affect and will be protected. Otherwise, even if out of the route, feeding habitats of birds which directly and/or indirectly dependent on the water may be impaired, if such sensitive habitats water regimes are reduced and/or interrupted.

In addition, in Section 4, in the field studies conducted at 4_2-3-4-5 sampling points, it was determined that a part of this route was subjected to anthropogenic influences and that the natural deciduous maquis and forest habitats were cut off. Resulting to anthropogenic influences in a semi-natural structure was created. In this section, natural deciduous maquis and forest habitats are particularly suitable for feeding, nesting and breeding areas for birds. Construction activities will be carried out gradually with the aim of providing the time and energy for bird to leave the area due to the habitat losses, noise, dust formation and vehicle-human traffics for construction activities.

The planned motorway passes very close to east border of Ballikayalar Natural Park. Especially, sampling point 4_5 and 4_6 are located adjacent border of Ballikayalar Natural Park. This area, where large mammal populations (especially jackal and roe deer) are healthy, will be monitored with camera traps during construction and subsequent work. Camera trapping will be done by using 1x1 grid system (one camera trap per one grid) and will be continued at least 45 days.

Section 5

The deciduous forest habitats found on the route are susceptible. Especially, these types of habitats are found in sampling points 5_1-2-7-9-11-12 (around km 152+500, 154+250, 169+550, 175+800; 0+250, 181+900; 0+250, 187+600). For this reason, the construction will be constructed without damage to the habitats which outside the motorway route.

In order to minimize of the critical species' population losses, bulbs of *Galanthus plicatus subsp. byzantinus, Ornithogalum pascheanum* and *Crocus pestalozzae* will be collected and transported to areas that will not be affected by the activity in March-April. Collecting seeds of other regional endemic *Hypericum aviculariifolium subsp. byzantinum* and passing them to the gene bank reduces the damage to the minimum level.

Although *Testudo graeca* are not common on a global scale, in Turkey it is a wide-spread turtle species spreading in most parts of Thrace and Anatolia except the eastern Black Sea shores. This terrestrial turtle species can be seen in many habitat types. As a matter of fact, in Section 5, this species was identified in 4 different EUNIS habitat types. *Emys orbicularis*, an indigenous tortoise species, is considered as Near Threatened (NT) according to IUCN criteria. This water turtle species, which is widely spread on national and global scale, has been detected only in 5_8 (Sipahiler Pond). The road route passes through the edge of the small lake in the sampling point 5_8. In the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible. In the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible. It is important that in the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible. Additionally, sampling point 5_8 is located out of the Motorway route.

In Section 5, field studies at sampling points and storage areas have determined that a large portion of this route is not subject to anthropogenic effects and is stabilized (stable, seated) natural deciduous maquis and forest habitats at the climax stage. This natural, stable (stable, seated) and forested areas at the climax stage are particularly sensitive feeding, nesting and breeding areas, especially for small passerine forest birds. As a result of the habitat losses, noise, dust formation and vehicle-human trafficking which will be the result of the construction activities, the construction activities will be made as a tentative purpose and to provide the necessary time and energy to the birds to leave the area.

Among the identified species, *Miniopterus schreibersii* is in the category "NT" (Near Threatened) and *Nannospalax xanthodon* is in the category "DD" (Data Deficient = Insufficient data about populations). There are no mammalian taxa that are categorized as endangered by the IUCN (CR-EN).

According to IUCN, the bat species, which is in the category of "NT", is a species dependent on caves, means generally winters and rests in a cave. However, there was no cave ecosystem in which this species could rest, winter and/or reproduce within the motorway route and area of influence. However, it was taken on the species list because it was thought that the area could be used for feeding. Therefore, there will not be any adverse effects on the bat resting areas considered to use the project sites for feeding during road construction works.

Nannospalax xanthodon is found at all work stations within the motorway route. Due to taxonomic problems, it is considered to be separated into several species. Thus, according to IUCN, it is in the category "DD". It is a species that has wide distribution in Anatolia and wide habitat preference. There will also be escapes due to noise and vibrations during construction activities, and it is a fact that some of them will be wasted. However, this species that can even use roadside landscapes as a living space will reach the climax again after construction. As a result, the individuals who escaped and wasted during the activities will be replaced by new individuals after the activity.

In Section 5 and its close vicinity, there are no important and special wintering and/or reproduction habitats for those of critical importance. There are no critically endemic species of mammals that are endangered and/or protected at the project site and in the close vicinity, internationally and nationally, and the mammal species that are detected are cosmopolitan species. Moreover, the number of species and number of individuals determined are relatively low. Therefore, the effects of construction activites to be done in these areas will not be irreversible in terms of mammal species.

Section 6

The deciduous forest habitats and broadleaved swamp woodland on acid peat found on the route are susceptible. Therefore, it is important that when construction activies conducted around the floodplain forestlands, water flow regime and direction will not changed. Especially, these types of habitats are found around km 202+500, 207+000, 208+700, 217+500, 242+000, 251+111; 1+350. For this reason, the construction will be constructed without damage to the habitats which outside the motorway route. In order to minimize of the critical species' population losses, bulbs of *Ornithogalum pascheanum* will be collected and transported to areas that will not be affected by the activity.

All of amphibian and reptilian species identified in Section 6 are widely spread species on the global and national scale. According to IUCN criteria, all except *Testudo graeca* (VU) and *Emys orbicularis (*NT) are considered as least risky level in LC status. Although Testudo graeca are not common on a global scale, in Turkey it is a wide-spread turtle species spreading in most parts of Thrace and Anatolia except the eastern Black Sea shores. This terrestrial turtle species can be seen in many habitat types.

Emys orbicularis, a water dependent turtle species is considered as Near Threatened (NT) according to IUCN criteria. This water turtle species, which is widely spread on national and global scale, has been detected only in 6_4 during the field studies. The road route passes through the edge of the small lake in the 6_4. In addition, there are floodplain forestland, which contain many amphibians and reptiles in the 6_4. In the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds and floodplain areas are given as little damage as possible.

In Section 6, field studies at sampling points and storage areas have determined that a large portion of this route is not subject to anthropogenic effects and is stabilized (stable, seated) natural leaf-making maquis and forest habitats at the climax stage. This natural, stable (stable, seated) and forested areas at the climax stage are particularly sensitive feeding, nesting and breeding areas, especially for small passerine forest birds. As a result of the habitat losses, noise, dust formation and vehicle-human trafficking which will be the result of the construction activities, the construction activities will be made as a tentative purpose and to provide the necessary time and energy to the birds to leave the area.

A total of 25 mammal species, 9 medium and large-sized and 16 small mammal species, were identified. Among these species, Nannospalax xanthodon is in the category "DD" (Data Deficient = Insufficient data about populations). There are no mammalian taxa that are categorized as endangered by the IUCN (CR-EN).

Nannospalax xanthodon is found at all sampling points within the motorway route. Due to taxonomic problems, it is considered to be separated into several species. Thus, according to IUCN, it is in the category "DD". It is a species that has wide distribution in Anatolia and wide habitat preference. There will also be escapes due to noise and vibrations during construction activities, and it is a fact that some of them will be wasted. However, this species that can even use roadside landscapes as a living space will reach the climax again after construction. As a result, the individuals who escaped and wasted during the activities will be replaced by new individuals after the activity.

In Section 6 and its close vicinity, there are no important and special wintering and/or reproduction habitats for those of critical importance. There are no critically endemic species of mammals that are endangered and/or protected at the project site and in the close vicinity, internationally and nationally, and the mammal species that are detected are cosmopolitan species. Moreover, the number of species and number of individuals determined are relatively low. Therefore, the effects of construction activites to be done in these areas will not be irreversible in terms of mammal species.

Aquatic Environment (for all Sections)

Most of the fish species that is exist in rivers on motorway route belongs to family Cyprinidae. The breeding period of this species belong to this family and for the other species of different families detected during the fields surveys is between the months of April and June –peaking in May-. Therefore, it is recommended that construction activities should be carried out carefully and impacts caused by human activities should be minimized especially in April, May and June in order not to harm the species that is exist in the river.

The following mitigation measures are recommended in order to minimize the potential impacts of the Project on aquatic fauna and species:

- Mixing any chemical substances, that is used in the construction area, in waterbed and/or aquatic ecosystems will be prevented.
- Excavation materials will not be dumped onto riverbed.
- Especially during the breeding season of fish species (April-June), any intervention on riverbed will be prevented.

- During the construction works that have to carried out in creek and/or river beds, sediment trap should be used and/or waterbed should be derivated for a short time.

- It will be attentioned that the bottom structure of the rivers/streams/creeks (sand, stone, gravelled, etc.) will recycle into natural structure after constructions in the rives.

- The natural structure of the riparian vegetation will be preserved which forms the spawning and sheltering area for many aquatic organisms.

In case any construction sources impact on rivers and/or streams within the scope of the Project, following criteria of water quality sould be taken into consideration and should be monitored for the continuity of aquatic species.

- Water temperature is one of the most important factors impacting the life in aquatic ecosystems and it changes according to seasons, circulation of air and depth. Increase in temperature decrease the gas solubility (such as oxygen and corbondioxide) in water (*Polat, 1997*). In addition, increase in temperature can cause change in density and also viscosity of water. Beside, temperature affects species distribution, feeding, spawning and general behavior. Most species of Cyprinidae (carps) stop feeding behavior when the temperature drops under 8-10ºC, and start breeding at temperatures above 15ºC (*Nikolskii, 1963*).

- Dissolved oxygen (DO) is another parameter that is recommended to be continuously monitored during the construction and operation phases of the Project. It is quite important for organisms that are dependent on aerobic metabolism. Amount of dissolved oxygen decreases with increasing temperature and organic matter concentrations. It increases with increasing air pressure (*Yaramaz, 1992*). In addition, factors like salinity and flow rate also affect amount of dissolved oxygen (Wetzel, 1983). Bremond et Vuichard (1973), states that for Cyprinidae to survive in a habitat the dissolved oxygen concentration should be at least 5 mg/l.

- Electrical conductivity (EC) value, which defines the electrical transmission capability of water ions, and it is directly changes with many parameters such as anion, cation, salt density, temperature, akcalinity, dissolved solids in the water. Besides, Bremond et Vuichard (1973) states that electrical conductivity is an indicator of dissolved matter and fluctuates between 150 and 750 µS/cm in inland waters suitable for fish species. When it reaches a concentration of 3,000 µS/cm, it causes disruption of ecological balance in water.

- One of the water quality parameters is pH, which is an indicator of acidic and basic characteristics of water. It is very important in terms of fish life and productivity. Freshwater fish usually prefer pH levels between 6.5 and 8.5.

9.7.2. Operation Phase

The main impact of the motorway Projects during the operation phase is barrier effects and collisions. Some variety of measures designed to reduce the number of animals killed on or around transport infrastructure and to eliminate the barrier effect. Measures to be taken for impacts on ecology and biodiversity during operation phase are presented below.

Viaducts and Culverts

General description and targets in hilly areas a viaduct is a good technical solution to lead a road from one side of a valley to the other. Valley bottoms are preferred routes for many animals, in particular when there is a watercourse present.

In these cases measures for wildlife only have to ensure that previously existing movement corridors of animals are preserved or enhanced.

Viaducts are particularly valuable to preserve ecosystems. They are favourable for invertebrates and small vertebrates, which are strongly linked to particular vegetation types and hardly use underpasses without plant cover. 10 viaducts will be established within the scope of the Asian part of the Motorway Project. On the other hand, tunnels and viaducts will be established for passage through forestry. Especially, sampling point 5_7 is located between two viaducts (V-03-V-04), 5_11 is located between tunnels (T-01-T-02), 5_12 is located to near tunnel (T-04). Therefore, these sensitive habitats will effect restrictedly. Addition to these, ecological bridge will be formed to Section 5, km 161+870.

The area where the ecological bridge planned to be constructed on the Section 5 km 161+870 is located, has the *Pinus nigra* forest and the deciduous forest habitat structure. These forests with 90-95% coverage and 4-10 meters of length are important habitats especially for large mammals. Naturally, it is not possible to create a habitat of tree species on ecological bridges. Because soil depth does not allow it. A habitat consisting of species of shrubs must be formed and within this habitat formed pathways will be left to be used by 2-3 animals.

It has been proposed to construct an ecological bridge to avoid habitat fragmentation and gene exchange between species. Reptiles and amphibians beings are expected to use transition regions with similar vegetation to neighboring habitats. Therefore, reptiles and amphibians will tend to use ecological bridges to pass. For birds, the ecological bridge is insignificant. Especially for mammals, this bridge has an important function.

It is known that mammals with omnivorous nutrient preferences, such as roe deer, identified in the habitats in the proposed area, use such bridges for transitional purposes. Carnivorous mammals prefer culverts, while omnivor large-scale mammals use such bridges. Bridge over vegetation is thought to allow for the passage of some small mammals, such as lesser mole. It should be preferred that the length of the bridge structure is below 200 meters. The minimum width of 30 m is important for safe passage of mammals. It is thought that the location and design of the ecological bridge to be constructed at 161 + 870 km is suitable for the transition of animals. Design of the ecological bridge are shown in Figure 9.5. However, in order to observe the use of the ecological bridge by the animal species, it is suggested that a specialist after the bridge construction use phototraps and monitor whether the species are using bridges. It will allow for the passage of wild animals between the two sides of the road in Section 5. Thus the fragmentation of the habitat in this region will be compensated. The effectiveness of the constructed ecological bridge will be monitored by the phototraps to be installed on both sides of the bridge. During the field surveys in Section 5 around the ecological bridge two critical species were observed; *Galanthus plicatus* and *Testdudo gracea.*

Culverts for animals are primarily constructed as safe crossing points for mammals. They are a suitable solution particularly in hilly areas or where the infrastructure is built on an embankment. Target species are usually mammals. Smaller mammals may readily use these

culverts as well. Culverts are less suitable for some flying species and for species guided in their movements by light (many invertebrates). Culverts are also less suitable for connecting habitats, because of the lack of light and water, which allows only limited growth of vegetation.

Some of culverts are designed to allow the flow of water and may contain small streams or drainage water. Some culverts carry water all year round, others only temporarily, e.g. after heavy rainfall or during the period of snow melt. When culverts are dry terrestrial animals may use them; this often requires only little adaptation. In culverts which carry water extra installations for terrestrial animals are usually needed. Modified culverts have been shown to be used by small mammals in particular, including the smaller carnivores (in addition to fish and other aquatic species).

There are 158 culverts within the Section 4 which will be used as stream/rives passage and animal passages (especially medium and large mammal species). 60 culverts located in Section 5 and 177 culverts located in Section 6.

Totally 395 culverts will be established used as both water flow and animal passage along the European part of the Motorway route. These culverts number will suffice for animal passage (mammals and fishes).

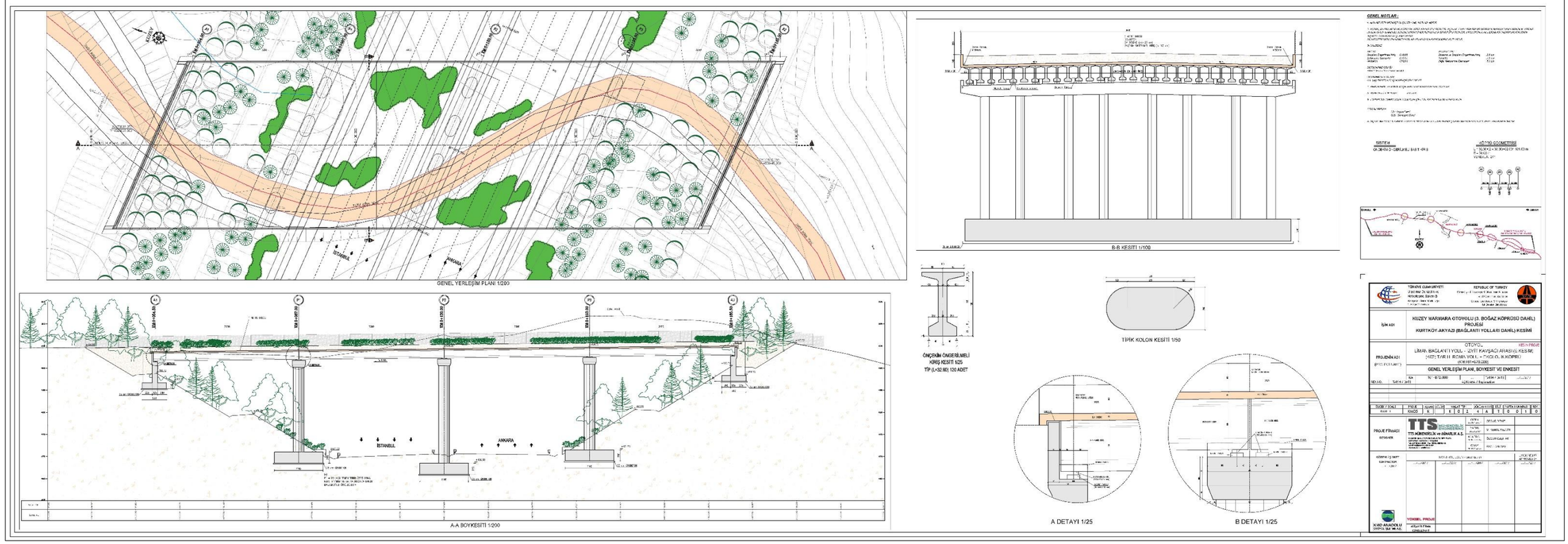


Figure 9.5. Ecological Bridge Design

Fences

Fences are erected to prevent the access of animals onto roads. They are mostly constructed to reduce accidents due to collisions between large mammals and cars, but also to reduce the number of smaller animals killed on the roads. The disadvantage of fences is that they increase the barrier effect. Where fences or other barriers are erected, it has to be ensured that the species concerned have enough opportunities to cross the road. In most cases, fences must therefore be combined with wildlife passages. In these cases they fulfill an important role in guiding animals to the crossing points. When traffic safety is not an issue fences should only be erected where animal mortality might threaten a population otherwise the barrier effect might have worse effects on the survival of the populations in the long term than the mortality due to traffic.

In general, wildlife fences should be erected only in places where the number of animals killed is high or where there is a high risk of accidents involving wildlife. This is mostly the case along high-speed roads. On ordinary roads with low traffic density fences should only be erected at high risk spots.

Fences should always be built on both sides of a road. The ends of the fences are danger points: animals may go round the end of the fence and get trapped on the road. Fences should therefore end at structures like bridges. Where only a stretch of the road is fenced in they should be extended 500 m or more beyond the danger area. On roads with relatively little traffic, openings in fences can be provided at locations where animals can easily cross and where crossing animals are well visible to drivers.

For conventional wildlife fences, a smaller mesh size in the bottom half or third of the fence is recommended. Distance between horizontal wires: bottom: 50-150 mm, top: 150-200 mm. Distance between vertical wires: 150 mm. Wires should have a diameter of at least 2.5 mm and should consist of rust-free material. The bottom wire should lie directly on the ground and be fixed to prevent animals from crawling under the fence. Where the ground is uneven, it has to be levelled out to avoid gaps e.g. due to holes in the ground. Special care should be given to places where fences cross ditches.

Within the scope of the Asian part of the Motorway Projects fences will be used in accordance with the practices mentioned above to prevent animals from colliding with other vehicles on the road especially in areas where vehicle traffic will be intense.

Warning signs

Warning signs aim at influencing the behavior of drivers in order to reduce the number and severity of collisions between large mammals and cars. Standard traffic signals are placed in areas where collisions often occur. They also exist for amphibians, waterbirds and other animals. Warning signs very suffice way for animal mortality especially large mammals and will be used along the Motorway where mammal species are intensively present such as around km 208+800, km 175+700, km 150+500.

Lights

Road lights often attract insects and as a consequence bats or nocturnal birds which hunt them. This results in high mortality for the insects as well as for their predators. In sensitive areas the need to establish road lights should therefore be balanced against the consequences for nature. To prevent collisions of insects the use of sodium lights is recommended.

Monitoring

Monitoring studies will be carried out to examine the habitats and flora species affected by the operational phase and to examine adaptations determined critical species (*Cirsium polycephalum, Galanthus plicatus subsp. byzantinus, Ornithogalum paschaenum, Crocus pestalozzae, Hypericum aviculariifolium subsp. byzantinum, Leucıjum aestivum, Cyclamen coum var. coum*) that will be collected and planted in alternative areas. In addition, monitoring studies will be carried out in order to examine adaptation of fauna species with mitigation measures that will be taken and whether amphibians, reptiles, mammals and bird species are affected from operation activities. Especially, ecological bridge which will be established in km 161+870 will be monitored in order to monitor whether the fauna species are using this bridge.

9.7.3. Summary of Assessment and Residual Impacts

Table 9.42 provides a summary on the ecology and biodiversity assessments. Significance of the identified impacts before and after the implementation of mitigation measures are summarized in this table.

Table 9.42. Summary of the Ecology and Biodiversity Assessments

Affected Ecosystem Component		Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
					Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Habitat Types	C1.2- Permanent mesotrophic lakes, ponds and pools	Land preparation and construction	-Damage or loss of habitats -Loss of important plant species -Direct incidental killing of fauna -Loss of habitat for faunal species -Increase in noise, visual and vibration which may cause disturbance or displacement of fauna Invasive species -Loss of ecosystem services	Adverse	Restricted	Long	Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)	Irreversible	One-off	Moderate	Low	Low (B1)	• Intrusion of any invasive flora species into the project area and its surroundings will be prevented. For this purpose, especially vehicles used for vegetation clearance and/or plant transfer will be checked beforehand, • Project workers will not be allowed to bring any live animals or plants into the construction site to avoid the risk of pest/invasive species establishing in the Project Area, • Measures to reduce noise, dust and air quality will be taken. • Project construction sites and access roads will be separated from other areas with appropriate signboards, signs and fences. Therefore, staff and vehicle access to the area will be limited to the construction site, • Construction waste generated due to project activities will first be stored at designated storage areas and then disposed. Solid waste will not be allowed to be left at natural habitats. • The deciduous forest habitats, maquis and pseudomaquis found on the route are susceptible. Especially, these types of habitats are found in sampling point 4_1, 4_2 and 4_4 (km 131+200, km 137+200; 1+300, 149+600). For this reason, the construction will be constructed without damage to the habitats which outside the motorway route. • .The deciduous forest habitats found on the route are susceptible. Especially, these types of habitats are found in sampling points 5_1-2-7-9-11-12 (around km 152+500, 154+250, 169+550, 175+800; 0+250, 181+900; 0+250, 187+600). For this reason, the construction will be constructed without damage to the habitats which outside the motorway route. • The deciduous forest habitats and broadleaved swamp woodland on acid peat found on the route are susceptible. Therefore, it is important that when construction activies conducted around the floodplain forestlands, water flow regime and direction will not changed. Especially, these types of habitats are found around km 202+500, 207+000, 208+700, 217+500, 242+000, 251+111; 1+350. For this reason, the construction will be constructed without damage to the habitats which outside the motorway route.	Low
	E 3.4- Moist or wet eutrophic and mesotrophic grassland						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
	E1.3- Mediterranean xerophilous meadow						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	Low	Low (B1)		Low
	F5.2- Maquis						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
	F5.3- Pseudomaquis						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
	G1.2- Mixed riparian forests						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
	G3.F- Highly artificial coniferous plantations						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	Low	Low (B1)		Low
	G1.A- Meso and Eutrophic Mixed Decidiuous Forests						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
	G1.C- Highly artificial broadleaved deciduous forestry plantations						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
	G1.5- Broad-leaved acidic marsh forest						Low (Only the intersection of this habitat with the Project area will disappear. The habitat is extensively present in the same area and it is also in the immediate vicinity of the Project area)			Moderate	High	High (B3)		Medium
Species (Flora)	*Cirsium polycephalum*	Land preparation and construction	Destroying/ disappearing	Adverse	Restricted	Long	High (Local endemic species and rare distributed within the Project area)	Irreversible	One-off	Major	High	High (A3)	• To collect in August-September and placed in appropriate habitats.	Medium
	Galanthus plicatus						High (Local endemic species and rare distributed			Major	High		• To collect and placed in appropriate habitatsin March-April.	

Affected Ecosystem		Project	Definition of	Type of	Impact Magnitude						Sensitivity/ Value of	Impact	Measures to be Taken	Significa
	subsp. byzantinus						within the Project area)							
	Crocus pestalozzae						High (Local endemic species and rare distributed within the Project area)			Major	High		• To collect and placed in appropriate habitatsin March-April.	
	Campanula lyrata subsp. lyrata						High (Regional endemic species and quite rare distributed within the Project area)			Major	High		• Although it is endemic, it is a widespread species. Also in LC category according to IUCN. Since this species has distribution in almost every region in Turkey, no measures have been proposed.	
	Ornithogalum pascheanum						High (Local endemic species and rare distributed within the Project area)			Major	High		• To collect and placed in appropriate habitatsin March-April.	
	Hypericum aviculariifolium subsp. byzantinum						High (Local endemic species and rare distributed within the Project area)			Major	High		• To collect in August-September and placed in appropriate habitats.	
(Amphibian-reptile)	Spur-thighed tortoise	Land preparation and construction	Destroying/ disappearing	Adverse	Restricted	Long	Medium (Limited ability to move, Vulnerable (VU) species by IUCN and abundant distributed within the Project area)	Irreversible	One-off	Moderate	Medium	Medium (B2)	• The road route passes through the edge of the small lake in the sampling point 4_4, 5_8 and 6_4. In the construction process, protection of populations of species dependent on aquatic habitat will be ensured if such ponds are given as little damage as possible.	Low
	European Pond Turtle						Medium (Limited ability to move, Near Threaten (NT) species by IUCN and abundant distributed within the Project area)	Irreversible	One-off	Moderate	Low	Low (B1)		Low
	The other amphibian-reptile species						Low (not endemic, non-protection status and not very rare distribution)							
(Birds)		Land preparation and construction	Destroying/ disappearing	Adverse	Restricted	Long	Low (not endemic, non-protection status and not very rare distribution)	Irreversible	One-off	Moderate	Low	Low (B1)	• Construction activities will be carried out gradually with the aim of providing the time and energy for bird to leave the area due to the habitat losses, noise, dust formation and vehicle-human traffics for construction activities in (partly) natural habitats which is cover sampling points 4_2-3-4-5.	Low
(Mammals)		Land preparation and construction	Destroying/ disappearing	Adverse	Restricted	Long	Low (not endemic, non-protection status, not migration and not very rare distribution)	Irreversible	One-off	Moderate	Low	Low (B1)	Construction Phase; • The planned motorway passes very close to east border of Ballikayalar Natural Park. Especially, sampling point 4_5 and 4_6 are located adjacent border of Ballikayalar Natural Park. Camera trapping will be done by using 1x1 grid system (one camera trap per one grid) and will be continued at least 45 days.	Low
													Operation Phase; • Totally 395 culverts will be established used as both water flow and animal passage along the Asian part of the Motorway route • Fences will be used to prevent animals from colliding with other vehicles on the road especially in areas where vehicle traffic will be intense. • Warning signs will be used along the Motorway • To prevent collisions of insects the use of sodium lights will be used. • Ecological bridge will be established to minimize the habitat fragmentation. • Tunnels and viaducts will be established for passage through forestry.	

Affected Ecosystem		Project	Definition of	Type of	Impact Magnitude						Sensitivity/ Value of	Impact	Measures to be Taken	Significa
(Freshwater species)	Chub	Land preparation and construction	Destroying/ disappearing	Adverse	Restricted	Long	Low (not endemic and not very rare distribution but Vulnerable (VU) species by IUCN)	Irreversible	One-off	Moderate	Low	Low (B1)	• Excavation materials will not be dumped onto riverbed, • Mixing any chemical substances, that is used in the construction area, in waterbed and/or aquatic ecosystems will be prevented. • The natural structure of the riparian vegetation will be preserved which forms the spawning and sheltering area for many aquatic organisms.	Low
	Sakarya Stone loach						Low (endemic but abundante)							
	Paphlagonian Sportive Loach													
	Galatian Spined Loach													
	Sakarya Bleak													
	Sakarya Barbel													
	Nipple-lip scraper													
	Western fourbarbel scraper													
	Blacksea nase													
	Sakarya Gudgeon													
	Tuzla Chub													
	Sakarya Chub													

9.8. Ecosystem Services within the Project Area

Ecosystem Services which are the goods provided by ecosystems upon are the benefits that people obtain from ecosystems. Two priority types are described Ecosystem Services that were detailed in "9.2.3. Standards and Guidelines for International Requirements / Ecosystem Services Review (ESR)". Potentially important ecosystem services for this project are described below.

Table 9.43. Ecosystem Services

Provisioning Services :	**Relevance to Study Area**	**Section**
Agricultural lands and fruit gardens supply the services for feeding for human population	Priority 1	Section 4, Section 5, Section 6
Mushrooms collected from natural forests, strawberry tree (*Arbutus unedo*), wild strawberry (*Fragaria vesca*), common medlar (*Mespilus germanica*), nut (*Coryllus avellana*) and Eastern borage (*Trachystemon orientale*) are consumed by local community.	Priority 1	Section 4, Section 5, Section 6
Both industrial timbers and fire wood are collected from natural plantation forests by local communities.	Priority 1	Section 4, Section 5, Section 6
Running and still surface waters supply water for animals and also used for agricultural irrigation purposes. Besides these water bodies regulate the water regime in the district.	Priority 1, Priority 2	Section 4, Section 5, Section 6
Natural plantation forests constitute the shelter, breeding and feeding areas for many birds, mammalians, reptiles and insect species.	Priority 1, Priority 2	Section 4, Section 5, Section 6
Regulatory Services (ecological functions):	**Relevance to Study Area**	**Section**
Carbon dioxide is used by vegetation and the trees and converted to oxygen required by human population.	Priority 1, Priority 2	Section 4, Section 5, Section 6
Vegetation controls erosion and prevents floods.	Priority 1	Section 4, Section 5, Section 6
Deep spot forests keep the excessive storm water run-off and protect the agricultural lands.	Priority 1	Section 4, Section 5, Section 6
Through the vegetation storm water run-off is avoided and storm water filtrates to subsoil. At the same time vegetation reduces the amount of sediment transferred to lakes and seas.	Priority 1	Section 4, Section 5, Section 6
Cultural services (in other words, non-economic benefit s)	**Relevance to Study Area**	**Section**
Natural forest areas are appropriate as resting circumstances for people.	Priority 1	Section 4, Section 5, Section 6
Natural forests provide nice visual landscape views.	Priority 1	Section 4, Section 5, Section 6
Natural habitats pose a very important mission for sustaining habitats for critical species.	Priority 1	Section 4, Section 5, Section 6
Natural forests act as genetic reserve areas since they inhabit the natural ornamental plants (*Galanthus plicatus subsp. byzantinus, Leucojum aestivum, Primula vulgaris, Helleborus orientalis, Ruscus aculeatus* etc.).	Priority 1	Section 4, Section 5, Section 6

9.9. Summary of Ecological Componants

Results of ecology and biodiversity studies are summarized as following:

9.9.1. Terrestrial Flora and Vegetation

The Asian part of North Marmara motorway is composed of Sections 4, 5 and 6. As a result of field studies carried out in February- March and June, 219 species and subspecies levels of taxa belonging to 67 families were detected in three sections. 6 of them are endemic (*Cirsium polycephalum, Galanthus plicatus subsp. byzantinus, Ornithogalum*

paschaenum, Crocus pestalozzae, Hypericum aviculariifolium subsp. byzantinum, Campanula lyrata subsp. lyrata), and 2 species are rarely distributed (*Leucıjum aestivum*, *Cyclamen coum var. coum*) although they are not endemic. IUCN categories and the distributional coordinates of the species in the route line that are endemic and rarely distributed but not endemic are shown in Table 9.44.

Table 9.44.Distribution of Endemic Species and Non endemic Species which are Rarely Distributed

Taxon	Turkkish Name	Threaten Status (Red Book, 2000)	Coodinates of endemic species and non endemic species which are rarely distributed
Hypericum aviculariifolium subsp. *byzantinum*	Uludağ koyunkıranı	VU	35T 726933-4530650
Campanula lyrata subsp. *lyrata*	Memek	LC	35T 707879-4531626 35T 752587-4525077
Cirsium polycephalum	Hoş kangal	CR	35T 713848-4524166 35T 715763-4522577 35T 711516-4517487
Ornithogalum pascheanum	Abant yıldızı	EN	35T 740361-4526745 36T 301685-4512676
Galanthus plicatus subsp. *byzantinus*	İstanbul kardelenei	VU	35T 727073-4530038 35T 733886-4528029
Crocus pestalozzae	Ümraniye çiğdemi	VU	35T 707879-4531626 35T 714226-4528016 35T 719386-4530164
Leucojum aestivum	Göl soğanı	VU	36T 279582-4523976
Cyclamen coum var. *coum*	Yer somunu		36T 278476-4526833

9.9.2. Terrestrial Fauna

Amphibians -Reptiles

A total of 29 species belonging to 4 ordo and 13 families were identified as a result of field studies conducted in all three sections. Systematic information on these species, international protection status, habitat information on species, and abundance ratios of species are given in Annex 7/ Table 2.a-b-c. Among the 8 species of the amphibian species identified on the basis of habitat-based field studies along the project route, one is a tailed frog and the other 7 are tailless frog species. Of the total 21 reptile species identified as a result of habitat-based field work along the Project route, 3 were tortoises, 9 were lizards and 9 were snake species.

When the amphibian species observed in the project route are evaluated in terms of IUCN conservation criteria, it is seen that only *Bufotes variabilis* is classified in the category of DD. The other 7 species are in LC (least concern) category. According to Bern criteria, *Pelophylax ridibundus* is in the list of Annex-3 and the other 7 species are in the list of Annex-2. None of the amphibian species identified in Section 4, 5 and 6 are found in Cites lists. These tailed and tailless frog species were observed in Eunis coded habitat types of G1.A; E3.4; E1.3; G3.F; G1.2; C1.2; I1.2; I1.5; J2.3; G1.C; G1.5; F5.3; F5.2 during field studies. Among these species B*ufo bufo, Bombina bombina, Pelobates syriacus, Hyla orientalis* and *Triturus karelinii* species were rarely observed. *Bufo bufo* has a wide distribution area especially in the Black Sea, Marmara, Aegean and Mediterranean coasts in our country. *Bombina bombina* has a narrow distribution in Turkey only near Trakya and Adapazarı, it spreads in most of Europe continent except Turkey. *Triturus karelinii* spreads

widely on the shores of the Black Sea Region in Turkey, in Thrace and Marmara regions and in Aegean Region to the vicinity of Denizli. Outside of Turkey, it is distributed in northern Iran, along with Caucasus, in Balkans up to Greece and Albanian. Pelobates syriacus is distributed in Turkey in large parts of Thrace and Anatolia. Outside of Turkey, it spreads in Syria, Israel and Transcaucasia. Hyla orientalis shows widespread distribution in all regions except Southeast and Eastern Anatolia Regions in Turkey. The 5 species of frogs that are rarely seen in the field are also in the LC category according to IUCN. None of the frog species detected in Section 4, 5 and 6 are endemic to our country, but are widely spread species.

When reptile species observed in Section 6 are evaluated in terms of protection criteria it is seen that according to IUCN criteria, *Emys orbicularis* is included in NT and *Testudo graeca* is included in VU category. *Testudo graeca* is a wide-spread turtle species in national and global scales which spreads in large regions of Thracia and Anatolia. This species is listed on the Annex-2 according to Bern Convention. This tortoise species is listed in the same time in CITES Appendix 2. *Emys orbicularis* is a widespread species on a global and national scale. This species which is completely water dependent is listed on the Annex-2 according to Bern Convention. Other reptile species identified in Section 4, 5 and 6 are the least risky species listed in LC category. According to the Bern criteria, *Anguis fragilis, Natrix natrix* and *Eirenis modestus* are listed in Annex 3, the other 18 reptilian species are listed in Annex 2. These reptilian species were observed abundantly in Eunis coded habitat types of G1.A; G1.2; E1.3; E3.4; G3.F; G1.5; C1.2; I1.5; I1.2; G1.C; J2.3; F5.2 and F5.3 during the field studies. Among these species, Emys *orbicularis, Mauremys rivulata*, *Podarcis tauricus*, Pod*arcis muralis, Podarcis siculus, Pseudopus apodus, Anguis fragilis, Ablepharus kitaibelii, Elaphe sauromates, Zamenis longissimus, Eirenis modestus, Platyceps najadum, Platyceps collaris, Coronella austriaca ve Dolichophis caspius* were rarely observed in all three sections. The above-mentioned species are low-risk species according to the international protection criteria as previously mentioned in the related sections. None of the reptilian species identified in Section 4, 5 and 6 are endemic to our country, but are widely distributed species.

Birds

According to the findings obtained, the evaluations of the project area and the surrounding environment in terms of bird fauna and effects are presented below.

- There are no significant and specific wintering-reproduction habitats for project sites and critical bird species in the close vicinity.

- There are no critically endemic bird species that are threatened and/or protected at the international and national scale in the project area and in the close vicinity.

- The number of bird species identified and the numbers of individuals are very low and there are not any significant bird areas in the project area and in the close vicinity.

- The bird species determined in the project area and in the close vicinity in winter season are wide spread and domestic bird species. These species are generally observed in settlements and their neighborhoods.

- In this context, the water regime of riparian and wet meadow habitats outside of the road route, which could affect the road construction, should be protected to prevent possible adverse effects. Otherwise, even if out of the route, feeding habitats of birds

which directly and/or indirectly dependent on the water may be impaired, if such sensitive habitats water regimes are reduced and/or interrupted.

- Although there are no critical bird species and habitats in the project route and there are no bird species breeding in these areas and/or a colony, there will be loss of habitat in terms of existing bird species, in the construction and operation phases of the project and in areas where construction activities will take place. The species of birds in these habitats do not have to be wasted because of their ability to fly to alternative habitats around the project area due to their ability to fly.

- It will be useful if construction activities are not carried out during the breeding season of birds, May-June, and in natural habitats.

- In addition to this, as a result of the habitat losses, noise, dust formation and vehicle-human trafficking which will be the result of the construction activities, the construction activities should be made as a tentative purpose and to provide the necessary time and energy to the birds to leave the area**.**

Mammals

There are no significant and specific wintering-reproduction habitats for project sites and critical mammal species in the close vicinity. There are no critical-endemic species of mammals that are endangered and/or protected on the international and national scale in the project area and in the close vicinity, and the mammal species that were detected are cosmopolitan species. In addition, the number of mammals and the number of individuals determined are relatively low. Although there are no critical mammal species and habitat on the project route, habitat loss will occur in the construction and operation phases of the project, roads and areas where construction activities will take place in terms of existing mammal species. Some of the mammal species in these habitats do not have to be wasted because of their ability to escape to alternative habitats around the project site. In addition to this, as a result of the habitat losses, noise, dust formation and vehicle-human traffic which will be the result of the construction activities, the construction activities will be conducted gradual to provide the necessary time and energy to the mammals to leave the area.

Aquatic Environment

Most of the fish species that is exist in rivers on motorway route belongs to family Cyprinidae. The breeding period of this species belong to this family and for the other species of different families detected during the fields surveys is between the months of April and June –peaking in May. Therefore, it is recommended that construction activities should be carried out carefully and impacts caused by human activities should be minimized especially in April, May and June in order not to harm the species that is exist in the river.

CHAPTER 10

AIR QUALITY
AND
CLIMATE CHANGE

CHAPTER 10. AIR QUALITY AND CLIMATE CHANGE

In this section, the potential impacts of the motorway project on air quality and climate of the region is assessed. Within this scope, the construction and operation phases of the motorway are taken into consideration and impacts are evaluated separately. For the assessment of impacts on air quality, air quality modeling studies were performed. This chapter includes the following:

- Turkish and IFC air quality legislation and standards
- Baseline air quality
- Assessment and quantification of potential project emissions
- Air quality modeling with AERMOD software for project land preparation and construction and operation phases taking into account local meteorological data and topography of the region.
- Assessment of potential impacts on air quality
- Mitigation measures regarding air quality
- Residual impacts on air quality
- Meteorological and climatic conditions of the project area
- Assessment of potential impacts regarding climate change and relevant mitigation measures

10.1. Air Quality

Air pollution can be defined as pollutants emitted from various sources reaching the level that affects human health and the environment negatively. Main sources that result in air pollution are anthropogenic sources such as traffic (motor vehicles), industrial activities, domestic heating and natural sources.

Main pollutants emitted from motorway projects are nitrogen oxides (NO_x (NO_2 and NO)), particulate matter (PM_{10}), carbon monoxide (CO), hydrocarbons (HC) and carbon dioxide (CO_2). PM_{10} is expected to be emitted mainly during operation phase of the project as a result of material extraction and supply, motorway construction cut and fill operations and storage of excavated material. Particles can vary according to size and composition. PM_{10} (particulate matter with aerodynamic diameter smaller than 10 µm) standard is set to define the particles that people are likely to inhale and PM_{10} has become the general measure of particulate matter. In this sense, generally limit values are defined for PM_{10}.

Other potential pollutants are expected to arise from operation of construction machinery and equipments during construction and traffic flow during operation of the motorway.

10.1.1. Assessment Methodology and Data Sources

10.1.1.1. Regulatory Framework

Regulation on Assessment and Management of Air Quality

Regulation on Assessment and Management of Air Quality was published on 06.06.2008 in Official Gazette No 26898. The purpose of this regulation is to define and set air quality targets in order to prevent or mitigate the negative impacts of air pollution on human health and environment, to assess air quality with defined methods and criteria, to sustain existing conditions in areas where air quality is good, to gather information about air quality and inform public with warning threshold levels.

In this regulation for the harmonization to European Union environmental legislation short and long term limit values are defined. However, a transition period is proposed for the application of these limit values. In addition to the limit values, warning threshold levels for air pollutants are identified.

Industrial Air Pollution Control Regulation

Published on 03.07.2009 in Official Gazette No 27277 the Industrial Air Pollution Control Regulation aims to control emissions in form of smoke, dust, gas, vapor and aerosol generated as a result of industrial activities and energy generation, protect human and environment from pollution in receiving environment, prevent negative impacts of air pollution on public and ensure that these effects do not arise.

According to the regulation, the limit values from stack and non-stack sources that require the calculation of the contribution values to air pollution in case exceeded are provided. According to IAPCR Appendix 2 Table 2.1 for dust emissions the limit value from stack sources is 10 kg/hr, from non-stack sources 1 kg/hr. If the dust emissions exceed this limit value the contribution values to air pollution should be calculated.

Emissions generated from project activities will be calculated and compared with the regulatory limits. If the calculated emission amount exceeds the regulatory limit value modeling study will be conducted and contribution of the emissions to air pollution will be estimated.

Regulation Concerning Follow up of Greenhouse Gas Emissions

The Regulation Concerning Follow up of Greenhouse Gas Emissions was published on 17.05.2014 in Official Gazette No 29003. The purpose of the regulation is to define procedures and principles for monitoring, reporting and verification of greenhouse gas emissions for a list of activities considered within the scope of the regulation.

10.1.1.2. Air Quality Standards

This section provides an overview of Turkish and international ambient air quality standards, which apply to assessment of on air quality.

Turkish Legal Requirements

Ambient air quality is regulated in Turkey by the Regulation on Assessment and Management of Air Quality. Appendices I and I-A of this regulation provide limit values for the 2009-2014 period and for the period after 1 January 2014. Both are based on a tiered system to reduce limit values to target values over time.

Air quality standards are defined in the Regulation on Assessment and Management of Air Quality published on 06.06.2008 in Official Gazette No 26898 and Industrial Air Pollution Control Regulation published on 03.07.2009 in Official Gazette No 27277. Ambient air quality limit values for various pollutants defined in Turkish regulations are presented in Table 10.1. The standards in Table 10.1 are for 2024 and further years.

Table10.1. Ambient Air Quality Limit Values – Turkish Regulations

Parameter	Duration	Limit Value* (µg/m^3)
SO_2	Hourly (cannot be exceeded more than 24 times a year)	350
	24 hour	125
	Long term limit	60
	Annual and winter season (October 1 - March 31)	20
NO_2	Hourly (cannot be exceeded more than 18 times a year)	200
	Annual	40
Particulate Matter (PM 10)	24 hour (cannot be exceeded more than 35 times a year)	50
	Annual	40
CO	8 hour daily maximum	10.000
O_3	8 hour daily maximum	120
VOC**	Hourly	280
	24-hour	70

** Regulation on Assessment and Management of Air Quality*
*** Industrial Air Pollution Control Regulation*

IFC Standards

IFC standards and requirements will apply to the project. The IFC General EHS Guidelines – Environmental Air Emissions and Ambient Air Quality refer to the World Health Organization (WHO) Ambient Air Quality Guidelines for recommended values. These limit values are presented in Table 10.2.

Table10.2. Ambient Air Quality Limit Values – IFC Standards

Parameter	Duration	(µg/m^3)*
SO_2	10 minute	500
	24 hour	20
NO_2	Hourly	200
	Annual	40
Particulate Matter (PM_{10})	24 hour	50
	Annual	20
Particulate Matter ($PM_{2,5}$)	24 hour	25
	Annual	10
O_3	8 hour daily maximum	100

**Environmental, Health and Safety Guidelines, General EHS Guidelines: Environmental, Air Emissions and Ambient Air Quality*

10.1.1.3. Significance Criteria

The significance criteria for the impacts on air quality will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on the air quality, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 10.3.

Table 10.3. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	Medium (2)	Low (1)
Human Receptors	Areas densely populated with residences and have poor air quality	Areas densely populated with residences and have good air quality	Areas with dense work places/ industrial areas and/or non densely populated with residences
Ecological Receptors	-	Forests with ecological function Dams for drinking water purpose	Forests with social and cultural and economic function Dams for irrigation and energy production purpose

**Good and poor air quality of receptors is determined according to baseline air quality measurements*

Evaluation of magnitude of impacts was based on percentage of exceedance of air quality standards defined in Regulation on Assessment and Management of Air Quality. Magnitude of impact is defined as low, medium and high when the result of modeling study increases Turkish air quality limit values of a specified location 0-25 %, 25-50 % and more than 50 %, respectively (see Table 10.4).

Table 10.4. Impact Magnitude Criteria

Magnitude of Impact	Exceedance of Air Quality Standard
Low	0-25 %
Medium	25-50 %
High	>50 %

10.1.1.4. Air Quality Modeling

Air quality modeling was performed with AERMOD Gaussian Plume Air Dispersion Model (Version 9.3.0) which is a complete and powerful air dispersion modeling. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. The software generates daily, monthly as well as annual concentrations of pollutants in ambient air. The model handles a variety of pollutant sources in a wide variety of settings such as rural and urban as well as flat and complex terrain.

There are two input data processors of the AERMOD modeling system: AERMET, a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data preprocessor that incorporates complex terrain using USGS Digital Elevation Data.

Air dispersion modeling was carried out within an area of 7.000 km^2 (140 km x 50 km) including motorway sections 4, 5 and 6.

Meteorological Parameters

AERMOD utilizes a meteorological data preprocessor AERMET. Hourly surface and upper air meteorological data inputs are processed by AERMET which generated SFC and PFL extended files for AERMOD. First, number of wind blows recorded in Kocaeli Meteorological Station (Station Number: 17066) between years 2006-2015 were compared with the average of the wind blow numbers recorded between 1961-2015 and the representative year was determined as 2015. Wind blow numbers recorded in Kocaeli Meteorological Station in 2015 and averages between 1961-2015 are presented in Figure 10.1.

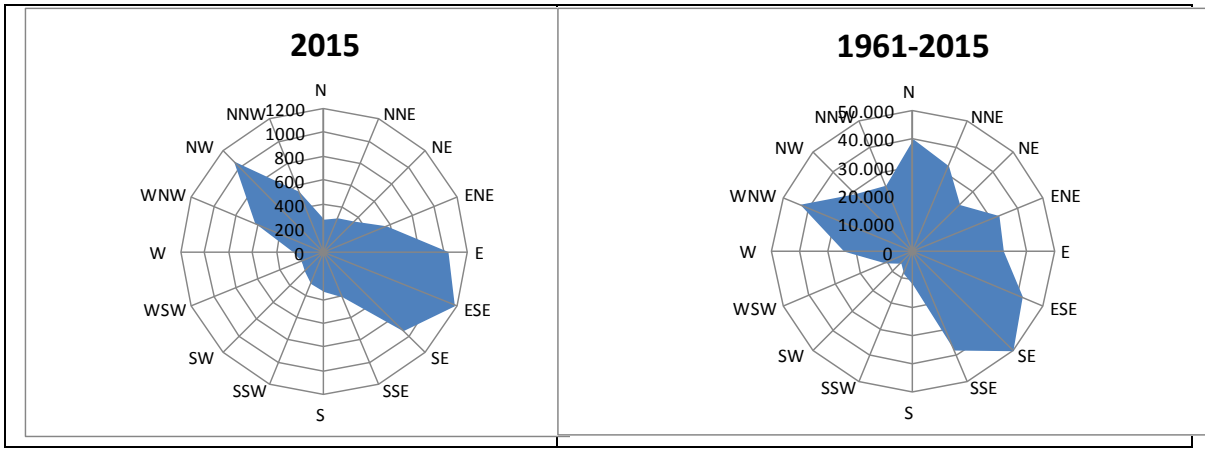


Figure 10.1. Wind Blow Numbers Recorded in Kocaeli Meteorological Station

After determination of the representative meteorological year, hourly meteorological data and upper air observations were obtained from the meteorological station which best represents the project area. For this purpose, hourly surface data including humidity, pressure, temperature, precipitation, cloud cover, cloud ceiling height, wind speed and direction were obtained from Kocaeli Meteorological Station (Station Number: 17066) while upper air data was obtained from Istanbul Regional Meteorological Station (Station Number: 17064). Data was processed by AERMET and SFC and PFL files were obtained and used in AERMOD.

10.1.2. Baseline Conditions

Air quality measurements in Istanbul, Kocaeli and Sakarya are performed regularly in air quality measurement stations located in various points throughout the cities. These stations work under automatic data recording system and the records are transferred to national air quality monitoring network of Turkish Ministry of Environment and Urban Planning. Air quality measurement stations representative for the project in Istanbul,

Kocaeli and Sakarya were selected and measurement results for 2016 are presented in Table 10.5.

Table 10.5. Results of Air Quality Measurements in Various Districts of Istanbul, Kocaeli and Sakarya (2016)

Station Location	Parameters and Annual Measurement Results (µg/m^3)							
	PM_{10}	$PM_{2,5}$	SO_2	NO	NO_2	NO_x	O_3	CO
Sultanbeyli - Istanbul	-	-	7	16	25	50	56	-
Dilovası – Kocaeli	55	-	16	17	41	58	36	553
Ozanlar – Sakarya	-	33	22	26	32	72	42	-

Source: *Republic of Turkey, Ministry of Environment and Urbanization, http://www.havaizleme.gov.tr/. 2017*

Air quality measurement results are below long term limit values defined for 2016 in the Regulation on Assessment and Management of Air Quality and Industrial Air Pollution Control Regulation except for Dilovasi, Kocaeli station where NO_2 and PM_{10} values exceed the standards. This can be contributed to intense industry in the district and advanced transportation network.

In order to determine air quality along the Motorway route and its surrounding environment comprehensive air quality measurement studies were performed in scope of the project. Parameters measured in this context are PM_{10}, heavy metals in PM_{10}, settled dust, heavy metals in settled dust, NO, NO_2, NO_x, SO_2, VOCs and TPH. Sensitive areas such as; settlements, quarries and areas where urban traffic is intense were taken into consideration in the selection of air quality measurement points. Map showing the locations of measurement stations is provided in Figure 10.2. Laboratory result reports are presented in Annex-5.

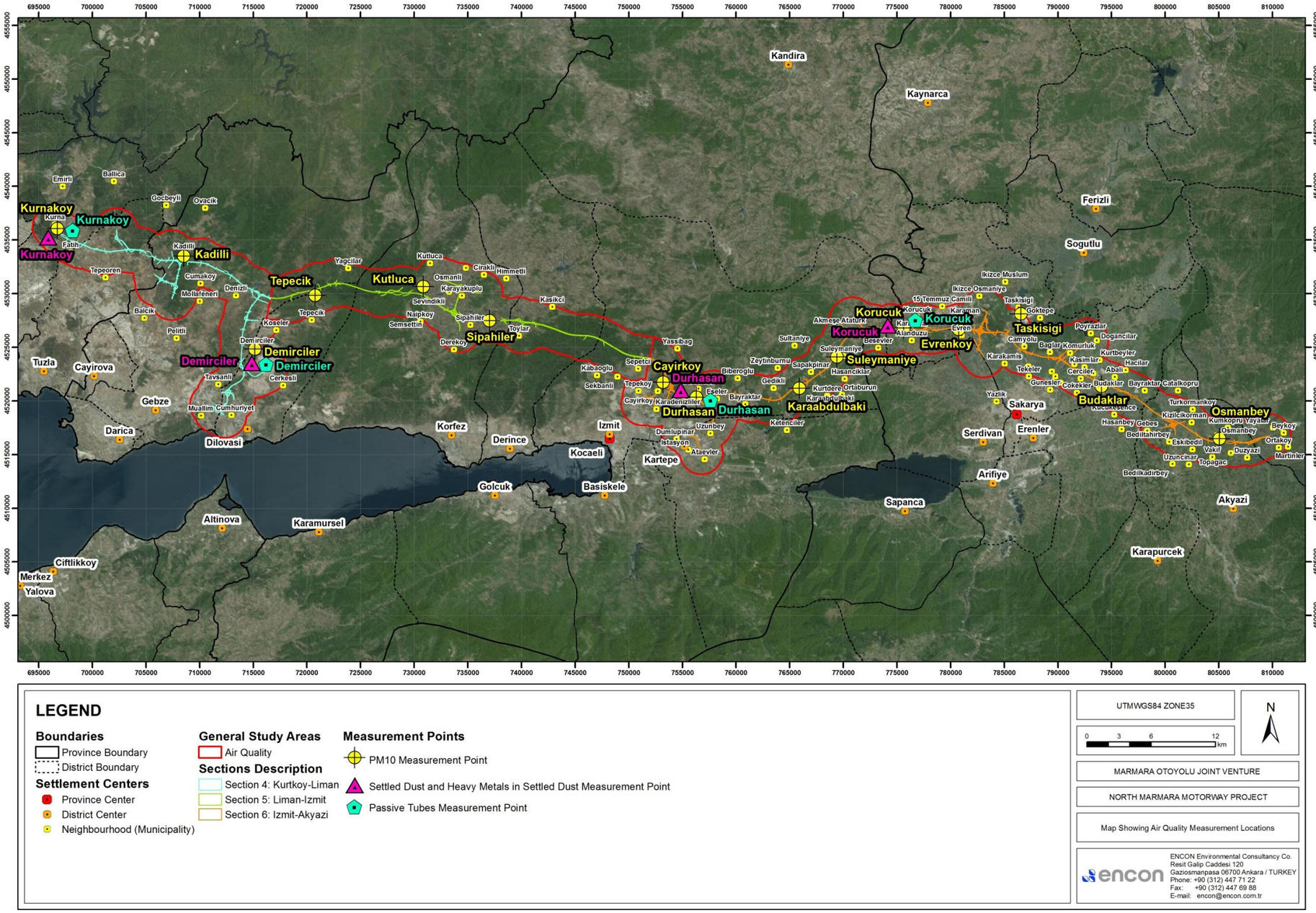


Figure 10.2. Map Showing Air Quality Measurement Locations

24 hour PM_{10} measurements were conducted at 15 measurement points while settled dust samples were collected at 4 locations. Results of PM_{10}, settled dust and heavy metals in settled dust measurements are presented in Table 10.6, and Table 10.7. Measurement results are below limit values defined in Regulation on Assessment and Management of Air Quality and Industrial Air Pollution Control Regulation. Except for Durhasan neighborhood, where PM_{10} concentration seems to be higher than regulatory limits. The region is characterized with a variety of big-scale industrial plants which explains higher pollutant concentrations.

Table 10.6. Results of PM_{10} Measurements

Districts	Neighborhoods	Coordinates	Nearest Approximate Motorway KM	Measurement Result (µg/m^3) PM10 (µg/m^3)
Section 4				
Pendik	Kurnakoy	696759-4536269	130+000	31,64
Gebze	Kadilli	708555-4533696	142+000	20,80
Dilovası	Demirciler	715178-4525026	150+500; 5+000	23,41
Section 5				
Izmit	Tepecik	720798-4530037	155+000	36,29
Korfez	Kutluca	730867-4530849	166+000	25,40
Korfez	Sipahiler	737056-4527669	171+000	16,99
Section 6				
Izmit	Cayirkoy	247102-4521917	191+500	33,96
Izmit	Durhasan	250110-4520309	194+500	80,65
Izmit	Karaabdulbaki	249732-4520490	205+000	13,99
Izmit	Suleymaniye	263438-4523179	209+000	6,35
Adapazari	Korucuk	269824-4525426	218+000	19,75
Adapazari	Evrenkoy	274920-4524949	222+000	49,85
Adapazari	Taskisigi	280806-4525988	226+500	40,39
Adapazari	Budaklar	2878381-4518759	237+000	19,64
Akyazi	Osmanbey	298475-4513142	249+000	17,34

Table 10.7. Results of Settled Dust and Heavy Metals in Settled Dust Measurements

Districts	Neighborhoods	Coordinates	Nearest Approximate Motorway KM	Measurement Result		
				Settled Dust (mg/m^2.day)	Heavy Metals in Settled Dust (µg/m^2.day)	
Section 4						
Pendik	Kurnakoy	696679-4536243	130+000	10.5	Cadmium	0,5221
					Lead	6,4600
					Thallium	0,5252
Dilovası	Demirciler	715130-4524928	150+500; 5+000	20.8	Cadmium	1,4449
					Lead	3,3015
					Thallium	0,5252
Section 6						
Izmit	Durhasan	250519-4520361	194+500	14.6	Cadmium	<0,5071
					Lead	2,4706
					Thallium	<0,5071
Adapazari	Korucuk	2699815-4525425	218+000	85,6	Cadmium	<0,5071
					Lead	1,5284
					Thallium	<0,5071

In addition to dust measurements, other parameters measured during baseline surveys were SO_2, NO, NO_2 and NO_x. Passive sampling for these parameters were conducted for 1 month period between 23.01.2017-20.02.2017. Results of these measurements are provided in Table 10.8. Baseline measurement results are below limit values defined in Regulation on Assessment and Management of Air Quality.

Table 10.8. Results of Passive Measurements

Districts	Neighborhoods	Coordinates	Nearest Approximate Motorway KM	Measurement Result (µg/m^3)	
				SO_2	NO_2
Section 4					
Pendik	Kurnakoy	696759-4536269	130+000	4,12	34,16
Dilovası	Demirciler	715178-4525026	150+500; 5+000	7,89	27,10
Section 6					
Izmit	Durhasan	250110-4520309	194+500	3,74	21,25
Adapazari	Korucuk	269824-4525426	218+000	2,84	10,42

10.1.3. Potential Impacts

Emissions during motorway construction will consist of dust emissions and emissions from construction machinery and equipment which will include mostly the same pollutants of concern. During the operation of the motorway, similar to other combustion processes, emissions from vehicles include CO, NO_x, SO_2, PM and VOCs. *(IFC General Health and Safety Guidelines on Air Emissions and Ambient Air Quality).* Within this context, main air pollutants of concern regarding the motorway project are described below:

Particulate Matter (PM)

PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen. Others can only be detected using an electron microscope. Particulate matter includes PM_{10} inhalable particles, with diameters that are generally 10 micrometers and smaller; and $PM_{2,5}$; fine inhalable particles, with diameters that are generally 2,5 micrometers and smaller. *(https://www.epa.gov/pm-pollution)*

Particulate matter come in many sizes and shapes and can be made up of hundreds of different chemicals. Some are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires. Most particles form in the atmosphere as a result of complex reactions of other pollutants such as sulfur dioxide and nitrogen oxides.

Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into lungs, and some may even get into the bloodstream.

Particles can vary according to size and composition. PM_{10} (particulate matter with aerodynamic diameter smaller than 10 µm) standard is set to define the particles that people are likely to inhale and PM_{10} has become the general measure of particulate matter.

Carbon monoxide (CO)

Carbon monoxide (CO) is a colorless, odorless gas that can be harmful when inhaled in large amounts. It is formed both naturally and human activities such as in complete burning of fossil fuels, and it is important to note that natural processes produce

relatively small amounts of CO when compared to anthropogenic sources. Main sources of CO in outdoor air can be accepted as cars, trucks and other vehicles and machinery that burn fossil fuels. Therefore, it can be said that CO levels in urban areas is closely related with traffic density. Other anthropogenic sources of the pollutant are power stations and waste incinerators.

Human inhalation of air with high CO concentration is known to reduce the amount of oxygen carrying capacity of blood stream as CO is rapidly absorbed by blood. Very high levels are generally associated with indoor pollution however; significant health problems for vulnerable individuals can be observed when CO levels are elevated outdoors.

CO is considered as a relatively stable compound and takes part slowly in atmospheric chemical reactions. CO reacts with other pollutants in air to form ozone. This forms ground level ozone which does not have significant environmental impacts at a global level. On the other hand, CO contributes indirectly to greenhouse effect by depleting hydroxyl radicals and slowing destruction of methane.

Sulfur Dioxide (SO_2)

Sulfur Dioxide (SO_2) is one of a group of gases called sulfur oxides (SO_x). While all of these gases are harmful to human health and the environment, SO2 is of greater concern. Other gaseous SO_x (such as SO_3) are found in the atmosphere at concentrations much lower than SO_2.The largest sources of SO_2 emissions are from fossil fuel combustion at power plants and other industrial facilities. Smaller sources of SO_2 emissions include: industrial processes such as extracting metal from ore; natural sources such as volcanoes; and transportation via locomotives, ships and other vehicles and heavy equipment that burn fuel with high sulfur content.

SO_2 can affect both health and the environment. Short-term exposures to SO_2 can harm the human respiratory system and make breathing difficult. Children, the elderly, and those who suffer from asthma are particularly sensitive to effects of SO_2.

SO_2 emissions that lead to high concentrations of pollutants in the air generally also lead to the formation of other sulfur oxides (SO_x). SO_x can react with other compounds in the atmosphere to form small particles. These particles contribute to particulate matter (PM) pollution: and cause additional health problems and reduce visibility (haze). Deposition of particles can also and damage stone and other materials, including culturally important objects. In addition, at high concentrations, gaseous SOx can harm trees and plants by damaging foliage and decreasing growth. SO_2 and other sulfur oxides can contribute to acid rain which can harm sensitive ecosystems. *(https://www.epa.gov/so2-pollution)*

Nitrogen Dioxide (NO_2)

Nitrogen Dioxide (NO2) is one of a group of highly reactive gases called nitrogen oxides (NOx). While all of these gases are harmful to human health and the environment, NO_2 is of greater concern. Other nitrogen oxides include nitrous acid and nitric acid. NO_2 primarily gets in the air from the burning of fuel. NO_2 forms from emissions from cars, trucks and buses, power plants, and off-road equipment.

Breathing air with a high concentration of NO_2 can irritate airways in respiratory system. Such exposures over short periods can cause respiratory diseases such as asthma, leading to respiratory symptoms such as coughing, or difficulty in breathing. Longer exposures to elevated concentrations of NO_2 may contribute to the development of serious health problems. NO_2 reacts with other chemicals in the air to form both particulate matter and ozone. Both of these are also harmful when inhaled due to effects on the respiratory system. *(https://www.epa.gov/no2-pollution)*

NO_2 and other NO_x interact with water, oxygen and other chemicals in the atmosphere to form acid rain. Acid rain harms sensitive ecosystems such as lakes and forests. The nitrate particles that result from NO_x make the air hazy and decrease visibility. In addition, NO_x in the atmosphere contributes to nutrient pollution in coastal waters.

Volatile Organic Compounds (VOCs)

VOCs are organic compounds containing one or more carbon atoms that have high vapour pressures and therefore evaporate readily to the atmosphere. There are thousands of compounds that meet this definition. VOCs play a significant role in the formation of ozone and fine particulates in the atmosphere. Under sunlight, VOCs react with nitrogen oxides emitted mainly from vehicles, power plants and industrial activities to form ozone, which in turn helps the formation of fine particulates. The accumulation of ozone, fine particulates and other gaseous pollutants results in smog that reduces visibility. Smog is particularly severe under stagnant weather conditions.

Smog can irritate eyes, nose and throat, or can worsen existing heart and respiratory problems such as asthma. People with heart and lung problems, the elderly and children whose respiratory systems are still developing are most at risk. Prolonged exposure to severe smog condition may cause permanent damage to lung tissue and affect our immune system. In addition, smog impairs visibility. *(http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/vocs_smog.html)*

Abovementioned pollutants are expected to be emitted during land preparation, construction and operation phases of the motorway project. In order to determine the potential impacts of project emissions on air quality, the sources of pollutants are clearly defined and amounts of pollutants emitted from each source are quantified. Sources and amounts of project emissions are described in detail for land preparation and construction and operation phases of the project separately in the following parts. Air quality modeling results are presented accordingly.

10.1.3.1. Land Preparation and Construction Phase

Project construction activities are expected to result in dust emissions during land preparation, cut-fill operations and activities of quarries operated in scope of the project. In addition, exhaust emissions such as PM_{10}, NO_x, CO, SO_2, VOC, benzene, NH_3 and N_2O. Asphalt plants and concrete plants are considered as other emission sources of construction activities. Camp sites, concrete plants, asphalt plants mechanical plants and quarries/material borrow sites to be operated during the construction phase are presented in Figure 10.3.

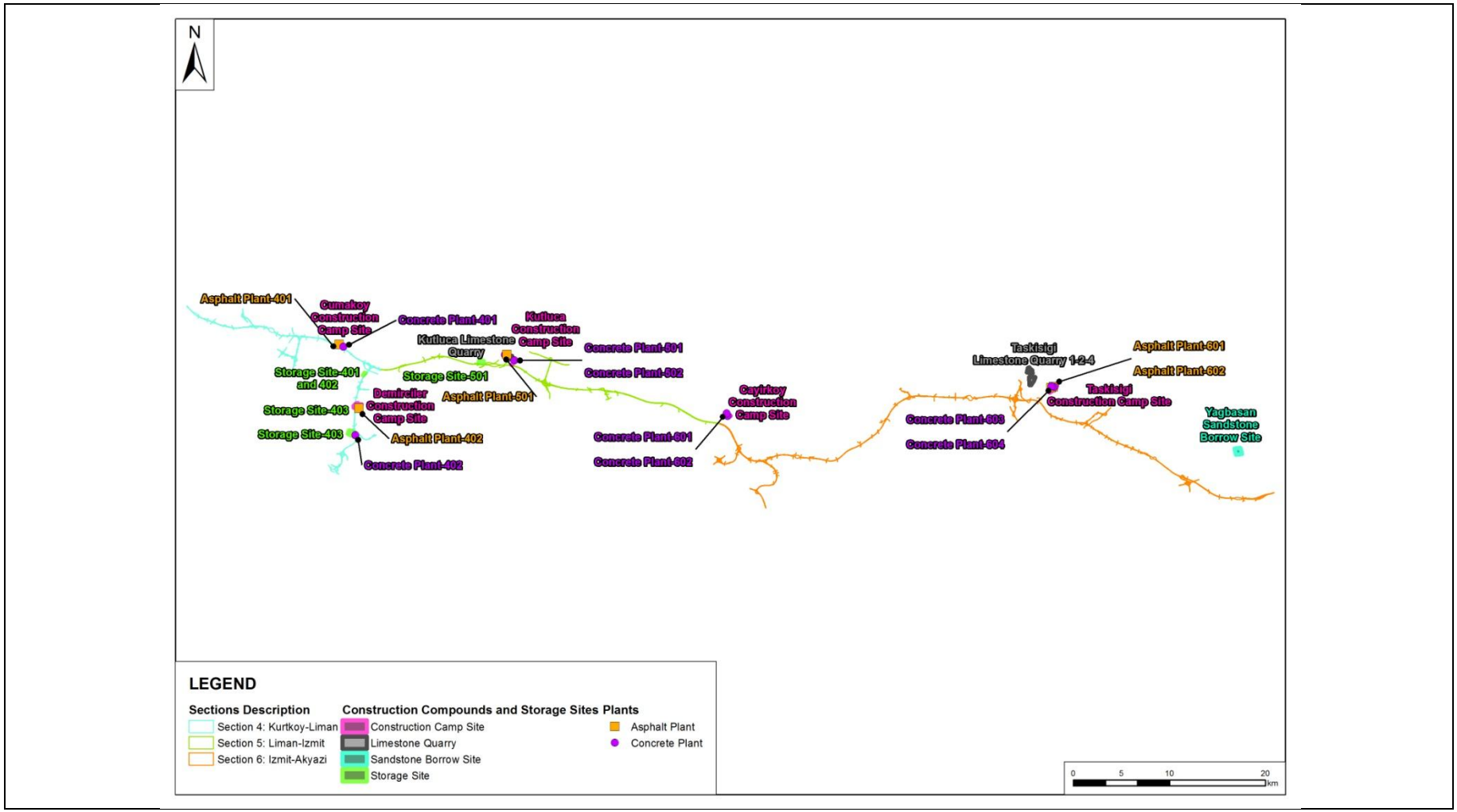


Figure 10.3. Location of Camp Sites, Asphalt, Concrete and Mechanical Plants, Quarries/Material Borrow Sites

According to the project schedule, construction of the motorway is planned to last approximately 3 years. Within this scope, top-soil stripping will be followed by excavation, fill and leveling. Next, bridges, underpass and overpass bridges, culverts, viaducts, tunnels and superstructures will be established accordingly.

Excavation and fill amounts for Sections 4, 5 and 6 are presented in Table 10.9.

Table 10.9. Amount of Excavation and Fill Material

Motorway Section	Excavation (m^3)	Fill (m^3)
Section 4	25.363.345,58	28.835.526,57
Section 5	16.996.901,04	19.307.395,79
Section 6	24.653.458,16	25.281.784,64
TOTAL	67.013.704,78	73.424.706,99

In the scope of road construction works, excavated materials are planned be used in the fill operations wherever the properties and the quality of the materials are suitable. When there is a surplus of excavated materials, excess material will need to be stored at designated storage areas. When there is need for supply of construction materials, materials will be supplied from nearby licensed quarries.

Materials will be supplied from Kutluca Limestone Quarry and quarries in Taskisigi region (Taskisigi 1, 2 and 4 Quarries). In addition Yagbasan Sandstone Borrow Site will serve materials for the motorway construction. Material extraction amount of Kutluca Limestone Quarry is 5.584.786 ton/year while 10.000.000 m^3 and 1.000.000 m^3 of material will be obtained from Taskisigi 1, 2 and Taskisigi 4, respectively. Production in Yagbasan Sandstone Borrow Site is planned to be 3.000.000 m^3. Quarries are planned to be operated for 3 years during construction period.

Emission factors defined in Industrial Air Pollution Control Regulation were used to calculate the dust emissions from excavation and fill operations. These emission factors are presented in Table 10.10. Uncontrolled emission factors represent the case in which the activities are performed without any measures taken, while controlled emission factors represent the case when measures such as watering, usage of closed transportation systems, keeping the material moisturized and performing loading and unloading of materials without scattering are taken.

Table 10.10. Emission Factors Used to Calculate Dust Emissions

Sources	Emission Factors		Unit
	Uncontrolled	Controlled	
Excavation	0.025	0.0125	kg/ton
Loading	0.010	0.005	
Unloading	0.010	0.005	
Primary Crusher	0.243	0.0243	
Secondary Crusher	0.585	0.0585	
Tertiary Crusher	0.585	0.0585	
Storage	5,8	2,9	kg/ha.day
Transportation (total distance)	0.7	0.35	kg/km-vehicle

Source: Industrial Air Pollution Control Regulation, Appendix 12.

Emissions resulting from excavation and fill operations are calculated with the emission factors presented above and provided in Table 10.11.

Table 10.11. PM_{10} Emissions from Project Excavation and Fill Operations

Activity	PM_{10} Emissions (kg/hr) (controlled)
Excavation, Load and Fill Operations for motorway construction – Section 4	53,44
Excavation, Load and Fill Operations for motorway construction – Section 5	36,48
Excavation, Load and Fill Operations for motorway construction – Section 6	51,65
Kutluca Limestone Quarry	4,78
Taskisigi 1 & 2 Quarries	13,70
Taskisigi 4 Quarry	1,37
Yagbasan Sandstone Borrow Site	4,11

Material extracted from quarries will be transferred to crushers located near quarries. According to the Technical Specifications of KGM, crushers should be operated in closed environments and equipped with dust suppression systems. Therefore, during emission calculations, emissions from crushers are assumed to be in small amounts when compared to other emission sources and therefore neglected.

As stated above, excess material from excavation will be stored at designated storage areas. Location and capacities of material storage areas are presented in Table 10.12. Locations of storage areas in Section 6 were not determined at this stage, however several locations were suggested. Therefore, three locations were assumed for the storage of excess material during construction. Emissions from material storage in designated storage sites are calculated using emission factors presented in Table 10.10.

Table 10.12. Material Storage Areas

Location	Location			Description of the Site	Area (m^2)	PM_{10} Emissions (kg/hr)
	Province	District	Nearest Neighborhood			
Section 4						
151+000; 1+000	Kocaeli	Gebze	Denizli	Storage Site-401 and 402	10.000	0,12
151+000; 4+000	Kocaeli	Dilovasi	Demirciler	Storage Site-403	55.000	0,66
151+000; 7+000	Kocaeli	Dilovasi	Demirciler	Storage Site-404	228.000	2,76
Section 5						
162+500	Kocaeli	Korfez	Kutluca (Kiyirlar)	Storage Site-501	140.400	1,36
Section 6						
206+300	Kocaeli	Izmit	Sapakpinari	Storage Site 1	164.923,55	1,06
236+000	Kocaeli	Adapazari	Haciormanlar	Storage Site 2	710.804,35	4,40
240+000	Kocaeli	Adapazari	Bayraktar	Storage Site 3	305.028,73	1,21

Asphalt plants and concrete plants are other sources of emissions during construction phase of the motorway. Location of these facilities can be seen in Figure 10.3. There will be 5 asphalt plants operated in construction of the motorway. Number of concrete plants to be established is 8.

Emissions from asphalt plants are calculated by using emission factors defined in US Environmental Protection Agency (EPA) AP42 Table 11.1-1 and presented in Table 10.13.

Table 10.13. Emissions from Asphalt Plants

Asphalt Plant Capacity (ton/hr)	Emissions (kg/hr)							
	PM_{10}	CO	CO_2	NO_x	SO_2	TOC	CH_4	VOC
320 (Asphalt Plant-401 -501)	3,89	57,60	5328,0	17,28	12,67	2,16	1,07	1,18
240 (Asphalt Plant-402)	2,92	43,20	3996,0	12,96	9,50	1,62	0,80	0,89
200 (Asphalt Plant-601)	2,43	36,00	3330,0	10,80	7,92	1,35	0,67	0,74
160 (Asphalt Plant-602)	1,94	28,80	2664,0	8,64	6,34	1,08	0,53	0,59

PM_{10} emissions from concrete plants are calculated with emission factors presented in EPA AP-42 Table 11.12-6. Emissions are calculated as 0,82 kg/hour, 1,09 kg/hour, 0,96 kg/hour and 0,55 kg/hour for concrete plants with 90 m^3/hour, 120 m^3/hour, 105 m^3/hour and 60 m^3/hour capacities, respectively.

In addition to dust emissions, exhaust gases will be emitted from operation of construction equipments and machinery. In order to represent the worst case scenario, maximum numbers of construction machinery and equipment proposed are used in emission estimation. Amount of machinery and equipments planned to be used in scope of construction activities are summarized in Table 10.14 along with exhaust gas emissions.

Table 10.14. Emissions from Construction Machinery and Equipments

Motorway Section	Maximum Number of Construction Machinery	Emissions (kg/hr)				
		PM	CO	SO_2	HC	NO_x
Section 4	250	0,20	3,75	0,38	0,73	2,25
Section 5	123	0,10	1,85	0,18	0,36	1,11
Section 6	292	0,23	4,38	0,44	0,85	2,63
Limit Value*	-	1	50	6	3	4

**Industrial Air Pollution Control Regulation*

Emissions from construction machinery and equipment are compared with the limit values defined in the Industrial Air Pollution Control Regulation. When these limit values are exceeded, the regulation requires an air quality modeling study for the related pollutant of concern. As can be observed in Table 10.14, emissions are below limit values above which air quality modeling should be performed. Emissions are calculated with maximum number of construction machinery planned to be used in each section. Under real construction conditions all equipments will not operate simultaneously and they will be scattered to different construction locations along the motorway route.

Air Quality Modeling for Land Preparation and Construction Phase

In order to evaluate potential impacts of project construction activities air quality modeling was carried out for $PM_{10.}$ Within this scope, 24 hour and annual PM_{10} concentrations and monthly and annual settled dust amounts are determined and compared with air quality limit values defined in Regulation on Assessment and Management of Air Quality and IFC standards (see Table 10.1 and Table 10.2). 24-hour PM_{10} results indicate that emissions concentrate around asphalt plants, concrete plants and quarries. Similar distribution can also be observed in annual PM_{10} concentrations.

24 hour and annual PM_{10} concentrations along with monthly and annual dry deposition values observed in settlements located within an area of 2 km buffer (2 kilometers from each side of the motorway centerline) are presented in Table 10.15. According to the Regulation on Assessment and Management of Air Quality, 24 hour PM_{10} concentrations are allowed to exceed the limit values 35 times in a year which corresponds to 90,41th percentile of PM_{10} concentrations for a given receptor. Therefore, 24 hour PM_{10} concentrations are provided for concentrations which correspond to 90,41th percentile.

Table 10.15. PM_{10} Concentrations Observed in Settlements

Settlement	24 h - 90,41perc PM_{10} Conc.	Annual PM_{10} Conc.	Monthly Dry Depos.	Annual Dry Depos.	Settlement	24 h - 90,41perc PM_{10} Conc.	Annual PM_{10} Conc.	Monthly Dry Depos.	Annual Dry Depos.
	($\mu g/m^3$)		(mg/m^2.day)			($\mu g/m^3$)		(mg/m^2.day)	
Kurnakoy	5,54	3,60	1,14	0,83	Alanduzu	4,18	2,65	0,93	0,70
Fatih	4,09	2,68	0,69	0,52	Korucuk	1,25	0,83	0,54	0,35
Kadilli	15,14	9,69	2,54	1,89	Karapinar	8,51	5,22	1,21	0,94
Cumakoy	8,59	5,47	1,26	1,04	Evren	6,27	4,02	0,88	0,67
Denizli	6,15	4,24	1,52	1,25	Karaman	5,04	2,92	0,95	0,67
Koseler	4,73	2,95	0,93	0,69	Ikizce Osmaniye	18,86	9,29	3,68	2,19
Demirciler	7,85	4,83	1,79	1,19	Taskisigi	31,50	15,01	3,55	2,58
Tavsanli	11,00	7,02	2,00	1,50	Camyolu	8,25	5,45	2,14	1,79
Cumhuriyet	9,02	5,95	1,79	1,30	Karakamis	5,71	3,68	0,73	0,57
Muallim	3,13	1,98	0,51	0,38	Dagdibi	7,62	4,72	1,04	0,80
Yagcilar	5,20	3,48	1,06	0,72	Baglar	5,49	3,05	0,96	0,74
Semsettin	9,67	5,89	1,53	1,14	Suleymanbey	7,12	4,05	0,85	0,65
Kutluca	5,43	2,53	0,71	0,58	Koprubasi	6,65	3,74	0,77	0,60
Sevindikli	8,72	5,47	1,30	1,04	Rustemler	6,00	3,27	0,69	0,53
Karayakuplu	7,05	4,50	1,55	1,19	Cerciler	7,02	4,00	1,00	0,74
Osmanli	4,09	2,47	0,53	0,40	Poyrazlar	5,60	2,81	0,53	0,41
Cirakli	3,42	2,24	0,52	0,39	Dogancilar	5,74	2,98	0,53	0,43
Sipahiler	10,83	7,36	2,17	1,72	Komurluk	4,41	2,95	0,64	0,53
Derekoy	3,77	2,37	0,54	0,45	Celebiler	7,41	3,98	0,96	0,68
Toylar	6,93	4,53	1,45	1,12	Kasimlar	9,52	5,07	1,47	0,94
Kasikci	4,14	2,67	0,61	0,48	Haciramazanlar	35,42	19,13	7,28	4,82
Sepetci	1,79	1,19	0,46	0,34	Kurtbeyler	9,85	4,39	1,03	0,80
Tepekoy	2,24	1,39	0,45	0,33	Cokekler	5,77	2,88	0,59	0,43
Cayirkoy	5,48	3,48	1,06	0,80	Budaklar	10,14	5,28	1,22	0,87
Karadenizliler	4,46	2,93	0,83	0,67	Abali	9,79	4,60	1,03	0,75
Durhasan	3,05	1,99	0,90	0,65	Hacilar	5,36	2,59	0,58	0,40
Dumlupinar	3,38	2,18	0,42	0,34	Bayraktar	5,09	2,79	0,80	0,50
Istasyon	3,26	2,13	0,42	0,33	Gebes	2,64	1,43	0,26	0,20
Ataevler	2,77	1,85	0,36	0,30	Turkormankoy	2,16	1,14	0,22	0,17
Uzunbey	5,06	3,30	0,82	0,61	Kizilcikorman	1,98	1,12	0,22	0,17
Eseler	13,74	9,05	2,53	2,00	Bediltahirbey	1,76	1,02	0,20	0,15
Bayraktar	9,84	6,34	1,80	1,42	Eskibedil	1,07	0,69	0,14	0,10
Biberoglu	4,04	2,54	0,72	0,54	Osmanbey	1,31	0,82	0,17	0,13
Gedikli	3,37	2,18	1,06	0,74	Kumkopru	3,45	1,44	0,27	0,19
Karaabdulbaki	8,00	5,34	2,79	1,79	Vakif	0,81	0,50	0,10	0,07
Sapakpinar	2,43	1,53	2,24	1,32	Topagac	1,85	0,82	0,15	0,10
Hasanciklar	2,56	1,55	0,64	0,43	Duzyazi	1,55	0,73	0,13	0,10
Suleymaniye	5,51	3,48	2,03	1,28	Yayalar	1,26	0,65	0,15	0,09
Akmese Ataturk	3,03	2,02	0,81	0,57	Beykoy	1,11	0,55	0,12	0,07
Besevler	2,65	1,46	0,55	0,41	Ortakoy	2,22	1,03	0,23	0,14

Contour plots of 24-h and annual PM_{10} concentrations are presented in Figure 10.4 - Figure 10.5.

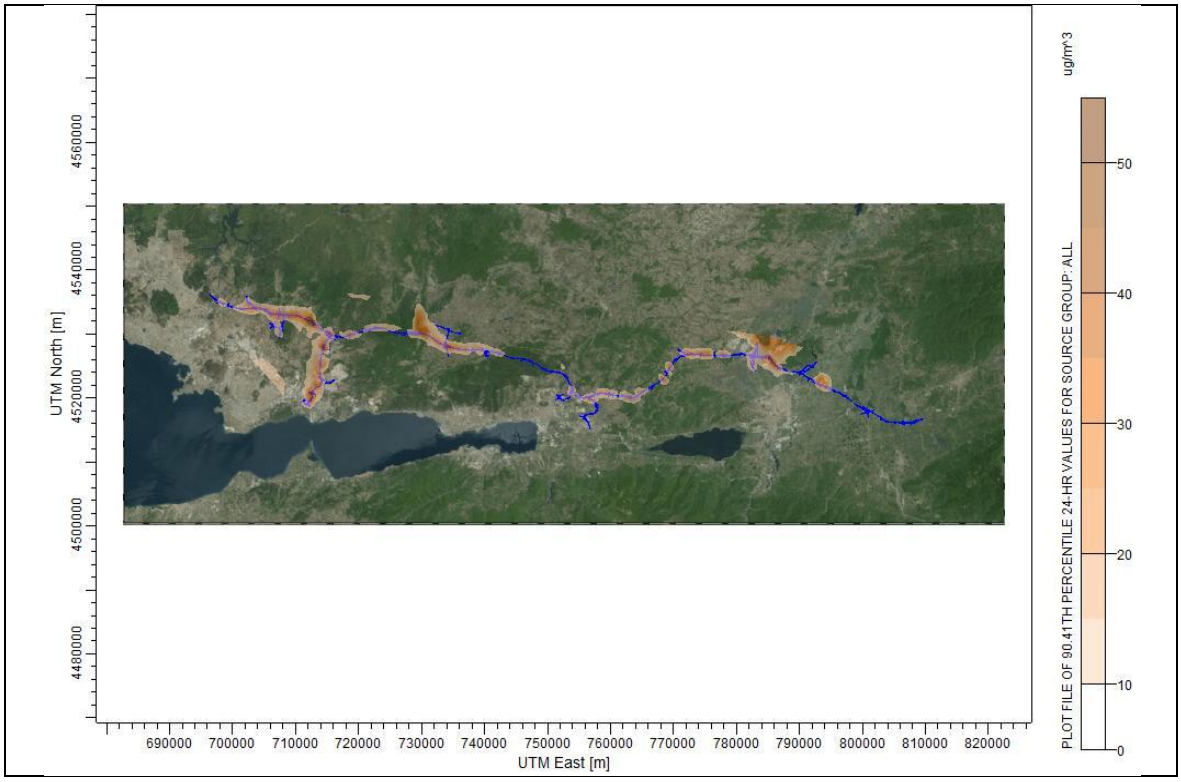


Figure 10.4. 24-hour PM_{10} Concentrations (90,41th percentile) for Land Preparation and Construction Phase

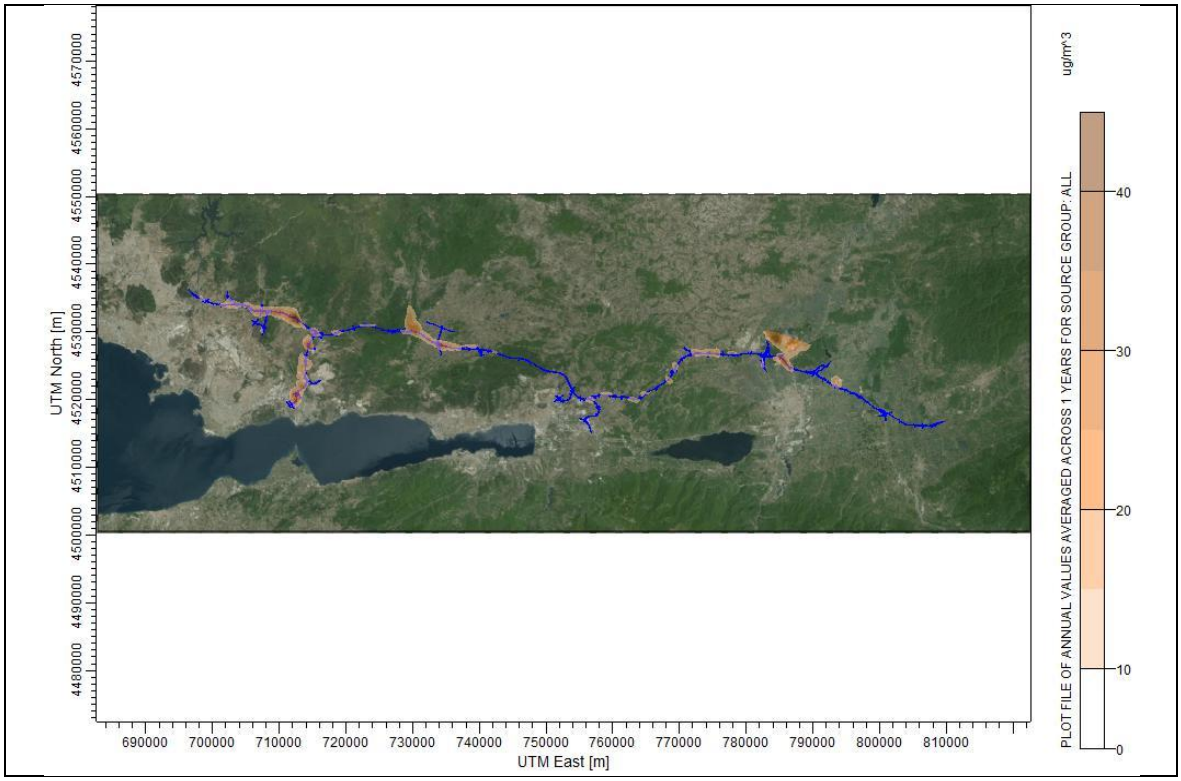


Figure 10.5. Annual PM_{10} Concentrations for Land Preparation and Construction Phase

For the assessment of impacts related to land preparation and construction phase, 25 receptors were selected along the route and sensitivities of each receptor were determined. Sensitivity of receptors depends on the usage purpose of the area. Evaluation of magnitude of impacts was based on percentage of exceedance of air quality standards defined for PM_{10} in Regulation on Assessment and Management of Air Quality and IFC. Magnitude of impact is defined as low, medium and high when the result of modeling study exceeds air quality standard in a specified location 0-25 %, 25-50 % and more than 50 %, respectively (see Table 10.16).

Table 10.16. Assessment of Impacts during Construction Activities on Receptors

Location/ Receptor	Type of Receptor	Sensitivity of Receptor	Modeling Result (24 h-90,41perc) (µg/m^3)	Baseline Measurement Result (µg/m^3)	Total Impact (µg/m^3)	Exceedance of Air Quality Standard (%)	Impact Magnitude
Kurnakoy	Human	Medium (2)	14,13	31,64	45,77	-	Low
Omerli Dam	Ecological	Medium (2)	2,28	31,64*	33,92	-	Low
Kadilli	Human	Medium (2)	16,28	20,80	37,08	-	Low
Denizli Pond	Ecological	Medium (2)	11,61	20,80*	32,41	-	Low
Demirciler	Human	Medium (2)	13,72	23,41	37,13	-	Low
Ballikayalar Nature Park	Ecological	Medium (2)	28,25	23,41*	51,66	3,3	Low
Tepecik	Human	Medium (2)	9,58	36,29	45,87	-	Low
Kutluca	Human	Medium (2)	38,72	25,40	64,12	28,2	Medium
Sevindikli Pond	Ecological	Low (1)	13,30	25,40*	38,70	-	Low
Sipahiler	Human	Medium (2)	22,55	16,99	39,54	-	Low
Sipahiler Pond	Ecological	Low (1)	28,83	16,99*	45,82	-	Low
Çayırkoy	Human	Medium (2)	3,87	33,96	37,83	-	Low
Bickidere Pond	Ecological	Low (1)	4,88	33,96*	38,84	-	Low
Durhasan	Human	High (3)	12,48	80,65	93,13	86,3	High
Bayraktar Pond	Ecological	Low (1)	4,87	13,99*	18,86	-	Low
Karaabdulbaki	Human	Medium (2)	15,49	13,99	29,48	-	Low
Kurtdere Pond	Ecological	Low (1)	5,44	13,99*	19,43	-	Low
Suleymaniye	Human	Medium (2)	18,33	6,35	24,68	-	Low
Korucuk	Human	Medium (2)	33,84	19,75	53,59	7,2	Low
Evrenkoy	Human	Medium (2)	6,27	49,85	56,12	12,2	Low
Taskisigi	Human	Medium (2)	49,24	40,39	89,63	79,3	High
Ikızce Osmaniye	Human	Medium (2)	18,86	40,39*	59,25	18,5	Low
Poyrazlar Lake and Nature Park	Ecological	Medium (2)	6,56	19,64*	26,20	-	Low
Budaklar	Human	Medium (2)	16,92	19,64	36,56	-	Low
Osmanbey	Human	Medium (2)	1,47	17,34	18,81	-	Low

**Baseline measurements at these locations are accepted to represent the nearest point of measurement. As there is no significant pollution source observed at these locations, baseline measurements were not performed during survey.*

Magnitude of impacts in Durhasan and Taskisigi are evaluated as high and impacts in Kutluca are evaluated as medium. It should be noted that baseline PM_{10} measurement in Durhasan already exceeds limit values while the contribution of the project is estimated as >50 %. With the application of measures defined in following sections, the impacts during construction of the motorway will be mitigated.

10.1.3.2. Operation Phase

Main pollutants expected to be generated during the operation of the motorway will include NO_x, PM_{10}, CO, VOCs and SO_2. In order to quantify the amounts of emissions generated during motorway operation, traffic forecast provided in the Feasibility Report prepared for the North Marmara Motorway Project were used. In order to represent the worst case scenario, traffic projections for 2038 are considered (highest traffic flow data) (see Table 10.17).

Table 10.17. Traffic Flow Data for 2038

Motorway Section	Description	Number of Vehicles					Heavy Vehicle Percentage (%)
		Passenger Car	Bus	Truck	Truck+Trailer, Tow Truck+Semi-Trailer	Total	
Section 4	Kurtkoy-Liman	135.651	6.542	15.424	11.353	168.970	16
Section 5	Liman-Izmit	103.354	6.612	15.920	13.889	139.774	21
Section 6	Izmit-Akyazi	55.076	3.201	8.568	6.746	73.591	21

Emission factors used for the calculation of emissions were obtained from UK National Atmospheric Emissions Inventory (2014) (see Table 10.18). Emissions are calculated for different types of vehicles including petroleum fueled cars and diesel cars and various types of heavy vehicles with the emission factors provided in Table 10.18. Results of the calculations are presented in Table 10.19.

Table 10.18. Emission Factors for Various Vehicle Types

Vehicle Type	Emission Factors (g/km)								
	NO_x	PM_{10}	$PM_{2.5}$	CO	VOC	NH_3	SO_2	Benzene	N_2O
Petrol cars	0,098	0,001	0,001	1,035	0,024	0,048	0,000	0,001	0,001
Diesel cars	0,637	0,011	0,011	0,022	0,005	0,001	0,001	0,000	0,004
Rigid HGVs	2,028	0,034	0,032	0,686	0,041	0,007	0,002	0,000	0,021
Artic HGVs	1,902	0,033	0,032	0,925	0,036	0,008	0,003	0,000	0,043
Buses	3,010	0,045	0,043	0,848	0,072	0,003	0,003	0,000	0,022

Table 10.19. Emissions Generated During Operation of the Motorway

Motorway Section/Vehicle Type	Emissions (kg/hr)								
	NO_x	PM_{10}	$PM_{2.5}$	CO	VOC	NH_3	SO_2	Benzene	N_2O
Section 4									
Passenger Cars	44,14	0,73	0,69	68,06	1,87	3,19	0,07	0,09	0,30
Buses	17,97	0,27	0,26	5,06	0,43	0,02	0,02	0,00	0,13
Heavy Vehicles	96,01	1,63	1,55	39,37	1,88	0,38	0,14	0,00	1,58
Section 4 - Total	158,12	2,63	2,50	112,49	4,18	3,59	0,23	0,10	2,01
Section 5									
Passenger Cars	56,52	0,94	0,89	87,13	2,39	4,09	0,09	0,12	0,38
Buses	30,51	0,46	0,44	8,60	0,73	0,03	0,03	0,00	0,22
Heavy Vehicles	179,61	3,05	2,90	73,65	3,51	0,71	0,26	0,00	2,96
Section 5 - Total	266,63	4,44	4,22	169,38	6,64	4,83	0,38	0,12	3,57
Section 6									
Passenger Cars	51,48	0,85	0,81	79,36	2,18	3,72	0,09	0,11	0,35
Buses	25,25	0,38	0,36	7,12	0,60	0,03	0,02	0,00	0,19
Heavy Vehicles	157,71	2,68	2,54	64,67	3,08	0,63	0,23	0,00	2,60
Section 6 - Total	234,44	3,91	3,71	151,15	5,87	4,38	0,34	0,11	3,13
TOTAL	659,19	10,98	10,43	433,02	16,68	12,80	0,94	0,33	8,72

In addition to emissions from main motorway, emissions from vehicles using the Liman Access Road are calculated. In order to estimate the traffic load expected on the Liman Access Road, traffic flow data presented in Environmental and Social Impact Assessment Report prepared for the Gebze – Orhangazi – Izmir Motorway and the Izmit Bay Crossing (ERM, 2011) is used. According to this report, traffic flow for Gebze – Orhangazi Section of them motorway is presented as approximately 88.000 (PCU – Passenger Car Units) in 2033. With a rough estimation, it was assumed that 100.000 PCU will be observed in 2038 and this projection is assumed to represent traffic estimations for Liman Access Road. Total number of vehicles expected to be using Liman Access Road is estimated as 69.000 and remaining 100.000 is estimated to be using North Marmara Motorway. Emissions for the access road are calculated accordingly with the emission factors presented in Table 10.18 and included in the modeling study.

Limit values above which air quality modeling should be performed are defined in Industrial Air Pollution Control Regulation. Emissions calculated for the worst case scenario were compared with the limit values for non-stack sources defined by the Industrial Air Pollution Control Regulation and air quality modeling was performed for NO_x, PM_{10}, CO, and VOC.

Air Quality Modeling for Operation Phase

In order to evaluate potential impacts of motorway project on air quality, air dispersion modeling was conducted for NO_2, PM_{10}, CO and VOCs and results were compared with air quality limit values defined in Regulation on Assessment and Management of Air Quality and IFC standards (see Table 10.1 and Table 10.2). Distribution of concentrations can be observed between Figure 10.6 – Figure 10.12. NO_2, PM_{10}, CO and VOC concentrations observed in settlements inside 2 km buffer zone of the motorway and presented in Table 10.20 – Table 10.23.

According to the Regulation on Assessment and Management of Air Quality, 24 hour PM_{10} concentrations are allowed to exceed the limit values 35 times in a year which corresponds to 90,41th percentile of PM_{10} concentrations for a given receptor. Therefore, 24 hour PM_{10} concentrations are provided for concentrations which correspond to 90,41th percentile. Similar to $PM_{10,}$ 1-hour NO_2 concentrations could be exceeded 18 times in a year which corresponds to 99,79th percentile of NO_2 concentrations for a given receptor. Therefore, 1-hour NO_2 results are provided for 99,79th percentile of the results.

Table 10.20. NO_2 Concentrations Observed in Settlements

Settlement	1-hour NO_2 Concentration (99,79th percentile)	Annual NO_2 Concentration	Settlement	1-hour NO_2 Concentration (99,79th percentile)	Annual NO_2 Concentration
	($\mu g/m^3$)			($\mu g/m^3$)	
Kurnakoy	167,70	24,97	Alanduzu	63,47	6,57
Fatih	119,26	15,91	Korucuk	23,82	2,13
Kadilli	265,56	27,14	Karapinar	193,41	12,50
Cumakoy	141,62	17,60	Evren	80,67	17,27
Denizli	157,91	21,28	Karaman	118,51	4,37
Koseler	112,80	12,27	Ikizce Osmaniye	31,76	5,30
Demirciler	181,64	19,28	Taskisigi	26,16	5,51
Tavsanli	112,38	22,88	Camyolu	181,32	11,18
Cumhuriyet	78,64	17,01	Karakamis	36,73	7,88
Muallim	95,18	7,32	Dagdibi	49,78	10,49
Yagcilar	120,34	14,48	Baglar	59,11	3,62
Semsettin	144,44	14,21	Suleymanbey	53,06	11,36
Kutluca	78,68	9,01	Koprubasi	46,11	9,78
Sevindikli	101,36	16,72	Rustemler	40,13	8,62
Karayakuplu	112,11	14,88	Cerciler	92,22	20,03
Osmanli	68,92	7,43	Poyrazlar	56,85	4,64
Cirakli	67,68	7,41	Dogancilar	24,97	5,23
Sipahiler	150,55	25,10	Komurluk	58,58	11,90
Derekoy	95,30	8,42	Celebiler	126,92	26,51
Toylar	120,11	13,14	Kasimlar	88,31	18,24
Kasikci	68,57	11,76	Haciramazanlar	97,56	20,17
Sepetci	145,13	11,27	Kurtbeyler	38,69	8,01
Tepekoy	76,74	7,61	Cokekler	38,15	8,15
Cayirkoy	136,51	12,78	Budaklar	76,74	16,71
Karadenizliler	42,26	8,23	Abali	59,65	12,37
Durhasan	58,67	6,60	Hacilar	35,79	7,40
Dumlupinar	24,51	5,43	Bayraktar	55,41	11,41
Istasyon	21,42	4,85	Gebes	35,83	7,52
Ataevler	19,14	4,33	Turkormankoy	36,99	7,63
Uzunbey	27,20	6,05	Kizilcikorman	74,76	15,51
Eseler	102,81	22,14	Bediltahirbey	35,16	7,65
Bayraktar	107,11	15,16	Eskibedil	41,17	8,58
Biberoglu	51,34	6,07	Osmanbey	78,97	16,71
Gedikli	49,44	4,33	Kumkopru	44,95	9,06
Karaabdulbaki	95,18	9,26	Vakif	43,40	8,09
Sapakpinar	36,16	2,82	Topagac	51,79	10,27
Hasanciklar	29,01	2,97	Duzyazi	52,40	7,14
Suleymaniye	58,59	5,86	Yayalar	25,38	4,12
Akmese Ataturk	40,86	4,76	Beykoy	33,05	2,79
Besevler	29,31	2,64	Ortakoy	34,42	3,70

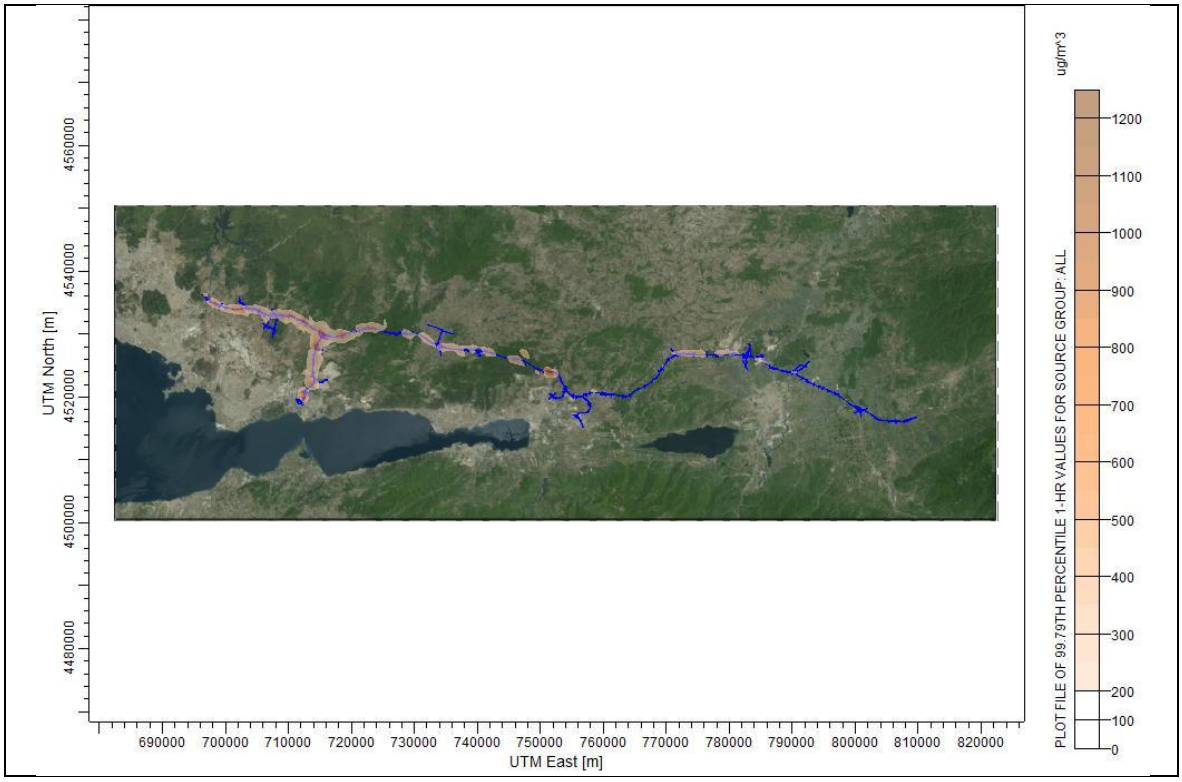


Figure 10.6. 1-hour NO_2 Concentrations (99,79th percentile) for Operation Phase

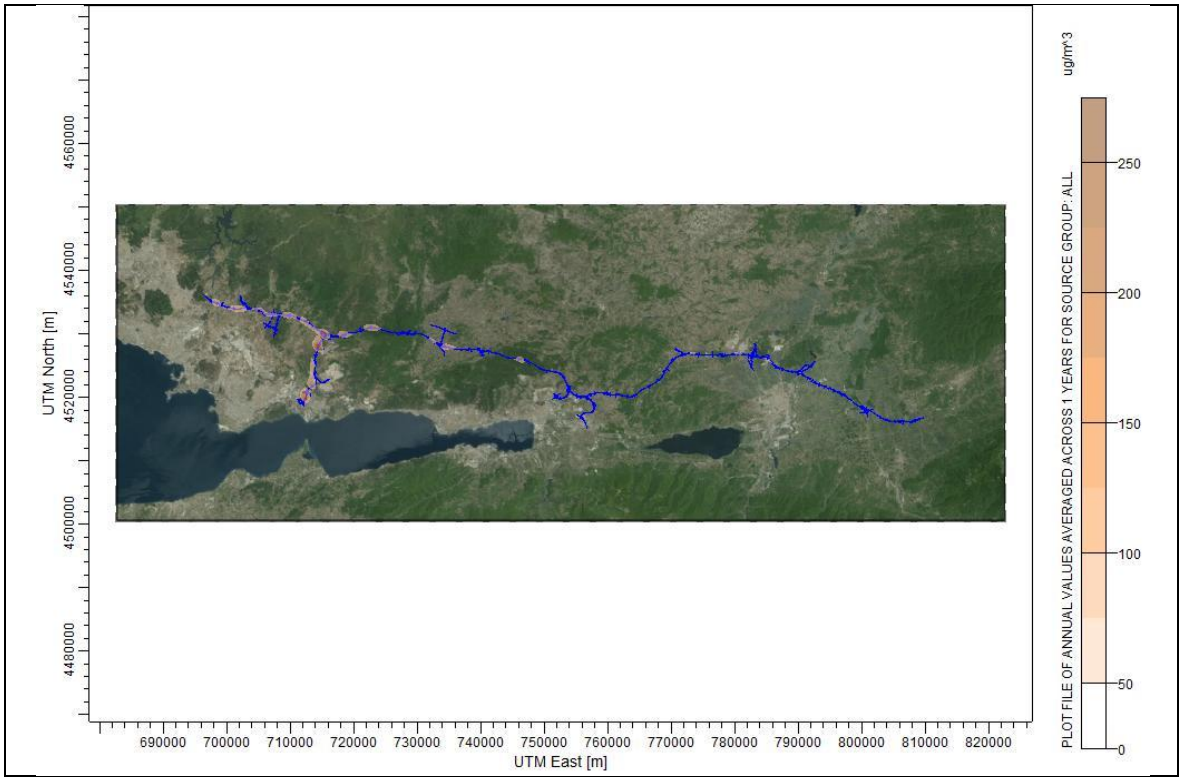


Figure 10.7. Annual NO_2 Concentrations for Operation Phase

NO_2 concentrations observed in settlements close to the motorway route are below short and long term limit values defined in Regulation on Assessment and Management of Air Quality and by IFC (for limit values see Table 10.1 and Table 10.2).

Table 10.21. PM_{10} Concentrations Observed in Settlements

Settlement	24 h -90,41perc PM_{10} Conc.	Annual PM_{10} Conc.	Settlement	24 h -90,41perc PM_{10} Conc.	Annual PM_{10} Conc.
	($\mu g/m^3$)			($\mu g/m^3$)	
Kurnakoy	0,86	0,55	Alanduzu	0,23	0,15
Fatih	0,53	0,35	Korucuk	0,07	0,05
Kadilli	0,95	0,60	Karapinar	0,44	0,28
Cumakoy	0,61	0,39	Evren	0,58	0,38
Denizli	0,70	0,47	Karaman	0,17	0,10
Koseler	0,43	0,27	Ikizce Osmaniye	0,18	0,12
Demirciler	0,69	0,43	Taskisigi	0,19	0,12
Tavsanli	0,77	0,51	Camyolu	0,39	0,25
Cumhuriyet	0,58	0,38	Karakamis	0,27	0,18
Muallim	0,26	0,16	Dagdibi	0,35	0,23
Yagcilar	0,49	0,32	Baglar	0,13	0,08
Semsettin	0,49	0,32	Suleymanbey	0,38	0,25
Kutluca	0,30	0,20	Koprubasi	0,33	0,22
Sevindikli	0,56	0,37	Rustemler	0,29	0,19
Karayakuplu	0,52	0,33	Cerciler	0,66	0,45
Osmanli	0,26	0,17	Poyrazlar	0,17	0,10
Cirakli	0,26	0,16	Dogancilar	0,18	0,12
Sipahiler	0,82	0,56	Komurluk	0,41	0,26
Derekoy	0,29	0,19	Celebiler	0,90	0,59
Toylar	0,45	0,29	Kasimlar	0,62	0,41
Kasikci	0,40	0,26	Haciramazanlar	0,70	0,45
Sepetci	0,41	0,25	Kurtbeyler	0,27	0,18
Tepekoy	0,27	0,17	Cokekler	0,28	0,18
Cayirkoy	0,44	0,28	Budaklar	0,56	0,37
Karadenizliler	0,28	0,18	Abali	0,42	0,28
Durhasan	0,23	0,15	Hacilar	0,25	0,16
Dumlupinar	0,18	0,12	Bayraktar	0,39	0,25
Istasyon	0,17	0,11	Gebes	0,25	0,17
Ataevler	0,15	0,10	Turkormankoy	0,27	0,17
Uzunbey	0,21	0,13	Kizilcikorman	0,53	0,34
Eseler	0,75	0,49	Bediltahirbey	0,26	0,17
Bayraktar	0,53	0,34	Eskibedil	0,29	0,19
Biberoglu	0,21	0,14	Osmanbey	0,57	0,37
Gedikli	0,15	0,10	Kumkopru	0,32	0,20
Karaabdulbaki	0,30	0,21	Vakif	0,28	0,18
Sapakpinar	0,09	0,06	Topagac	0,36	0,23
Hasanciklar	0,10	0,07	Duzyazi	0,25	0,16
Suleymaniye	0,20	0,13	Yayalar	0,15	0,09
Akmese Ataturk	0,16	0,11	Beykoy	0,11	0,06
Besevler	0,09	0,06	Ortakoy	0,13	0,08

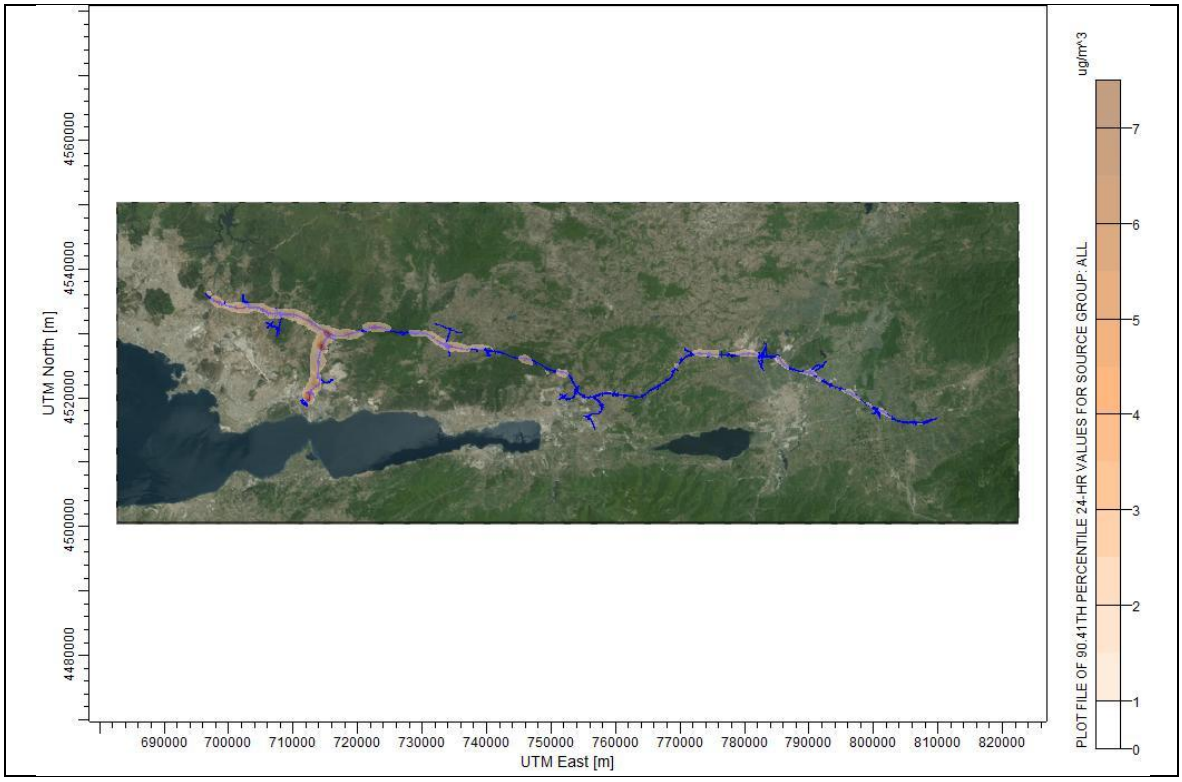


Figure 10.8. 24-hour PM_{10} Concentrations (90,41th percentile) for Operation Phase

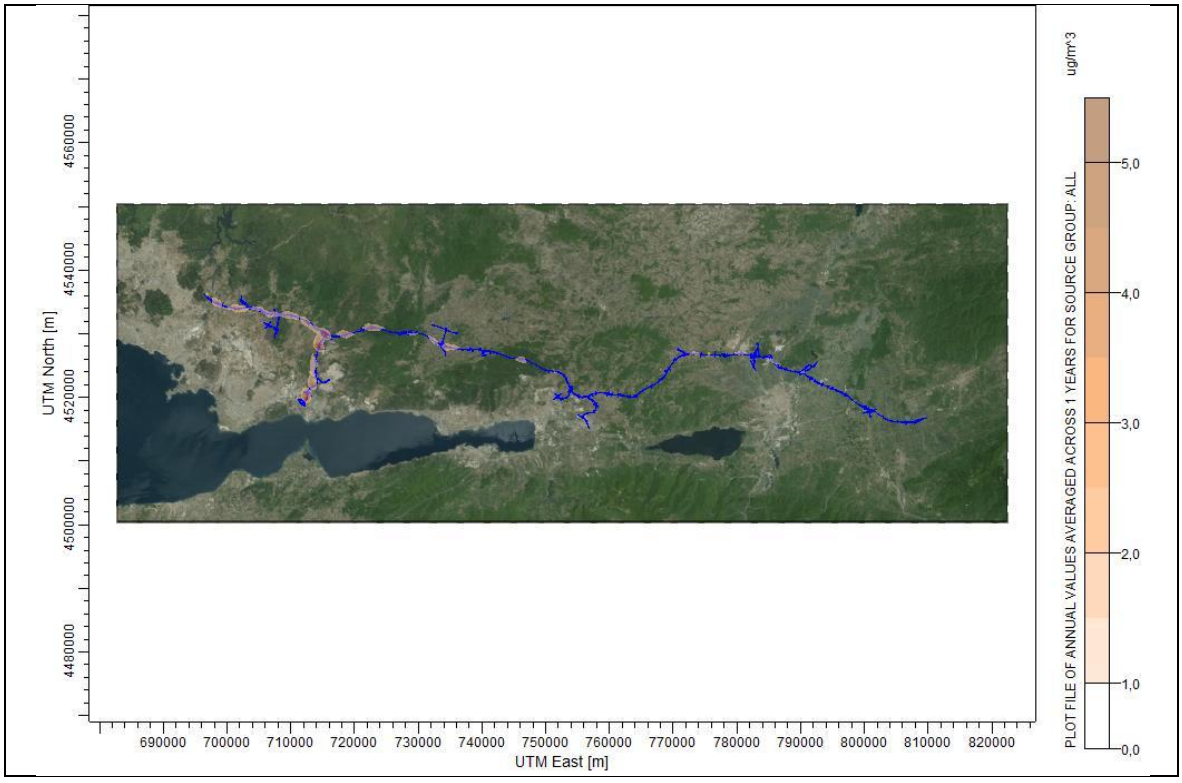


Figure 10.9. Annual PM_{10} Concentrations for Operation Phase

PM_{10} concentrations observed in settlements close to the motorway route are below short and long term limit values defined in Regulation on Assessment and Management of Air Quality and by IFC (for limit values see Table 10.1 and Table 10.2).

Table 10.22. CO Concentrations Observed in Settlements

Settlement	8-hour CO Concentration (µg/m^3)	Settlement	8-hour CO Concentration (µg/m^3)
Kurnakoy	91,05	Alanduzu	29,89
Fatih	59,33	Korucuk	10,23
Kadilli	124,69	Karapinar	71,00
Cumakoy	59,74	Evren	58,75
Denizli	68,37	Karaman	33,69
Koseler	47,09	Ikizce Osmaniye	18,42
Demirciler	59,83	Taskisigi	19,54
Tavsanli	59,41	Camyolu	60,34
Cumhuriyet	46,08	Karakamis	27,11
Muallim	25,75	Dagdibi	36,47
Yagcilar	51,99	Baglar	28,09
Semsettin	62,75	Suleymanbey	39,18
Kutluca	35,10	Koprubasi	34,04
Sevindikli	57,45	Rustemler	29,52
Karayakuplu	56,65	Cerciler	68,34
Osmanli	28,82	Poyrazlar	19,66
Cirakli	26,51	Dogancilar	18,58
Sipahiler	85,51	Komurluk	43,71
Derekoy	34,44	Celebiler	94,99
Toylar	48,23	Kasimlar	65,93
Kasikci	44,37	Haciramazanlar	72,88
Sepetci	61,20	Kurtbeyler	29,01
Tepekoy	29,66	Cokekler	28,04
Cayirkoy	56,13	Budaklar	56,61
Karadenizliler	28,37	Abali	44,76
Durhasan	25,79	Hacilar	26,67
Dumlupinar	17,83	Bayraktar	41,32
Istasyon	15,60	Gebes	26,53
Ataevler	13,95	Turkormankoy	27,50
Uzunbey	19,92	Kizilcikorman	55,67
Eseler	75,36	Bediltahirbey	25,87
Bayraktar	54,80	Eskibedil	30,34
Biberoglu	21,21	Osmanbey	58,85
Gedikli	20,07	Kumkopru	32,36
Karaabdulbaki	37,41	Vakif	28,20
Sapakpinar	10,13	Topagac	37,80
Hasanciklar	12,85	Duzyazi	25,38
Suleymaniye	28,46	Yayalar	15,80
Akmese Ataturk	14,86	Beykoy	12,40
Besevler	12,67	Ortakoy	13,48

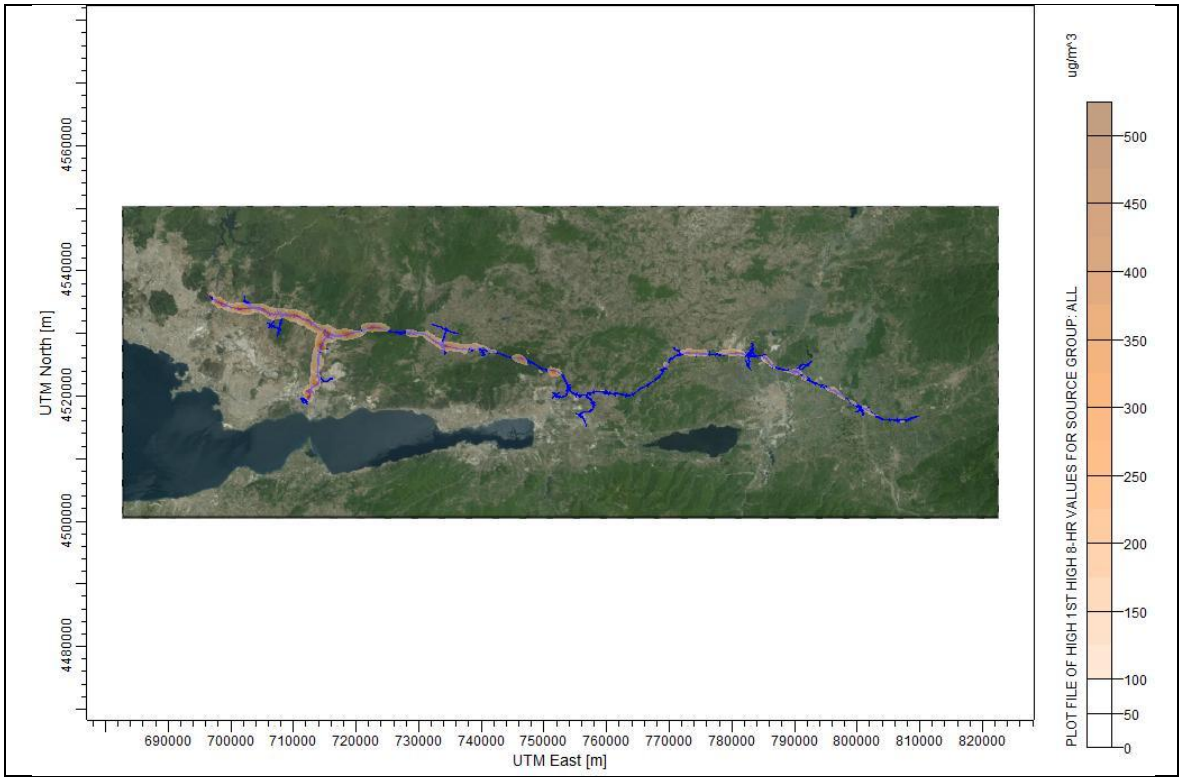


Figure 10.10. 8-hour CO Concentrations for Operation Phase

CO concentrations observed in settlements close to the motorway route are below limit values defined in Regulation on Assessment and Management of Air Quality (see Table 10.1).

Table 10.23 VOC Concentrations Observed in Settlements

Settlement	1-hour VOC Concentration	24-hour VOC Concentration	Settlement	1-hour VOC Concentration	24-hour VOC Concentration
	(µg/m^3)			(µg/m^3)	
Kurnakoy	5,91	2,20	Alanduzu	2,06	0,56
Fatih	4,18	1,27	Korucuk	1,52	0,19
Kadilli	11,48	2,39	Karapinar	6,28	1,17
Cumakoy	5,11	1,31	Evren	2,55	1,42
Denizli	7,97	1,66	Karaman	7,43	0,56
Koseler	3,87	1,13	Ikizce Osmaniye	1,07	0,46
Demirciler	5,18	1,52	Taskisigi	0,97	0,47
Tavsanli	3,51	1,57	Camyolu	9,29	1,15
Cumhuriyet	2,19	1,22	Karakamis	1,15	0,65
Muallim	4,19	0,51	Dagdibi	1,64	0,86
Yagcilar	4,26	1,19	Baglar	2,68	0,42
Semsettin	5,69	1,06	Suleymanbey	1,68	0,92
Kutluca	3,26	0,77	Koprubasi	1,47	0,80
Sevindikli	3,45	1,32	Rustemler	1,32	0,69
Karayakuplu	3,66	1,20	Cerciler	4,08	1,60
Osmanli	2,85	0,66	Poyrazlar	2,72	0,51
Cirakli	3,07	0,62	Dogancilar	1,19	0,47
Sipahiler	4,76	2,00	Komurluk	1,84	1,04

Settlement	1-hour VOC Concentration	24-hour VOC Concentration	Settlement	1-hour VOC Concentration	24-hour VOC Concentration
	(µg/m^3)			(µg/m^3)	
Derekoy	4,15	0,71	Celebiler	3,99	2,26
Toylar	4,17	0,98	Kasimlar	2,78	1,57
Kasikci	2,30	1,04	Haciramazanlar	3,07	1,73
Sepetci	4,82	1,34	Kurtbeyler	1,22	0,69
Tepekoy	3,32	0,67	Cokekler	1,22	0,66
Cayirkoy	4,93	0,97	Budaklar	3,30	1,32
Karadenizliler	1,57	0,69	Abali	1,88	1,06
Durhasan	3,54	0,53	Hacilar	1,13	0,64
Dumlupinar	0,86	0,44	Bayraktar	1,74	0,98
Istasyon	1,01	0,39	Gebes	1,13	0,62
Ataevler	0,91	0,36	Turkormankoy	1,16	0,66
Uzunbey	1,40	0,50	Kizilcikorman	5,11	1,33
Eseler	3,46	1,77	Bediltahirbey	1,72	0,63
Bayraktar	3,38	1,33	Eskibedil	1,30	0,72
Biberoglu	1,75	0,52	Osmanbey	4,53	1,40
Gedikli	1,99	0,35	Kumkopru	1,43	0,77
Karaabdulbaki	4,93	0,72	Vakif	1,40	0,69
Sapakpinar	1,39	0,23	Topagac	1,75	0,89
Hasanciklar	1,24	0,28	Duzyazi	3,72	0,61
Suleymaniye	3,63	0,56	Yayalar	0,84	0,35
Akmese Ataturk	1,42	0,38	Beykoy	1,74	0,26
Besevler	1,64	0,26	Ortakoy	1,29	0,33

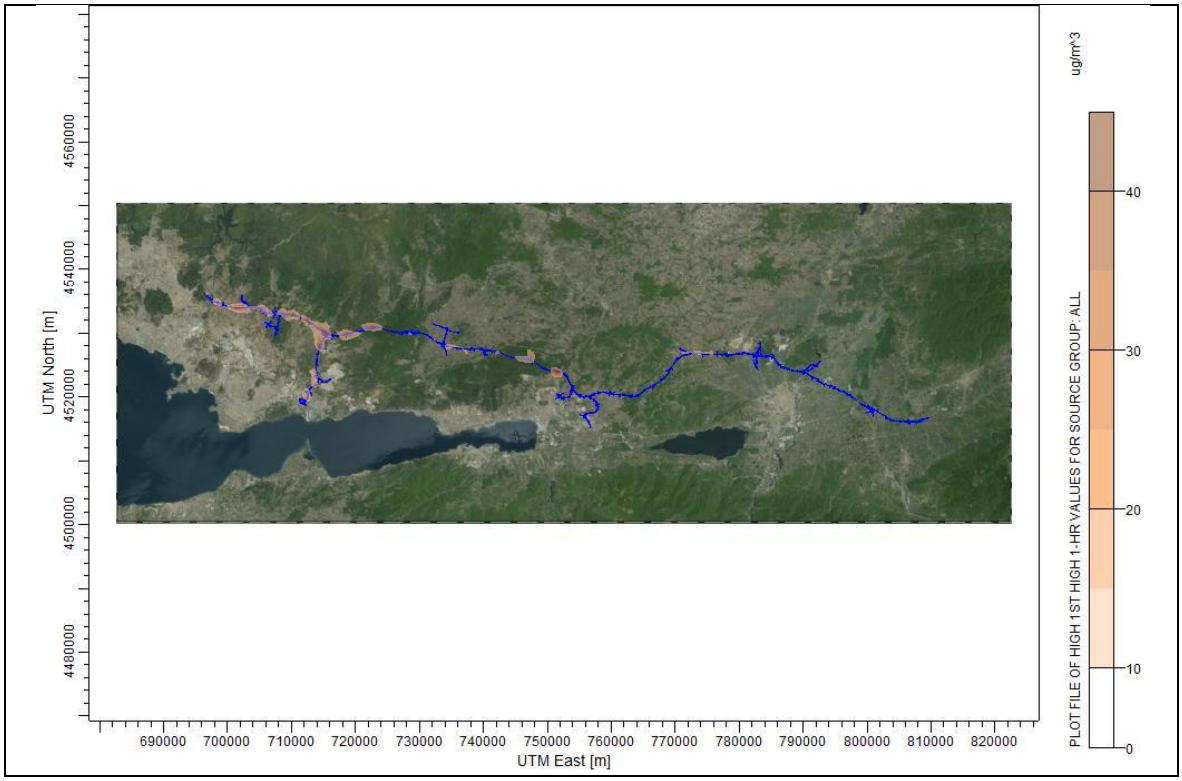


Figure 10.11. 1-hour VOC Concentrations for Operation Phase

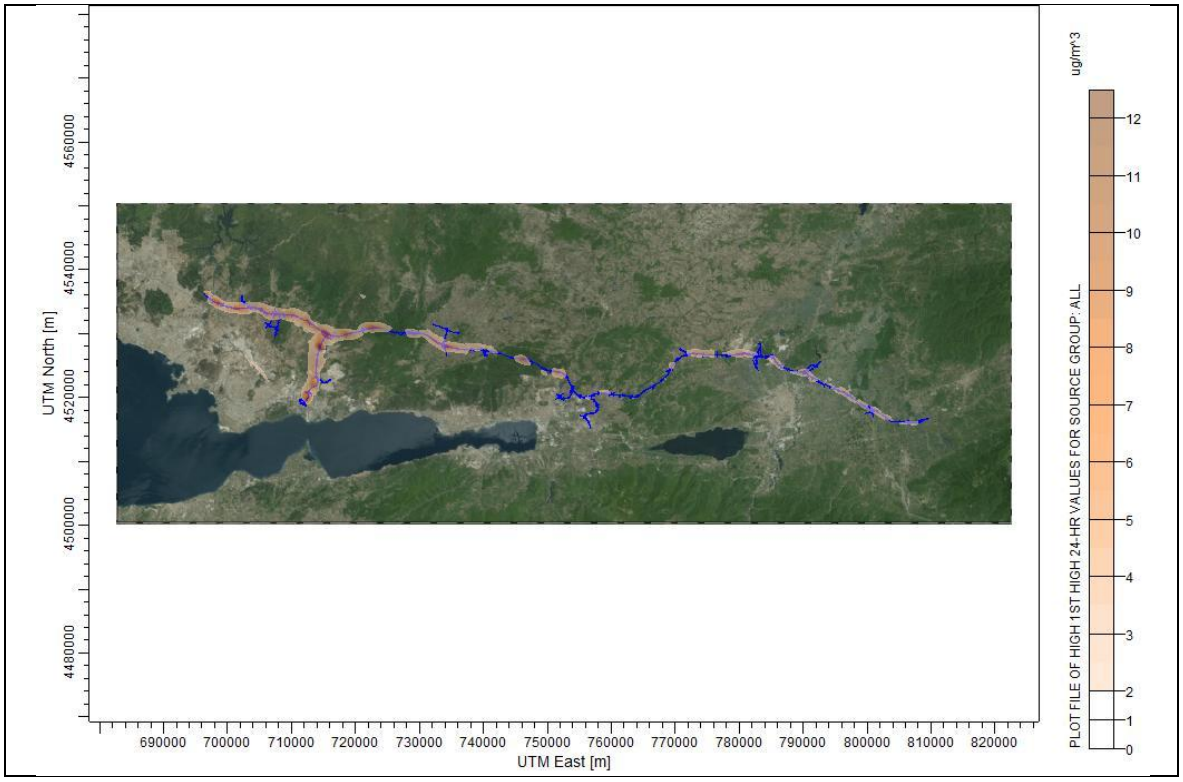


Figure 10.12. 24-hour VOC Concentrations for Operation Phase

VOC concentrations observed in settlements close to the motorway route are below short and long term limit values defined in Industrial Air Pollution Control Regulation (see Table 10.1 for limit values).

Assessment of magnitude of impacts according to sensitivities of most affected receptors for operation phase is carried out for NO_2 because NO_2 concentrations indicate exceedance of limit values along the motorway route. For the assessment of impacts related to operation phase, 17 receptors were selected along the route and sensitivities of each receptor were determined. Sensitivity of receptors depends on the usage purpose of the area. Evaluation of magnitude of impacts was based on percentage of exceedance of air quality standards defined for NO_2 in Regulation on Assessment and Management of Air Quality and IFC. Magnitude of impact is defined as low, medium and high when the result of modeling study exceeds air quality standard in a specified location 0-25 %, 25-50 % and more than 50 %, respectively (see Table 10.24).

Table 10.24. Assessment of Impacts during Operation Activities on Receptors

Location/ Receptor	Type of Receptor	Sensitivity of Receptor	Modeling Result (1-h - 99,79perc) (µg/m^3)	Baseline Measurement Result (µg/m^3)	Total Impact (µg/m^3)	Exceedance of Air Quality Standard (%)	Impact Magnitude
Kurnakoy	Human	Medium (2)	440,40	34,16	474,56	137,3	High
Omerli Dam	Ecological	Medium (2)	54,29	34,16*	88,45	-	Low
Kadilli	Human	Medium (2)	265,56	34,16*	299,72	49,9	Medium
Denizli Pond	Ecological	Medium (2)	347,40	27,10*	374,5	87,3	High
Demirciler	Human	Medium (2)	201,63	27,10	228,73	14,4	Low
Ballikayalar Nature Park	Ecological	Medium (2)	298,48	27,10*	325,58	62,8	High
Tavsanli	Human	Medium (2)	112,38	27,10*	139,48	-	Low
Sepetci	Human	Medium (2)	145,13	21,25*	166,38	-	Low
Çayırkoy	Human	Medium (2)	136,51	21,25*	157,76	-	Low
Bickidere Pond	Ecological	Low (1)	111,43	21,25*	132,68	-	Low
Durhasan	Human	High (3)	157,43	21,25	178,68	-	Low
Eseler	Human	Medium (2)	102,81	21,25*	124,06	-	Low
Bayraktar Pond	Ecological	Low (1)	64,41	21,25*	85,66	-	Low
Korucuk	Human	Medium (2)	386,73	10,42	397,15	98,6	High
Karapinar	Human	Medium (2)	193,41	10,42*	203,83	1,9	Low
Karaman	Human	Medium (2)	118,51	10,42*	128,93	-	Low
Evrenkoy	Human	Medium (2)	80,67	10,42*	91,09	-	Low

**Baseline measurements at these locations are accepted to represent the nearest point of measurement. As there is no significant pollution source observed at these locations, baseline measurements were not performed during survey.*

Magnitude of impacts in selected receptors are evaluated as high in Kurnakoy, Denizli Pond, Ballikayalar Nature Park and Korucuk. In addition, impacts in Kadilli are evaluated as medium while impacts in other settlements are evaluated as low. It should be noted that air quality modeling study was carried out by taking into account the predicted traffic load in 2038. This study presents the worst case scenario and high NO_2 concentrations observed across the route is associated with high traffic loads. In addition, it was observed that NO_2 concentrations near tunnel portals tend to exceed limit values while concentrations decrease rapidly and no significant exceedences are observed in close settlements.

Road tunnels can be viewed as a chamber in which the emissions from a section of road which would normally be dispersed into the atmosphere along the whole length of the road, are first collected rather than being instantly dispersed. Compared to a surface road, the air quality experienced by road users is relatively poor, however the impact on surrounding residential areas is redistributed so that contaminated air is more concentrated near the points where tunnel air is released into the atmosphere. The interior of a road tunnel is generally sheltered from wind effect and even though there will be turbulence, there is only a limited supply of fresh air to dilute the polluted air. It is clear that mass of pollutants emitted in a tunnel depends on the number of vehicles passing through and the emissions per vehicle. *(Longley I, Coulson G, Olivares G., 2010)*

As can be seen from the results of the modeling study, NO_2 concentrations along Section 4 and around tunnel portals in Section 5 are relatively higher than other sections of the motorway. The main reason for high NO_2 concentrations is that traffic projections for 2038 reflect considerably high number of vehicles using the motorway section. This was accepted as the worst case scenario and exhaust emissions of the vehicles in 2038 are expected to be much lower as more electrically operated vehicles or low emission engines

will be in operation in year 2038. Relevant mitigation measures are presented in Section 10.1.4.

In addition, it should be noted that air quality exceeds the limit values (presented in Table 10.1 and Table 10.2) in the immediate vicinity (about 10 m) of the portals. Away from the immediate vicinity of the portals, concentrations of pollutants are observed to decrease rapidly, which was proved by model results. *(Longley, I., 2014)*

10.1.4. Mitigation Measures

The following section describes the actions and strategies designed to avoid, minimize or offset the potential adverse air quality impacts of the project, or to enhance potential project benefits.

10.1.4.1. Land Preparation and Construction Phase

As described in the sections above, construction activities may generate emission of dust caused by excavation, fill and materials handling and storage as well as exhaust emissions from diesel fueled construction machinery and equipments. The following techniques for the reduction and control of air emissions will be implemented during the land preparation and construction phase in accordance with relevant Turkish regulations and KGM's Technical Specifications for Motorways:

- Dust should be minimized from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house filters or cyclones)
- Dust should be minimized from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content
- Speed limitations will be defined and obeyed for construction vehicles.
- Well and adequate maintained vehicles shall be used. Regular maintenance of machinery and equipments will be ensured.
- The drop height of potentially dust generating materials will be kept as low as possible.
- Construction vehicles will not be permitted to keep engines running while waiting to enter the site or waiting on-site.
- Dust suppression methods (i.e. watering with water trucks, applying non-toxic chemicals, speed limits for mobile vehicles, use of well-maintained vehicles/machinery) will be applied at road construction sites, service roads and quarry/material borrow/storage sites to mitigate Project-related dust emissions. In this respect, upper layers of the work sites/materials will be kept at a humidity level of about 10%. Watering will be applied at any time necessary including night time, weekends or off-days by using pressurized distribution or spraying systems that would ensure even distribution of water.
- If there is traffic flow on the existing roads near the work sites, dust suppression measures will be continuously applied to ensure traffic safety. If there is no traffic existing in the local roads, dust suppression measures will be applied only at local residential and business areas.

- All the dust-emitting components of the crushing-screening plants will be put in closed spaces and equipped with dust suppression systems.
- Loading and unloading operations will be performed without throwing/scattering.
- During transportation, excavated materials will be covered with nylon canvas or materials with grain size larger than 10 mm.
- In the supply of construction materials, local licensed quarries (existing or new) will be preferred to reduce transportation distance to minimize associated impacts and costs.
- Wind shields/barriers will be placed at work sites such as material storage areas to prevent dust dispersion where necessary.
- Relevant provisions of the Regulation on Air Pollution Control Sourced from Industry and Regulation on the Assessment and Management of Air Quality will be complied with to minimize air emissions sourced from construction machinery and trucks.
- Blasting operations will be conducted in line with the legislation in force and good industry practices/modern techniques.
- Roads to be used for access to quarry sites will be upgraded by the Project Sponsors to minimize dust emissions during transport. These roads will have sufficient width.
- Driving through settlements will be avoided wherever alternative roads are present.
- Any damage caused by insufficient or lack of dust suppression measures will be compensated.

10.1.4.2. Operation Phase

- At the service areas, a green buffer strip will be formed between the outer lane of the Motorway and the facilities. This strip will be properly planted (e.g. with shrubs that start growing from the base and are resistant to dust and gaseous emissions) to form a barrier against dust to be sourced from the motorway traffic.
- The application of automatic toll systems along the motorway will contribute to an optimization of traffic flows and thus lower emissions.
- Tunnel ventilation system designed with the objective to remove/dilute vehicle emissions will be installed so that air quality within the tunnel complies with relevant air quality standards.
- In order to ensure appropriate air quality near tunnel portals, need, capacity and type of tunnel ventilation systems, dispersion techniques, air stacks and other technologies will be considered during the design of tunnels. Example illustration showing tunnel air flow and stack application for avoiding tunnel portal emissions is presented in Figure 10.13.

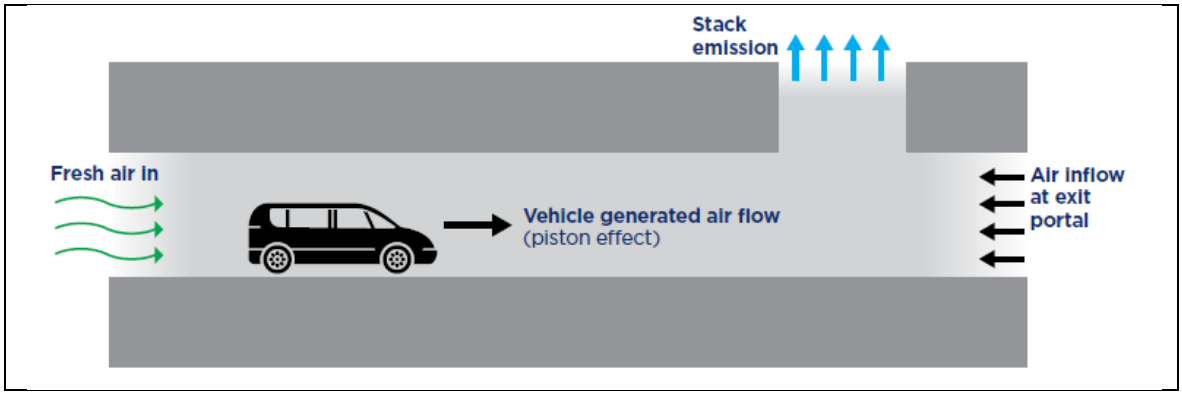


Figure 10.13. Example Illustration of Tunnel Air Flow and Stack Application to Avoid Portal Emissions (Longley, I., 2014)

10.1.5. Summary of Assessment and Residual Impacts

Table 10.51 provides a summary on the air quality assessments. Significance of the identified impacts before and after the implementation of mitigation measures are summarized in this table. As can be seen from the Table, potential impacts on local communities are assessed as medium and high during land preparation and construction phase of the motorway while it is anticipated that these impacts would be lower with mitigation measures to be applied. During operation of the motorway, medium and high level impacts are anticipated to result in residual impacts of medium and low with relevant mitigation measures. Furthermore, already existing traffic load on alternative roads will shift on to North Marmara Motorway and it is anticipated that emissions from these roads will decrease. It should also be noted that high impact significance (for Durhasan) is mainly attributed to the baseline air quality measured which reflect exceedance of air quality standards.

10.2. Climate Change

10.2.1. Assessment Methodology and Data Sources

North Marmara Motorway Project is considered having the potential to emit one or more of the greenhouse gases (GHGs). GHG assessment for the land preparation and construction phase and operation phase of the motorway is carried out in this section.

10.2.1.1. Greenhouse Gases

Greenhouse gas emissions refer to the release of greenhouse gases (GHG) into the atmosphere. United Nations Framework Convention on Climate Change (UNFCCC) lists GHG as below:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulfur hexafluoride (SF_6)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)

Contribution of project activities to climate change is evaluated by estimation of the amount of greenhouse gas emissions. Greenhouse gas emissions will be generated during both construction and operation phases of the project.

Mobile sources and transportation account for a large fraction of fossil fuel combustion in most countries. Internal combustion engines derive energy from burning of hydrocarbon fuel in air, generating carbon dioxide (CO_2) and water vapor (H_2O). During combustion, some amount of the fuel is either not burnt or partially burnt. This results in generation of carbon monoxide (CO), volatile organic compounds (VOCs) and particulate matter (PM).

In addition, at the high temperatures and pressures found in the combustion chamber, some of the nitrogen in the air and fuel is oxidized, forming mainly nitric oxide (NO) with a small amount of nitrogen dioxide (NO_2). By convention, the sum total of oxides of nitrogen (i.e. NO + NO_2) is abbreviated as NO_x. To summarize, CO, VOCs, NO_x and PM, have normally been regarded as the pollutants of most concern, and rates of emission are legally restricted in many countries. CO_2, being a major contributor to global warming, is now also considered to be an atmospheric pollutant.

Besides local air pollution, vehicle emissions also contribute to a regional degradation of air quality such that greenhouse gases such as CO2, may contribute to environmental problems on a global scale for many years.

10.2.1.2. Regulatory Framework

Turkish Legal Requirements

Turkey became a party of the United Nations Framework Convention on Climate Change in 2004. In the 7th Conferences of the Parties (COP7) meeting held in Marrakech in 2001, the special conditions of Turkey which has a different position than the other countries in the Annex-I list of the Convention, were recognized and it was decided that its name will remain on the Annex-I while it will be removed from the Annex-II list.

The process that is started when Turkey is recognized as an Annex-I country having special conditions different from the other parties of the Convention, has affected and accelerated the country's political decision of being a party of the Kyoto Protocol. Around five years after becoming a part of the Convention, in February 2009, "The law on the convenience of Turkey's entrance to the Kyoto Protocol for the United Nations Framework Convention on Climate Change" came into force, in May 2009, Turkey's entrance to the Kyoto Protocol was documented and sent to the General Secretariat of the United Nations. The whole ratification process of the Protocol was completed in 26 August 2009.

As a country that ratified the UN Convention Framework on Climate Change and the Kyoto Protocol, Turkey has taken the responsibilities described under UNFCCC, that are related to the adaptation to the effects of the climate change which are imposed to the parties. The issues of some of the international UN conventions that Turkey is a party, are also indirectly related with the adaptation to the effects of the climate change. These are; Convention to Combat Desertification, Convention on Biological Diversity, Bern Convention on the Conservation of European Wildlife and Natural Habitats, Conventions for the Protection of Mediterranean Sea and the Black Sea Against Pollution and its additional protocols. (*Ministry of Environment and Urbanization, 2011).*

Within this scope, adaptation to climate change and actions towards mitigation of potential impacts of climate change are regulated through a variety of national legislation including topics such as disaster risk management, conservation of biodiversity, water safety and security, food safety and security.

IFC Standards

IFC has established the Performance Standards on Environmental and Social Sustainability and relevant guidance notes. IFC Performance Standard (PS) 3 on Resource Efficiency and Pollution Prevention states that; for projects that are expected to or currently produce more than 25.000 tons of CO_2eq annually, the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the project. It suggests the client to consider alternatives and implement technically and financially feasible and cost-effective options to reduce project related GHG emissions during the design and operation of the project which may include, but not limited to, alternative project locations, adoption of renewable or low carbon energy sources, sustainable agricultural, forestry and livestock management practices, the reduction of fugitive emissions and the reduction of gas flaring. Another requirement of PS

3 is quantification of GHG emissions which will be conducted by the client annually in accordance with internationally recognized methodologies and good practice.

10.2.2. Baseline Conditions

10.2.2.1. Meteorological and Climatic Characteristics

In this section, properties of the project area are evaluated regarding its climatic and meteorological properties.

Asian Section of North Marmara Motorway Project passes from three provinces which are İstanbul, Kocaeli and Sakarya. Located in the Marmara Region, the climate of Istanbul shows transient properties between Black Sea climate and Mediterranean climate. Within the province, the weather is generally hot and arid during summer and mild and rainy during winter. Along the coast of Marmara Sea, summers are hot and arid while winters are mild. Proceeding towards the North, summers become cooler with more rain while winters get colder. In the province, where most precipitation is observed during autumn and winter, most precipitation is observed in December while least precipitation is observed during August *(The Governorship of Istanbul, Province Directorate of the Ministry of Environment and Urbanization, 2015).*

Similar to Istanbul, Kocaeli and Sakarya provinces are located in Marmara Region and climate of these provinces show transient properties between Black Sea climate and Mediterranean climate. Generally winters are mild and rainy, while summers are hot. Climate can show varying characteristics among Kocaeli province. For example, summers along Izmit Bay are observed to be hotter while it is cooler along Blacksea coasts of the province. Mediterranean climate is predominant in west and south of Sakarya while Black Sea climate dominated along the Black Sea coast and eastern parts of the province.

In order to evaluate the meteorological and climatic characteristics of the Asian Section of North Marmara Motorway Project, Meteorological Bulletin published by the Turkish State Meteorological Service including the long term average data recorded in Kocaeli Meteorology Station (station number: 17066) was obtained. In light of the data obtained, meteorological characteristics of the project area and its surrounding are evaluated in the following parts. The station is located 74 m above sea level. The evaluations presented below are based on long term statistical data recorded between 1961 and 2015 in Kocaeli Meteorology Station.

Pressure Distribution

Annual mean local pressure measured in Kocaeli Meteorology Station is 1006,7 hPa. During the whole observation period, minimum pressure is recorded as 975,6 hPa in January and maximum pressure is recorded as 1035,0 hPa in December. Monthly average, maximum and minimum pressure values recorded in the station are provided in Figure 10.14 and Table 10.25.

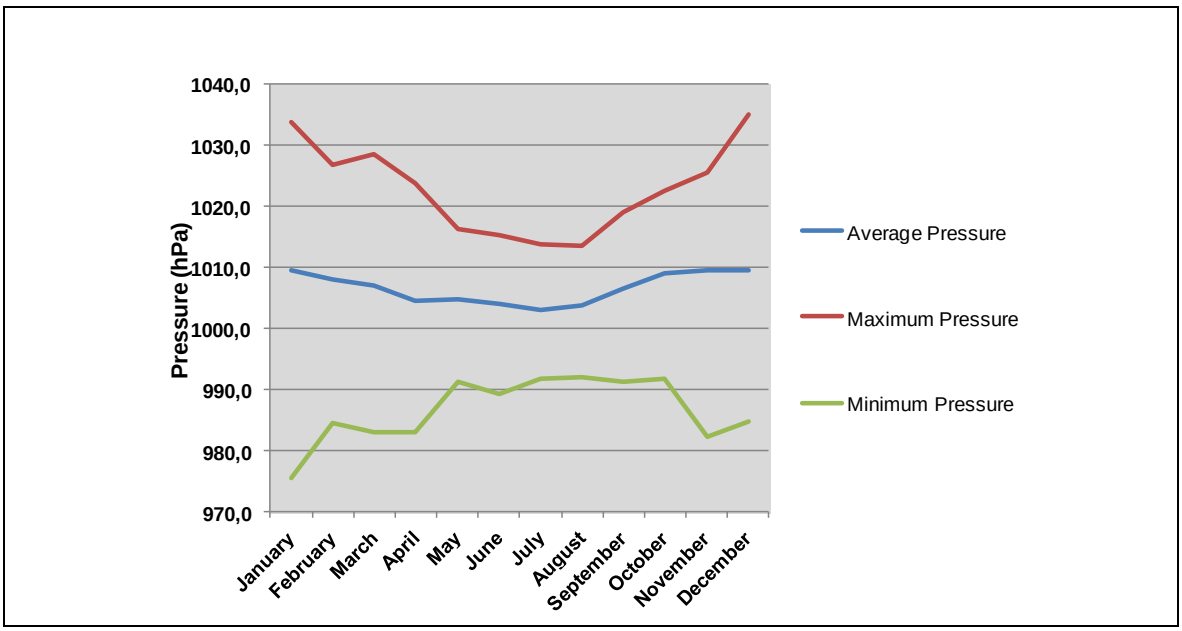


Figure 10.14. Monthly Average, Maximum and Minimum Pressure Values

Table 10.25. Monthly Average, Maximum and Minimum Pressure Values

Months	Average Pressure (hPa)	Maximum Pressure (hPa)	Minimum Pressure (hPa)
January	1009,7	1033,9	975,6
February	1008,1	1026,9	984,5
March	1007,1	1028,6	983,2
April	1004,6	1023,9	983,1
May	1004,8	1016,3	991,4
June	1004,1	1015,3	989,3
July	1003,2	1013,9	991,9
August	1003,8	1013,7	992,0
September	1006,6	1019,0	991,4
October	1009,2	1022,5	991,8
November	1009,5	1025,5	982,3
December	1009,5	1035,0	984,8
Annual	1006,7	1035,0	975,6

Temperature Distribution

According to Kocaeli Meteorology Station records, annual mean temperature is 14,9 °C. The highest temperature is recorded as 44,1ºC in July. The lowest temperature is recorded as –9,7ºC in January. The graphical and tabular representation of the average, maximum, minimum temperature records and maximum average and minimum average temperature records measured in this station are given in Figure 10.15 and Table 10.26, respectively.

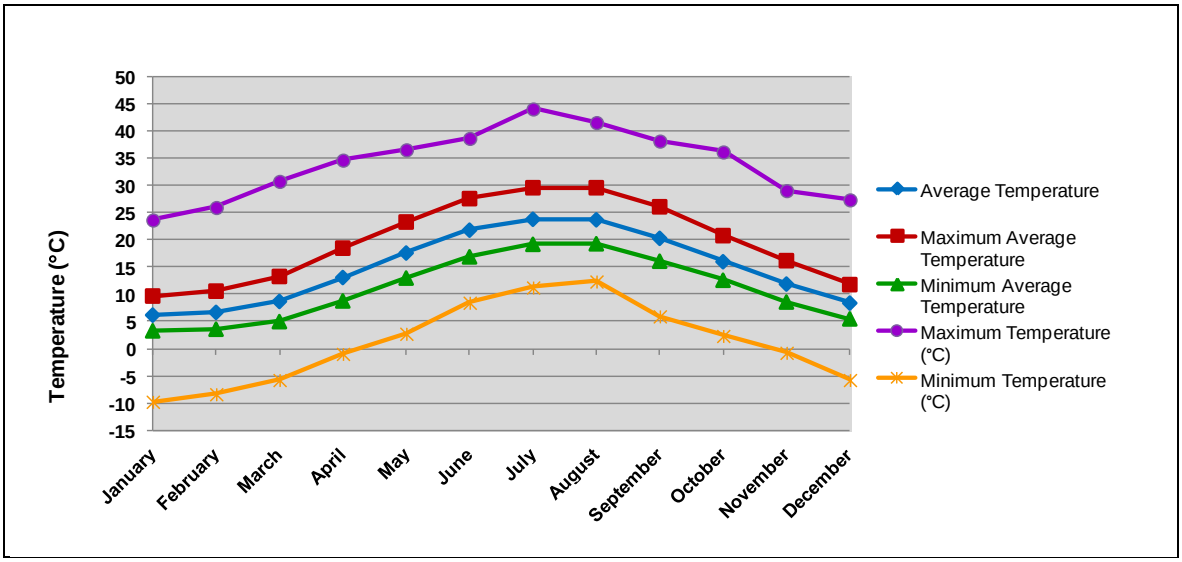


Figure 10.15. Average Temperature, Maximum Average Temperature, Minimum Average Temperature

Table 10.26. Temperature Values

Months	Average Temperature (°C)	Maximum Average Temperatures (°C)	Minimum Average Temperatures (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)
January	6,2	9,7	3,3	23,7	-9,7
February	6,7	10,6	3,6	26,0	-8,3
March	8,7	13,3	5,0	30,8	-5,7
April	13,1	18,5	8,8	34,7	-0,9
May	17,6	23,3	13,0	36,6	2,8
June	21,8	27,6	16,9	38,7	8,5
July	23,8	29,6	19,2	44,1	11,3
August	23,7	29,6	19,3	41,6	12,4
September	20,3	26,1	16,1	38,2	6,0
October	16,0	20,8	12,6	36,2	2,4
November	11,9	16,2	8,6	29,1	-0,7
December	8,4	11,8	5,5	27,4	-5,7
Annual	14,9	19,8	11,0	44,1	-9,7

Precipitation Distribution

According to Kocaeli Meteorology Station records, annual average total precipitation is 809,3 mm. Average total precipitation is maximum in December with 110,0 mm and minimum in July with 37,1 mm. During long time records, maximum daily precipitation is recorded as 125,8 mm in August. Average monthly precipitation and daily maximum precipitation amounts are given graphically in Figure 10.16 and tabulated in Table 10.27.

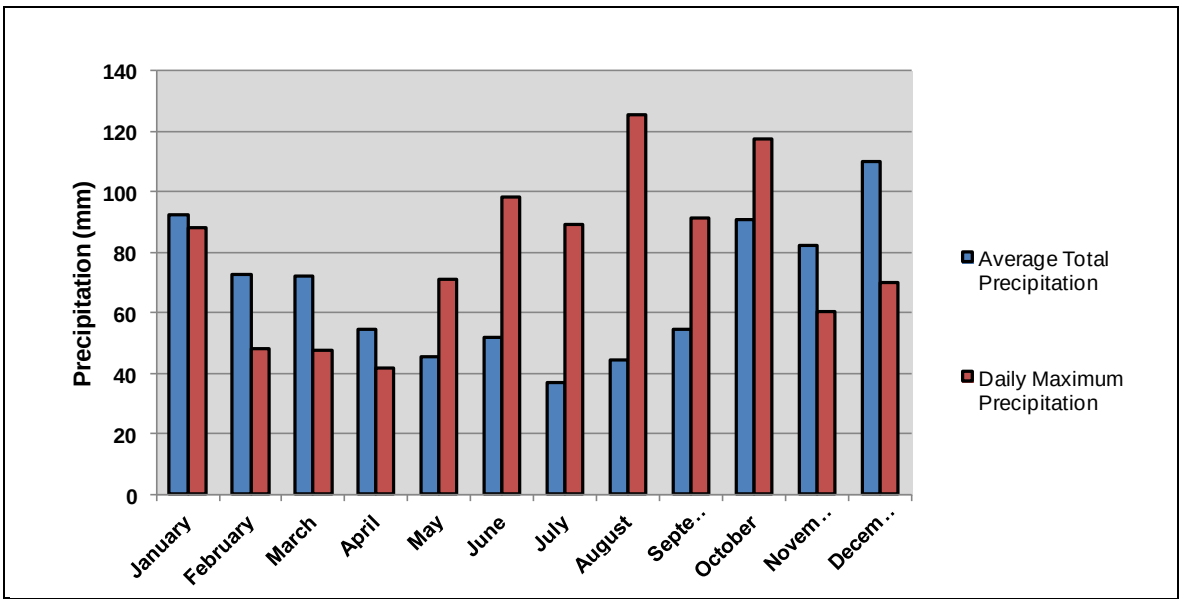


Figure 10.16. Average Monthly Precipitation and Daily Maximum Precipitation Amounts

Table 10.27. Average Monthly Precipitation and Daily Maximum Precipitation Amounts

Months	Average Precipitation Amount (mm)	Daily Maximum Precipitation Amount (mm)
January	92,3	88,0
February	72,6	48,1
March	72,4	47,5
April	54,7	42,0
May	45,7	70,9
June	52,0	98,1
July	37,1	89,1
August	44,7	125,8
September	54,5	91,2
October	90,8	117,3
November	82,5	60,4
December	110,0	70,0
Annual	809,3	125,8

Humidity Distribution

According to Kocaeli Meteorology Station records, average annual humidity is 71,2%. Minimum monthly relative humidity is recorded in June (65,9%) and maximum relative humidity is recorded in January (75,5%). The monthly average and minimum relative humidity values are given graphically in Figure 10.17 and in tabular format in Table 10.28.

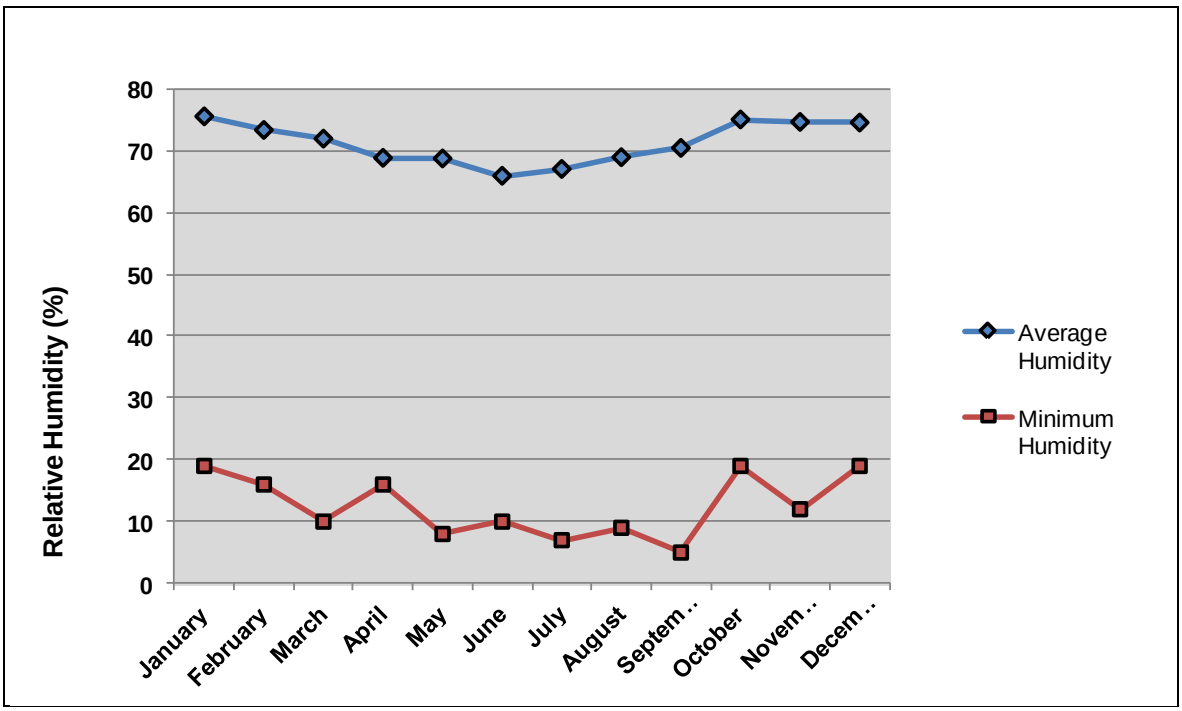


Figure 10.17. Average and Minimum Relative Humidity Values

Table 10.28. Average and Minimum Relative Humidity Values

Months	Average Relative Humidity (%)	Minimum Relative Humidity (%)
January	75,5	19,0
February	73,3	16,0
March	71,9	10,0
April	68,8	16,0
May	68,7	8,0
June	65,9	10,0
July	67,0	7,0
August	68,9	9,0
September	70,4	5,0
October	75,0	19,0
November	74,6	12,0
December	74,5	19,0
Annual	71,2	5,0

Evaporation

According to Kocaeli observation records monthly maximum open surface evaporation is 13,4 mm, measured in September. Annual total average open surface evaporation is 903,4 mm. Monthly maximum and average open surface evaporation values are provided graphically in Figure 10.18 and in tabular format in Table 10.29.

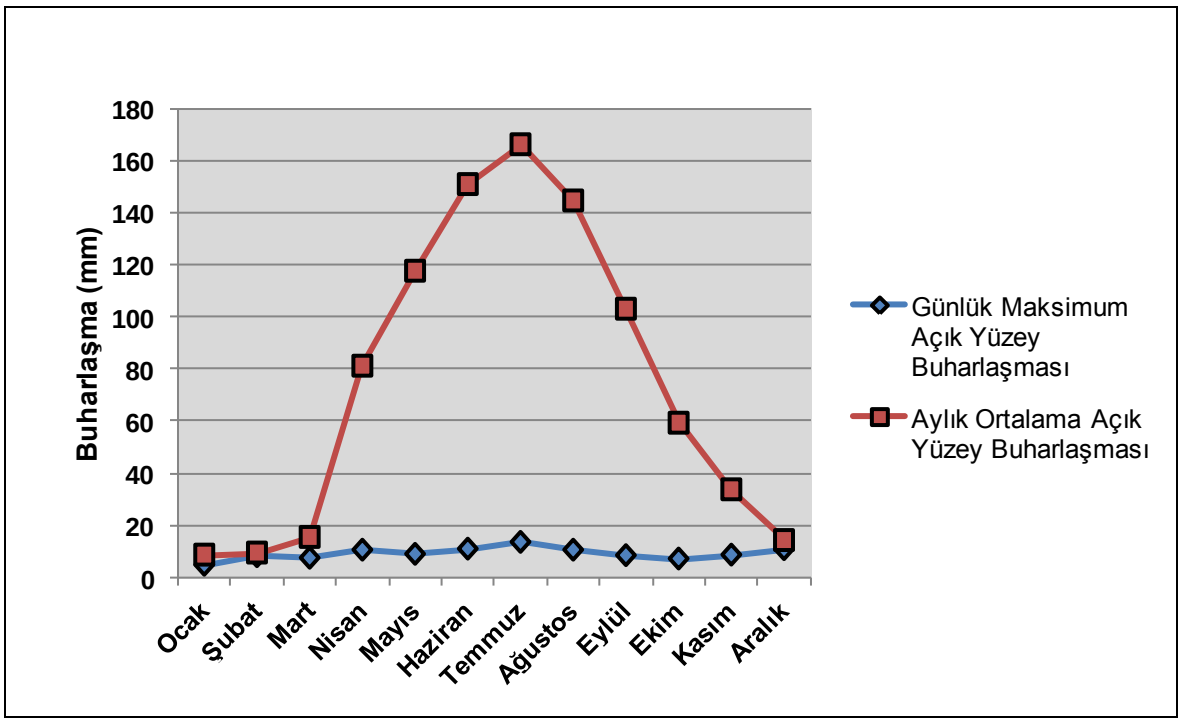


Figure 10.18 Monthly Maximum and Monthly Average Open Surface Evaporation Values

Table 10.29. Monthly Maximum and Monthly Average Open Surface Evaporation Values

Months	Monthly Maximum Open Surface Evaporation (mm)	Monthly Average Open Surface Evaporation (mm)
January	4,6	8,5
February	7,9	9,3
March	7,3	15,3
April	10,4	81,1
May	8,8	117,6
June	10,8	150,9
July	13,4	166,2
August	10,4	144,6
September	8,3	103
October	7	59,2
November	8,5	33,6
December	10,6	14,1
Annual	13,4	903,4

Cloud Cover

Annual average number of clear days (cloud cover: 0.0-1.9) in Kocaeli Meteorology Station is 61,7. Annual average number of partly cloudy days (cloud cover: 2.0-8.0) is 205,9 and annual average number of cloudy days (cloud cover: 8.1-10.0) is 97,6. Average number of clear, partly cloudy and cloudy number of days are given in graphically in Figure 10.19 and in tabular format in Table 10.30.

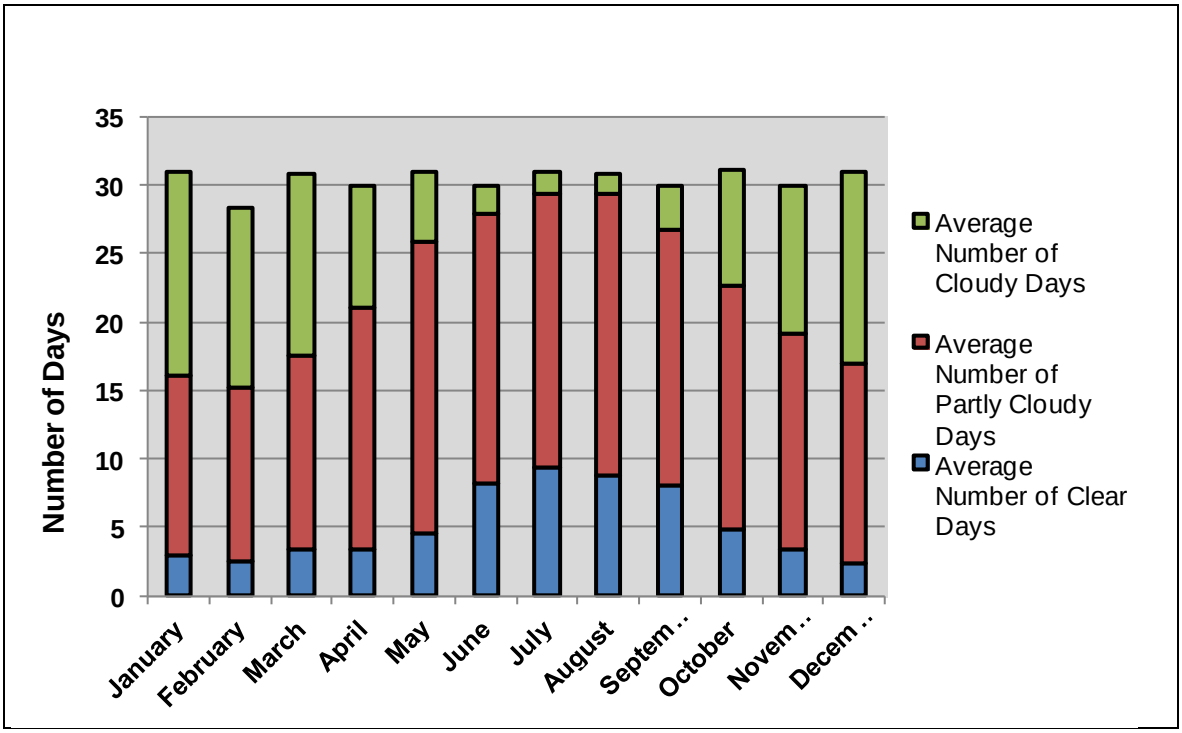


Figure 10.19. Average Number of Clear, Partly Cloudy and Cloudy Days

Table 10.30. Average Number of Clear, Partly Cloudy and Cloudy Days

Months	Average Number of Clear Days	Average Number of Partly Cloudy Days	Average Number of Cloudy Days
January	3,0	13,1	14,9
February	2,5	12,7	13,1
March	3,3	14,3	13,3
April	3,4	17,6	9,0
May	4,5	21,3	5,2
June	8,2	19,7	2,1
July	9,4	19,9	1,7
August	8,8	20,5	1,6
September	8,0	18,7	3,3
October	4,9	17,8	8,4
November	3,3	15,8	10,9
December	2,4	14,5	14,1
Annual	61,7	205,9	97,6

Foggy, Snowy, Haily, Frosty and Stormy Days Distribution

According to Kocaeli Meteorology Station records, the number of annual average snowy days is 16,9 and annual average number of days with snow blanket is 9,1. Monthly distribution of average foggy, snowy, snow covered, haily, frosty and stormy days are given in Figure 10.20 and Table 10.31.

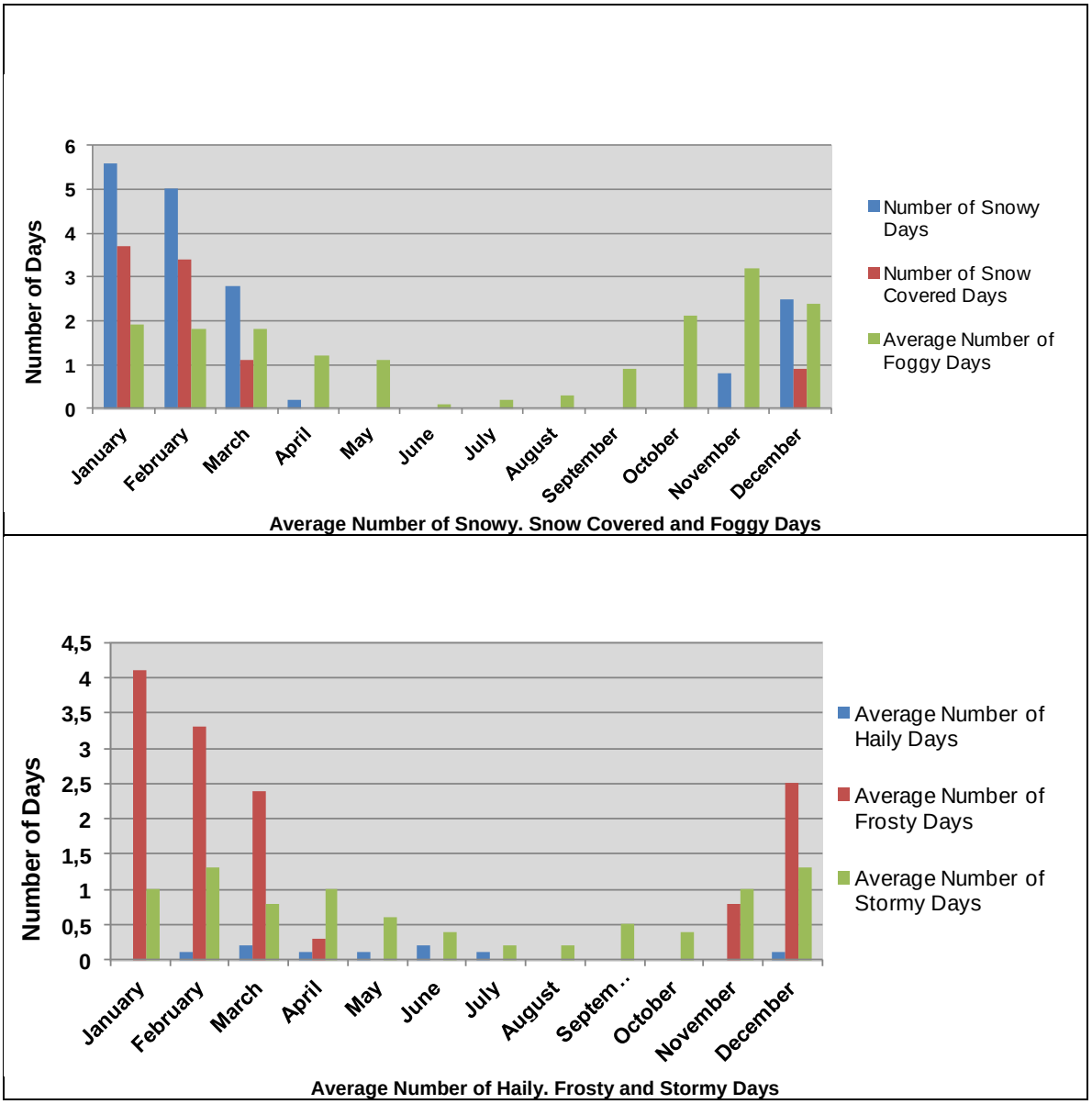


Figure 10.20. Monthly Average Foggy, Snowy, Snow Covered, Haily, Frosty and Stormy Days Distribution

Table 10.31. Monthly Average Foggy, Snowy, Snow Covered, Haily, Frosty and Stormy Days Distribution

Months	Number of Snowy Days	Number of Snow Covered Days	Average Number of Foggy Days	Average Number of Haily Days	Average Number of Frosty Days	Average Number of Stormy Days
January	5,6	3,7	1,9		4,1	1,0
February	5,0	3,4	1,8	0,1	3,3	1,3
March	2,8	1,1	1,8	0,2	2,4	0,8
April	0,2	0,0	1,2	0,1	0,3	1,0
May			1,1	0,1		0,6
June			0,1	0,2		0,4
July			0,2	0,1		0,2
August			0,3	0,0		0,2
September			0,9			0,5
October			2,1	0,0		0,4
November	0,8	0,0	3,2	0,0	0,8	1,0
December	2,5	0,9	2,4	0,1	2,5	1,3
Annual	16,9	9,1	17,0	0,9	13,4	8,7

Maximum Snow Depth

Monthly distribution of maximum snow cover depths recorded are represented graphically in Figure 10.21 and in tabular format in Table 10.32. The maximum snow cover depth is 74 cm in February.

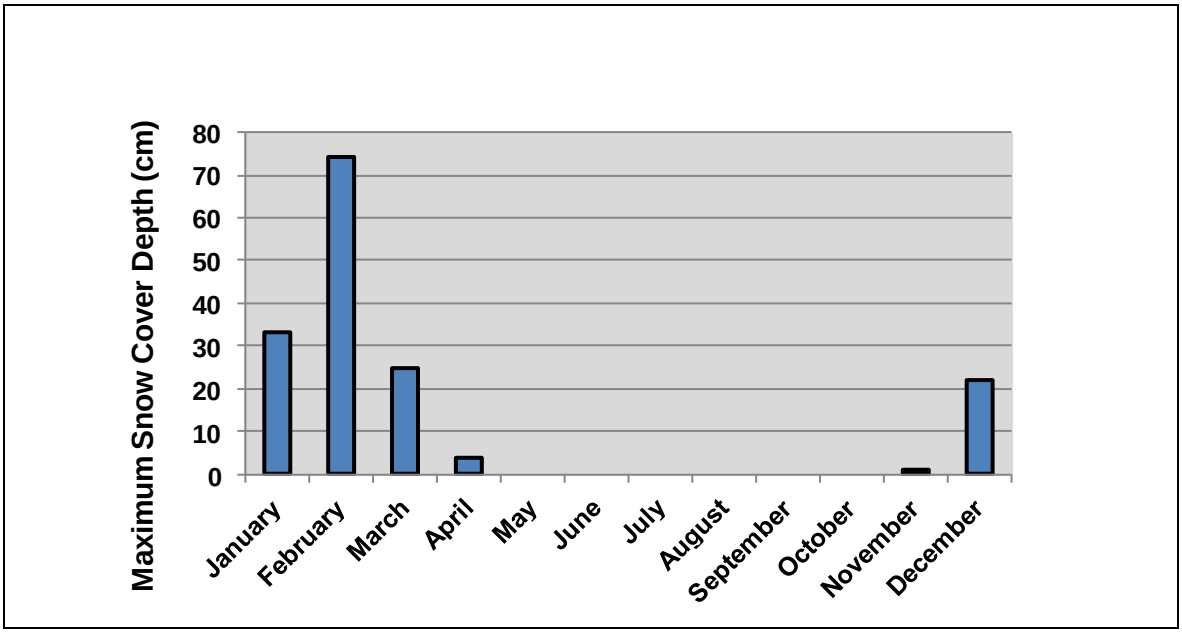


Figure 10.21. Monthly Distribution of Maximum Snow Cover Depths

Table 10.32. Monthly Distribution of Maximum Snow Cover Depths

Months	January	February	March	April	November	December
Maximum Snow Depth (cm)	33	74	25	4	1	22

Wind Distribution

The monthly, yearly and seasonally distribution of wind blow numbers and wind speeds recorded in Kocaeli Meteorological Station are given in Table 10.33, Table 10.34. Table 10.35, Table 10.36 and graphical representations are provided in Figure 10.22, Figure 10.23 and Figure 10.24. According to annual wind blow numbers, 1st dominant wind direction is SE (southeast). 2nd dominant wind direction is ESE (east-southeast). 3rd dominant wind direction is N (north) and 4th dominant wind direction is SSE (south-southeast).

Table 10.33. Distribution of Monthly and Yearly Wind Blow Numbers According to Directions (1961-2015)

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	3208	2499	1518	2313	2636	3836	4494	3055	887	682	471	727	2132	4141	3281	2464
February	3037	2561	1649	2328	2344	3131	3734	2948	907	644	430	728	2137	3950	2675	2258
March	3451	2597	1647	2655	2622	3398	3769	3029	961	740	459	880	2432	4770	2998	2507
April	2547	2093	1558	2180	2327	3264	3764	3125	908	724	570	1075	2929	5483	2716	2154
May	2963	2490	1691	2490	2788	3498	4379	3429	1100	811	606	1268	2639	4480	2412	1720
June	3253	2697	2078	2754	2557	3347	4265	3430	1125	789	704	1161	2295	3075	2011	1784
July	4511	3338	2626	3231	2775	3400	4578	3404	1340	830	489	855	1589	2021	1630	1970
August	4084	3594	2679	3163	2869	3569	4398	3486	1201	819	418	901	1427	1939	1588	1537
September	3340	3124	2255	3089	2760	3469	4478	3067	1040	703	456	769	1671	2388	1829	1539
October	3185	3165	2096	3354	3067	3706	4065	2945	817	531	454	739	1539	3058	2147	2035
November	2770	2299	1823	2684	2630	3405	3840	2899	935	690	559	830	1757	3941	2679	2522
December	3415	2294	1701	2653	2585	3817	4179	3149	821	730	476	927	2007	4130	2870	2804
Annual	39764	32751	23321	32894	31960	41840	49943	37966	12042	8693	6092	10860	24554	43376	28836	25294

Table 10.34. Distribution of Monthly and Yearly Average Wind Speeds According to Directions (m/sec) (1961-2015)

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	1,3	1,2	1,1	1,2	1,2	1,3	1,2	1,3	1,3	1,2	1,3	1,4	1,8	2,1	1,6	1,4
February	1,4	1,4	1,2	1,3	1,3	1,3	1,2	1,4	1,4	1,4	1,4	1,6	2,1	2,3	1,7	1,6
March	1,5	1,4	1,3	1,3	1,3	1,3	1,2	1,2	1,3	1,2	1,3	1,6	2,2	2,5	1,8	1,7
April	1,4	1,4	1,2	1,3	1,3	1,3	1,2	1,2	1,4	1,2	1,2	1,8	2,5	2,7	1,8	1,5
May	1,4	1,3	1,3	1,4	1,3	1,3	1,2	1,3	1,3	1,3	1,3	1,9	2,4	2,5	1,6	1,5
June	1,5	1,4	1,3	1,4	1,4	1,3	1,2	1,3	1,3	1,3	1,3	1,9	2,2	2,1	1,5	1,4
July	1,6	1,4	1,5	1,5	1,4	1,4	1,2	1,3	1,3	1,3	1,3	1,7	2	1,8	1,4	1,5
August	1,6	1,4	1,5	1,5	1,5	1,4	1,3	1,3	1,2	1,2	1,1	1,6	1,7	1,7	1,3	1,4
September	1,5	1,4	1,3	1,3	1,3	1,3	1,1	1,3	1,2	1,2	1,1	1,6	1,9	1,9	1,4	1,4
October	1,3	1,3	1,1	1,2	1,1	1,2	1,1	1,1	1,2	1,1	1,1	1,4	1,7	1,8	1,4	1,3
November	1,2	1,1	1	1,1	1,1	1,1	1,1	1,1	1,2	1,2	1,2	1,4	1,6	1,9	1,5	1,3
December	1,3	1,2	1,1	1,2	1,2	1,3	1,2	1,2	1,3	1,3	1,3	1,6	1,9	2	1,5	1,5
Annual	1,4	1,3	1,2	1,3	1,3	1,3	1,2	1,3	1,3	1,2	1,2	1,6	2,0	2,1	1,5	1,5

Table 10.35. Seasonal Distribution of Wind Blow Numbers According to Directions (1961-2015)

Season	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Winter	9660	7354	4868	7294	7565	10784	12407	9152	2615	2056	1377	2382	6276	12221	8826	7526
Spring	8961	7180	4896	7325	7737	10160	11912	9583	2969	2275	1635	3223	8000	14733	8126	6381
Summer	11848	9629	7383	9148	8201	10316	13241	10320	3666	2438	1611	2917	5311	7035	5229	5291
Autumn	9295	8588	6174	9127	8457	10580	12383	8911	2792	1924	1469	2338	4967	9387	6655	6096

Table 10.36. Seasonal Distribution of Average Wind Speeds According to Directions (m/sec) (1961-2015)

Season	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Winter	1,3	1,3	1,1	1,2	1,2	1,3	1,2	1,3	1,3	1,3	1,3	1,5	1,9	2,1	1,6	1,5
Spring	1,4	1,4	1,3	1,3	1,3	1,3	1,2	1,2	1,3	1,2	1,3	1,8	2,4	2,6	1,7	1,6
Summer	1,6	1,4	1,4	1,5	1,4	1,4	1,2	1,3	1,3	1,3	1,2	1,7	2,0	1,9	1,4	1,4
Autumn	1,3	1,3	1,1	1,2	1,2	1,2	1,1	1,2	1,2	1,2	1,1	1,5	1,7	1,9	1,4	1,3

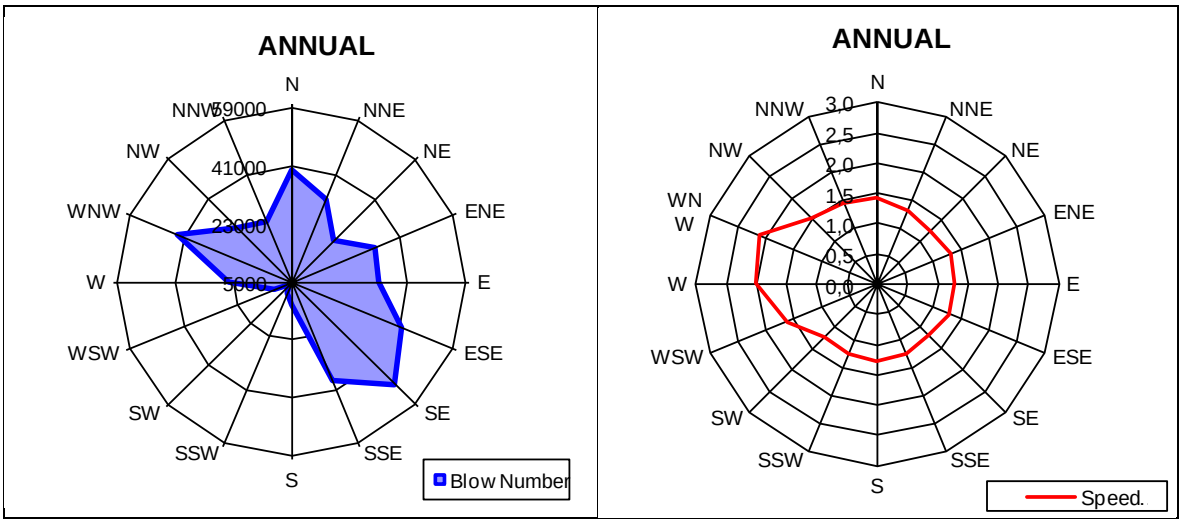


Figure 10.22. Annual Wind Diagram of Wind Blow Numbers and Average Wind Speeds

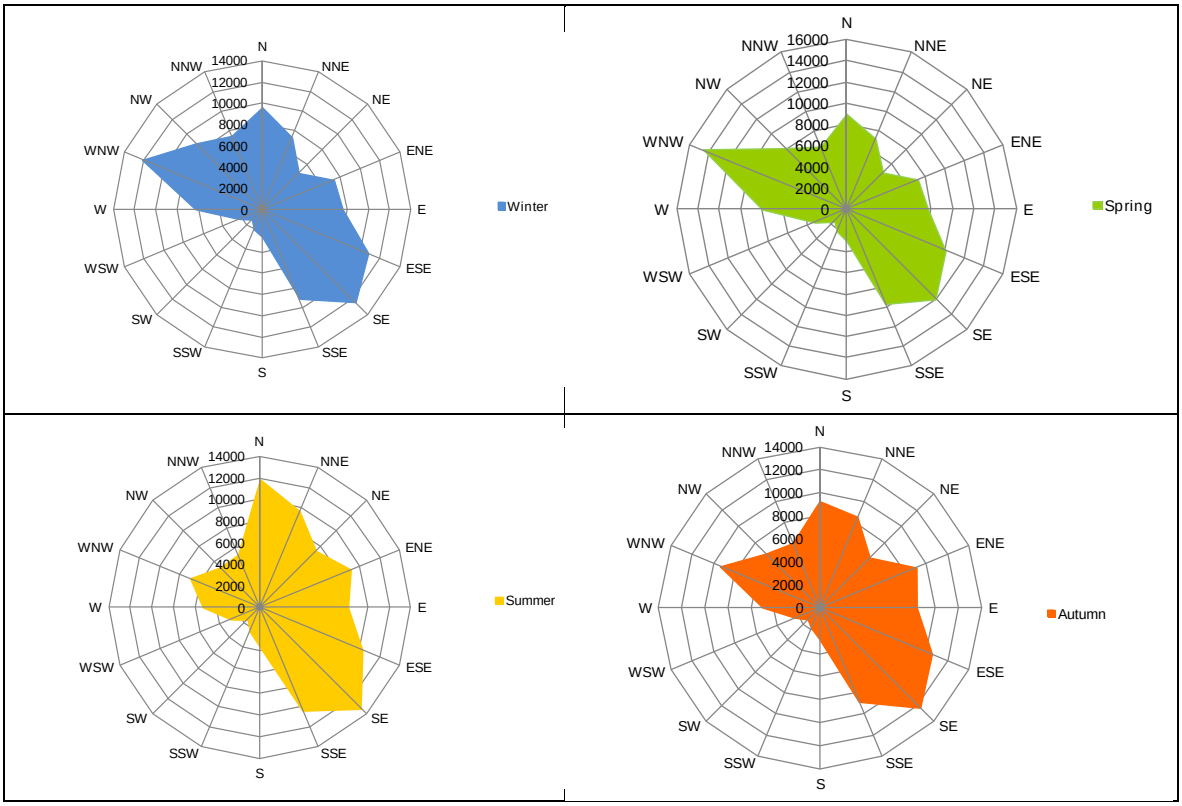


Figure 10.23. Seasonal Wind Diagram of Wind Blow Numbers

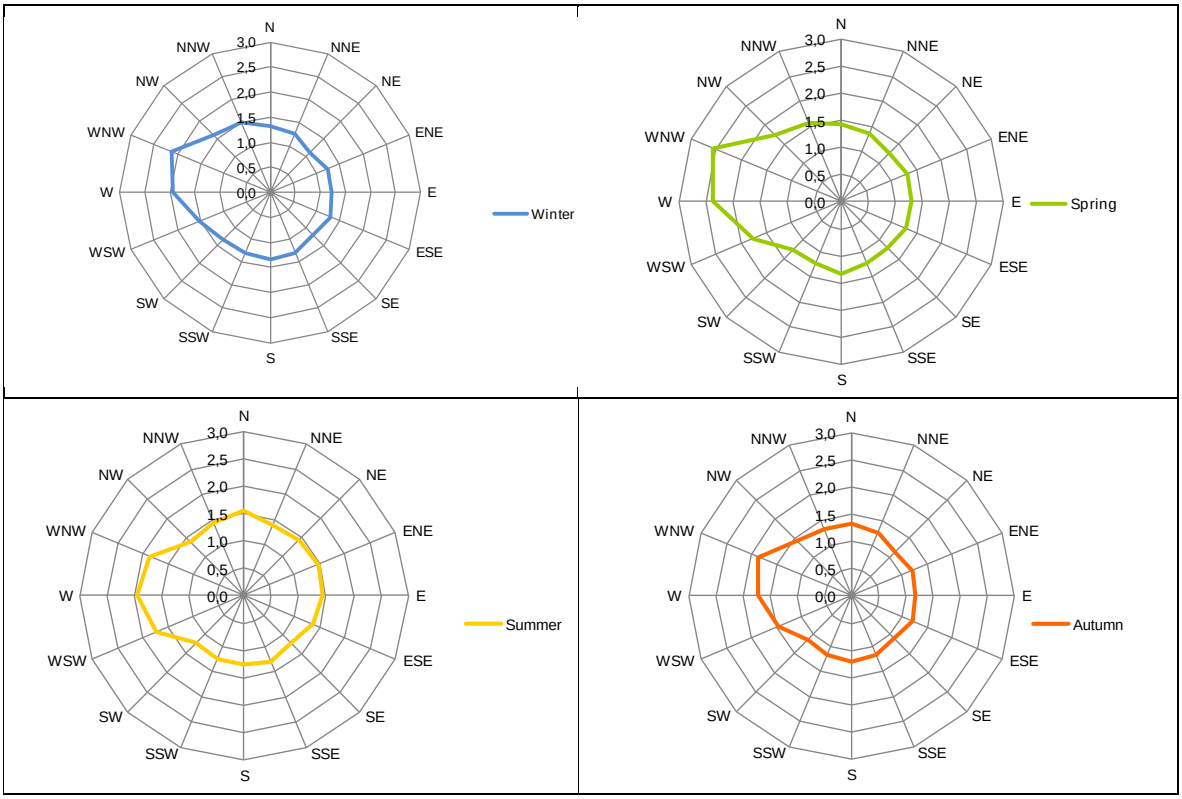


Figure 10.24. Seasonal Wind Diagram of Average Wind Speeds (m/sec)

Monthly wind diagrams of wind blow numbers and average wind speeds are given in Figure 10.25.

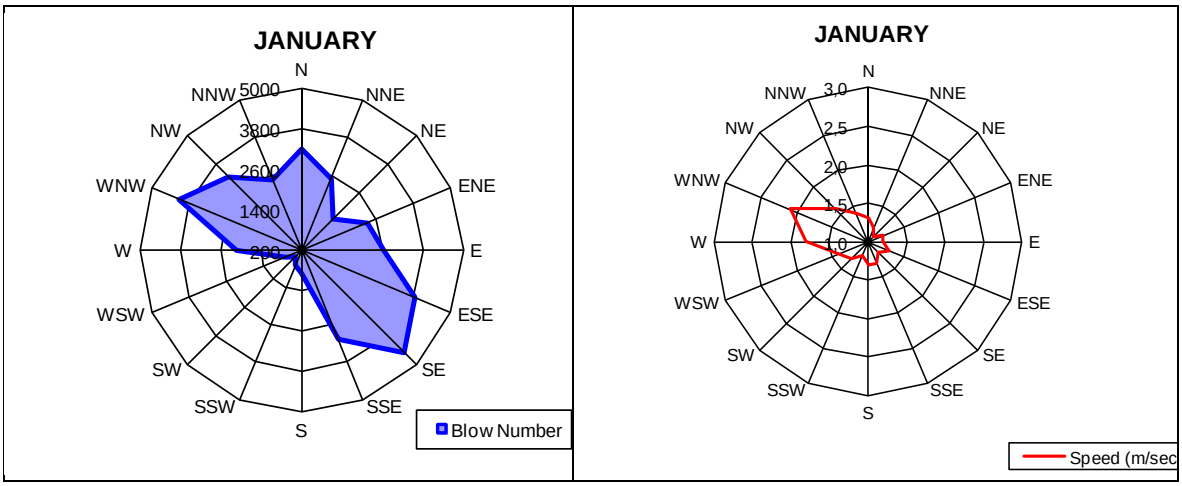


Figure 10.25. Monthly Wind Diagrams of Wind Blow Numbers and Average Wind Speeds

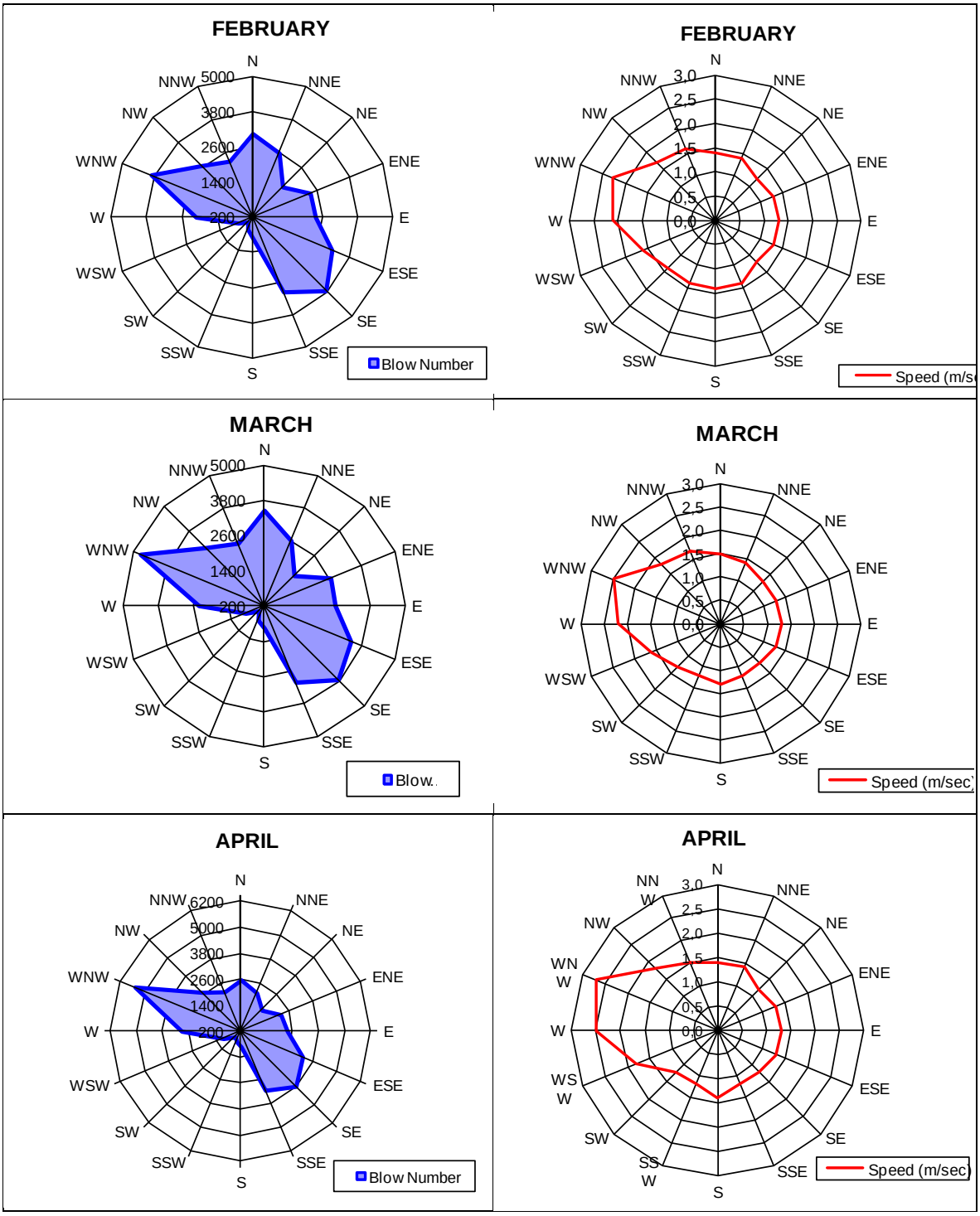


Figure 10.25. Monthly Wind Diagrams of Wind Blow Numbers and Average Wind Speeds (Continued)

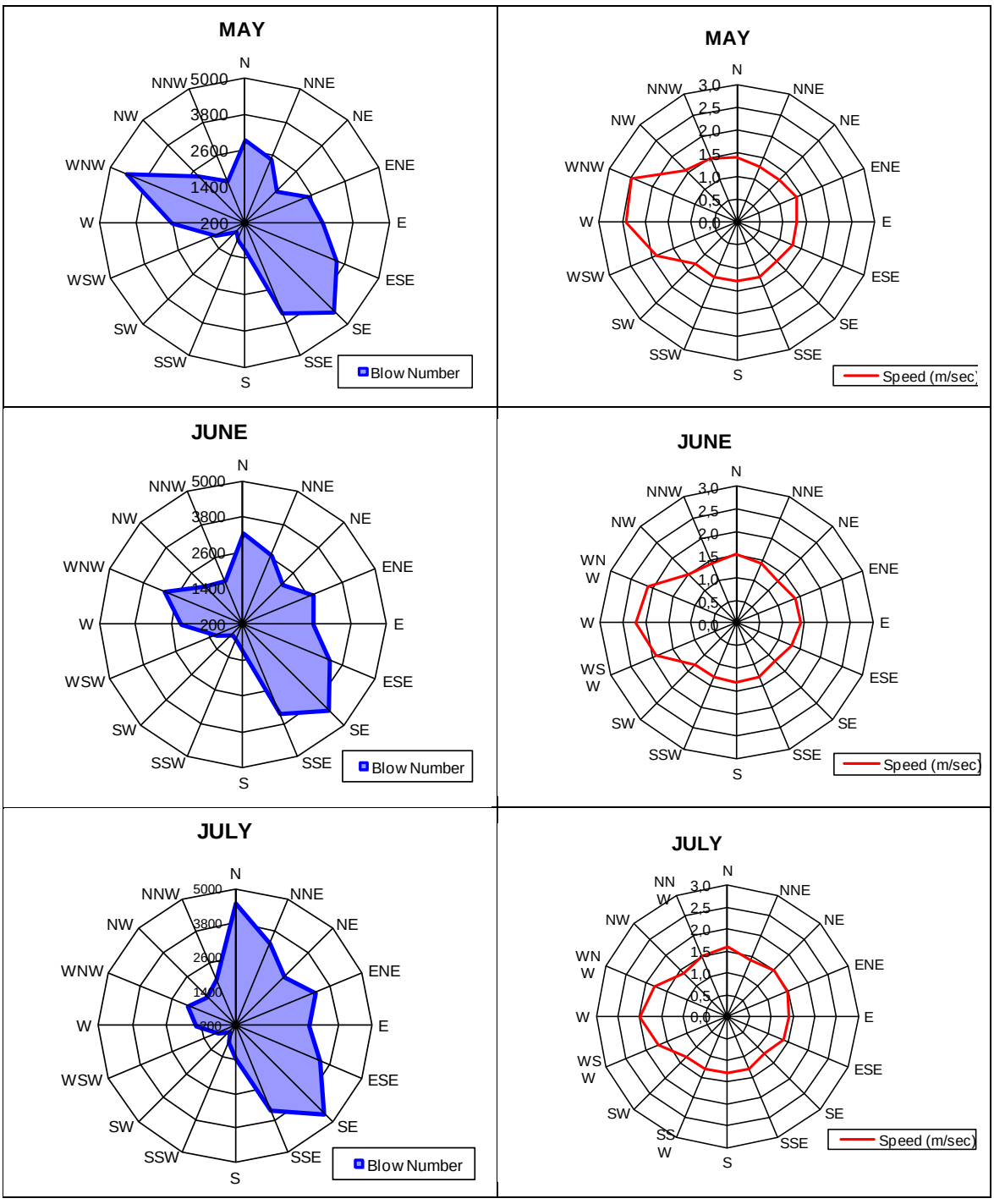


Figure 10.25. Monthly Wind Diagrams of Wind Blow Numbers and Average Wind Speeds (Continued)

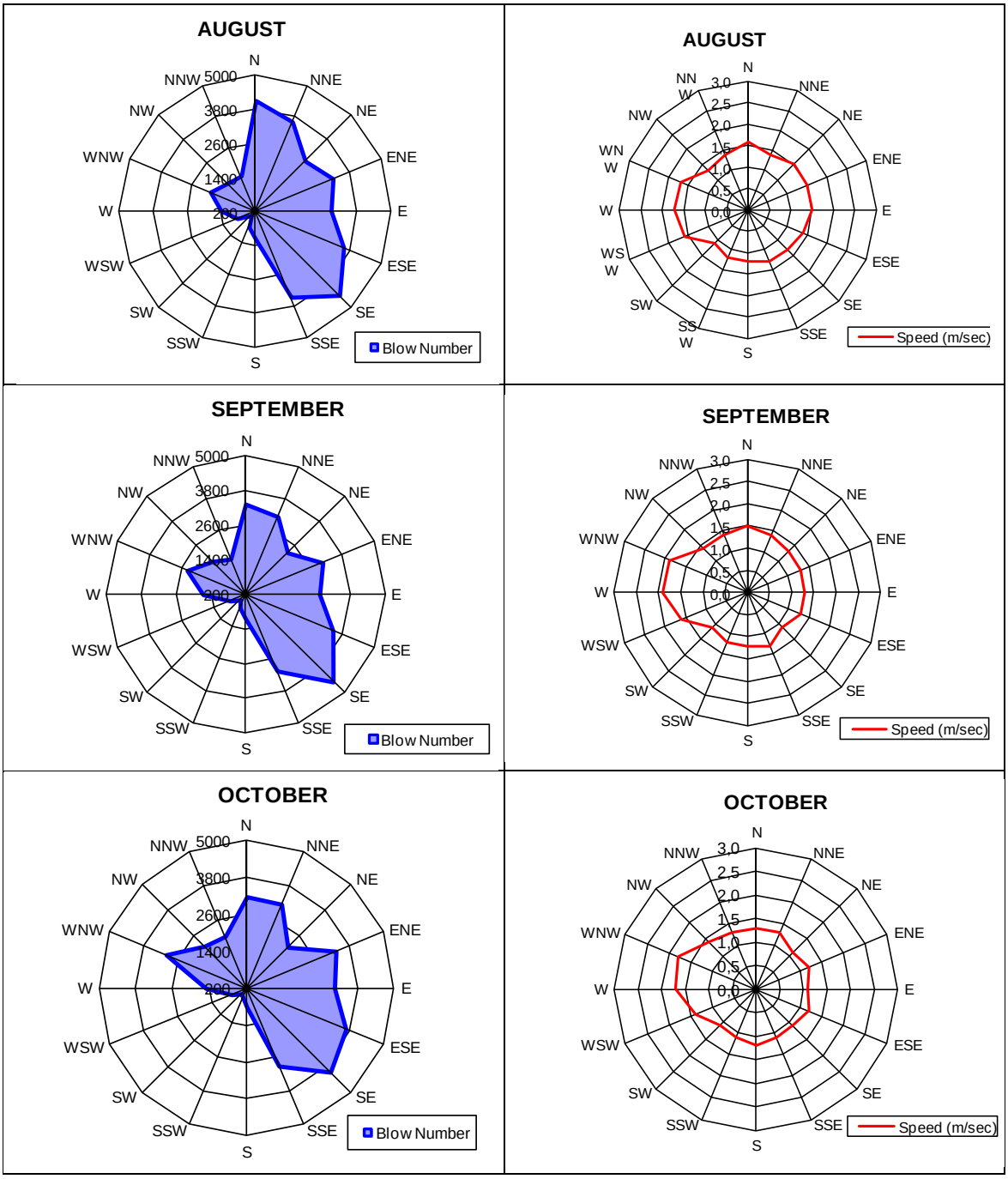


Figure 10.25. Monthly Wind Diagrams of Wind Blow Numbers and Average Wind Speeds (Continued)

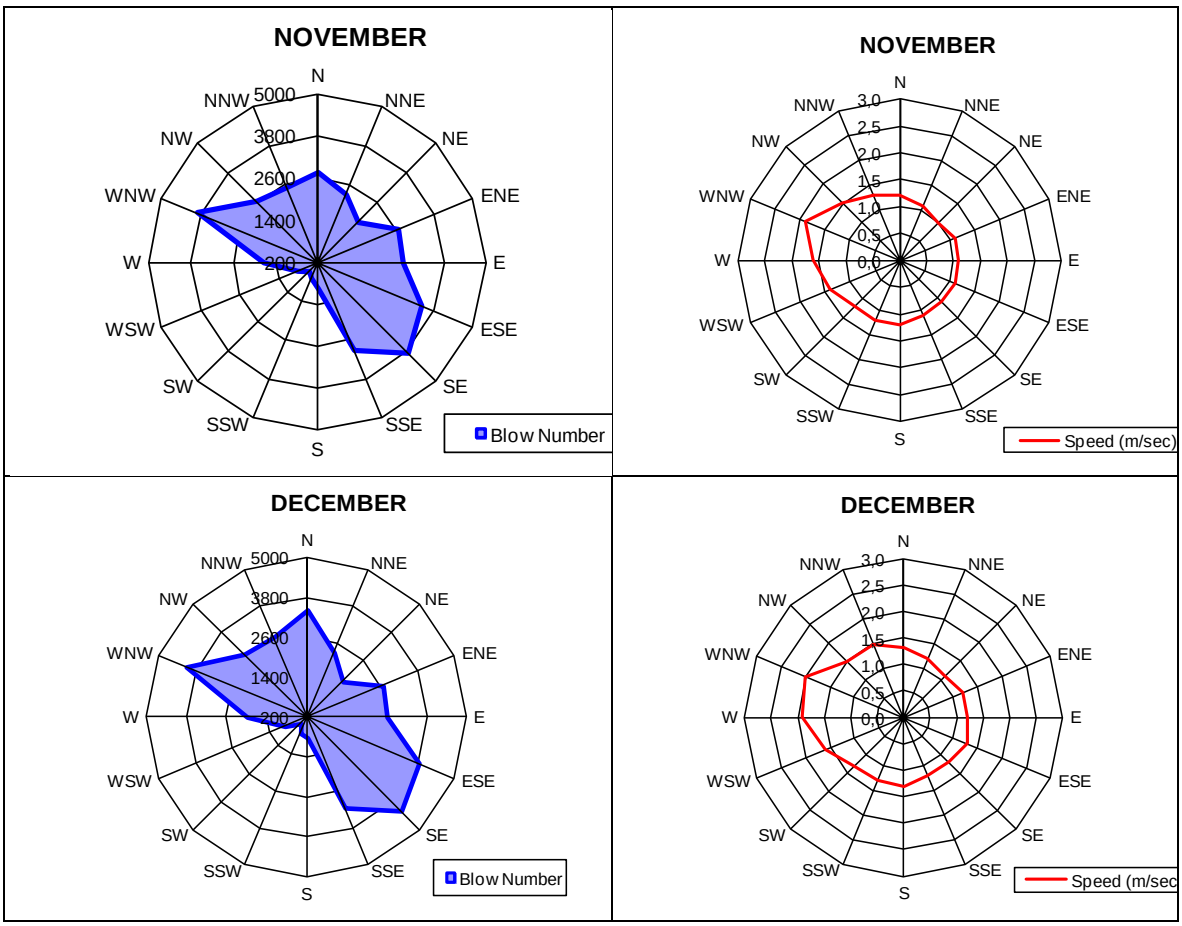


Figure 10.25. Monthly Wind Diagrams of Wind Blow Numbers and Average Wind Speeds (Continued)

Average Wind Speed Distribution

According to Kocaeli Meteorology Station records, annual average wind speed is 1,7 m/sec. Monthly average wind speeds are given numerically in Table 10.37 and graphically in Figure 10.26.

Table 10.37. Monthly Average Wind Speeds

Months	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Average
Average Wind Speed (m/sec)	1,7	1,9	1,8	1,9	1,8	1,8	1,7	1,6	1,4	1,4	1,5	1,7	1,7

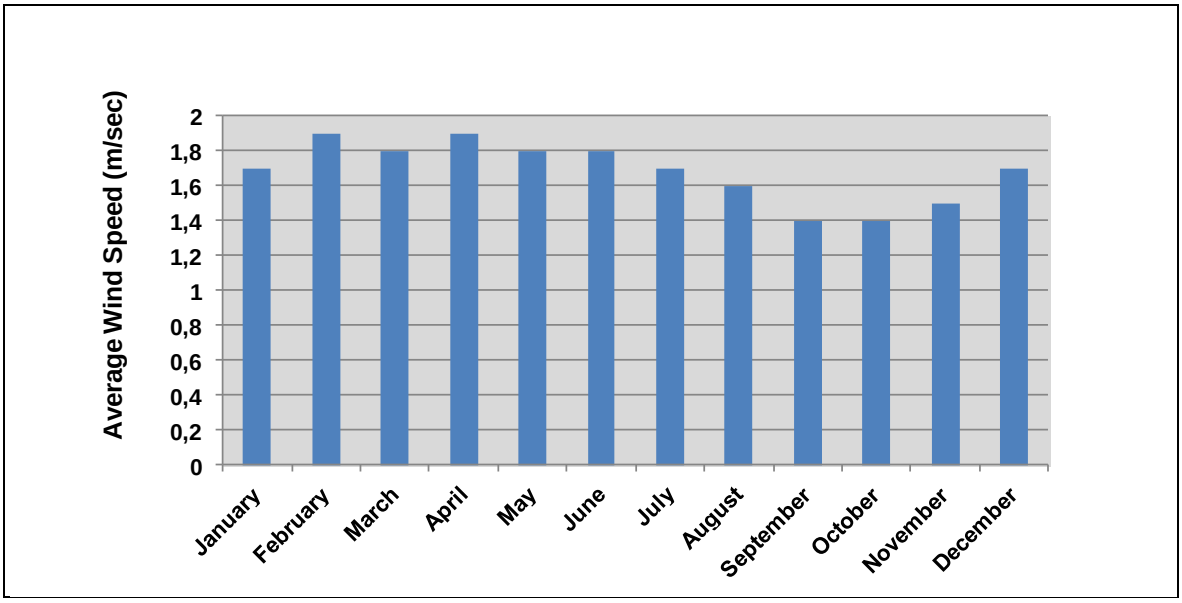


Figure 10.26. Monthly Average Wind Speeds

Wind Speed According to Directions and Speed & Direction of the Maximum Wind and Average Number of Stormy Days and Strong Windy Days

According to Kocaeli Meteorology Station records, the direction of the highest wind speed is west-northwest (WNW) with 35,0 m/sec. According to Kocaeli Meteorology station records, number of annual average stormy days is 8,7 and number of annual average strong windy days is 46,9. Maximum wind speeds and directions and average stormy and strong windy day numbers are provided in Table 10.38 with graphical representations in Figure 10.27 and Figure 10.28.

Table 10.38. Maximum Wind Speeds and Directions, Average Numbers of Stormy and Windy Days (1961-2015)

Months	Direction of Maximum Wind	Maximum Wind Speed (m/sec)	Average Number of Stormy Days*	Average Number of Strong Windy Days**
January	NW	29,9	1,0	4,6
February	W	31,3	1,3	4,1
March	WNW	35,0	0,8	5,2
April	WNW	28,7	1,0	5,1
May	W	32,6	0,6	4,1
June	WNW	26,1	0,4	3,1
July	NNW	29,4	0,2	3,5
August	NNW	26,2	0,2	3,3
September	NNW	27,7	0,5	2,7
October	W	26,1	0,4	2,8
November	WNW	31,1	1,0	3,5
December	SW	28,5	1,3	4,9
	WNW	35,0	8,7	46,9

* Wind Speed >= 17.2 m/sec.
*** Wind Speed: 10.8 – 17.1 m/sec*

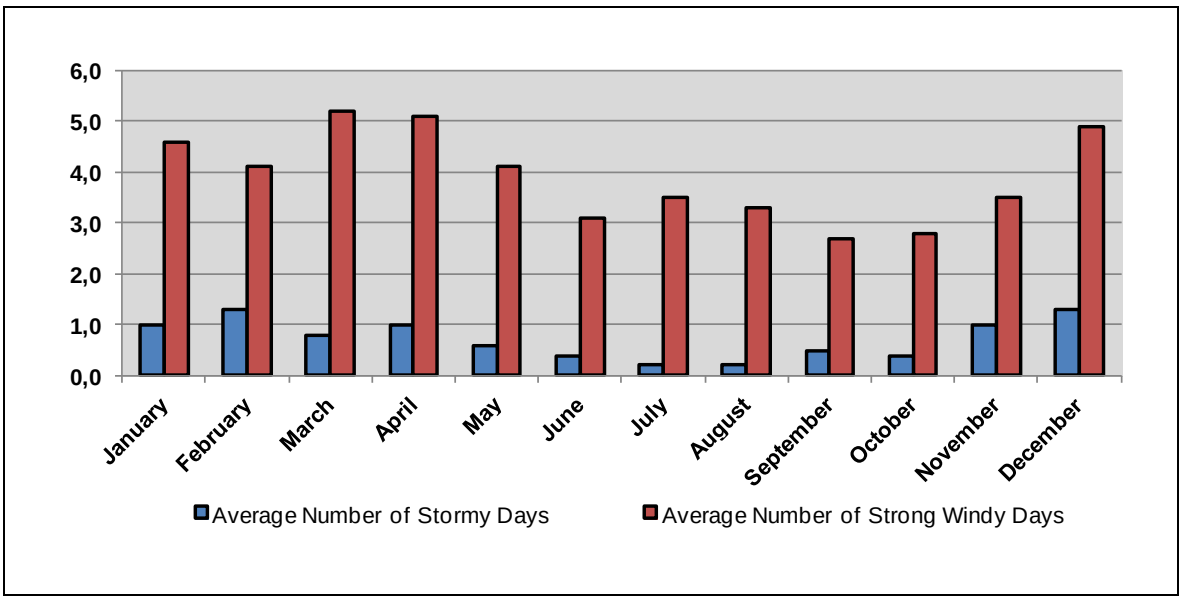


Figure 10.27. Average Number of Stormy Days and Strong Windy Days

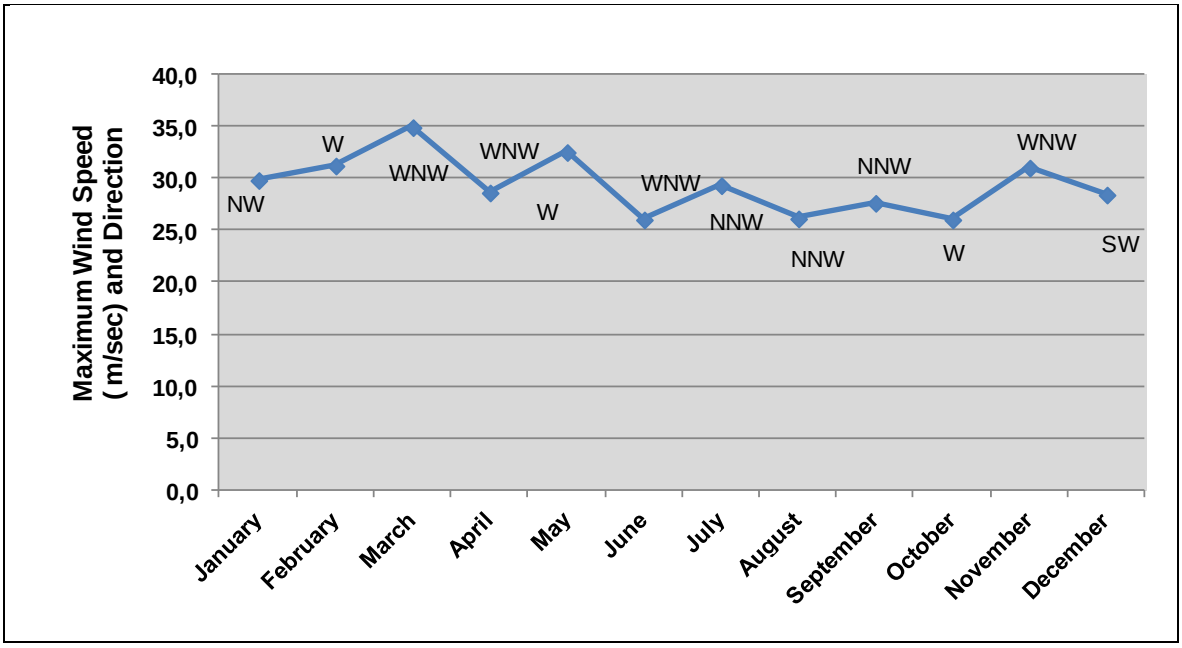


Figure 10.28. Maximum Wind Direction and Speed

Peak Precipitation Values Observed on Standard Time and Precipitation Intensity-Duration-Frequency Curves

Precipitation intensity – duration – frequency curves recorded in Kocaeli Meteorology Station are given in Figure 10.29 and peak precipitation values observed on standard time are provided in Table 10.39.

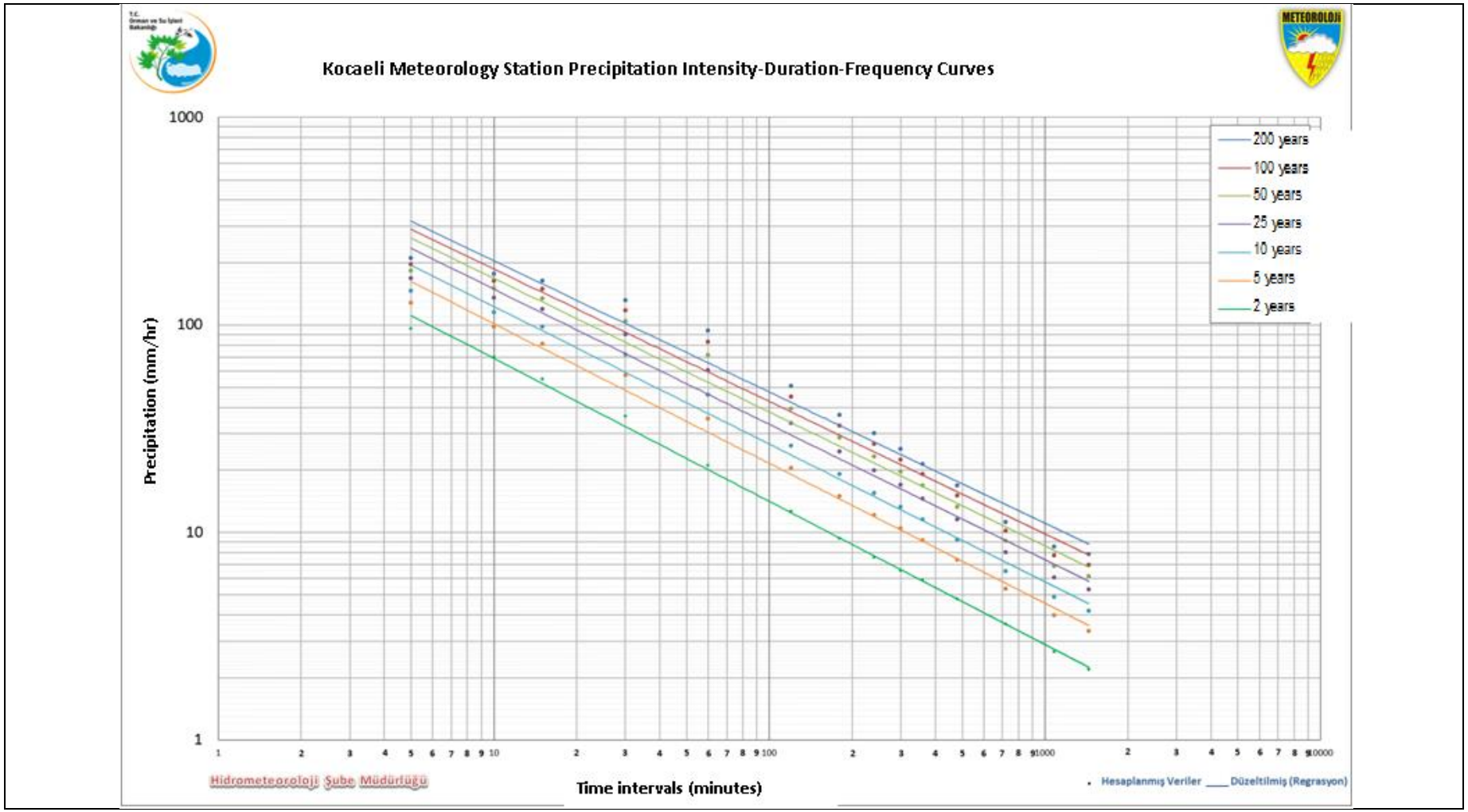


Figure 10.29. Precipitation Intensity-Duration-Frequency Curves

Table 10.39. Peak Precipitation Values Observed on Standard Time

OBS.	MINUTE				HOUR										
YEAR	5	10	15	30	1	2	3	4	5	6	8	12	18	24	24 +
2015	9,8	17,9	19,0	26,1	35,1	36,8	36,9	36,9	38,5	40,5	42,2	42,4	52,1	52,5	
2014	8,1	13,5	15,5	24,3	33,3	36,0	36,0	39,0	39,1	39,1	39,1	43,2	44,0	49,3	
2013	9,0	12,7	17,9	23,9	31,0	40,8	40,9	40,9	41,4	41,4	41,5	41,6	41,6	50,4	
2012	8,6	16,6	20,3	27,3	28,4	28,4	28,5	28,6	29,5	29,5	29,6	29,7	30,0	57,1	
2011	4,9	7,5	10,7	17,0	17,3	17,4	25,8	25,9	27,9	30,0	34,9	35,1	35,2	36,2	
2010	5,0	7,4	9,6	14,4	17,3	21,9	24,9	29,8	32,4	34,4	38,3	56,9	75,8	83,3	
2009	10,5	20,8	27,5	36,5	42,6	51,4	51,8	52,6	52,6	52,6	52,7	52,7	57,5	64,8	
2008	7,1	10,6	14,5	22,2	32,7	36,6	37,4	37,4	37,4	37,4	37,4	37,4	37,4	41,4	
2007	14,1	24,1	34,2	45,7	48,1	49,3	51,2	53,4	53,4	53,4	53,4	53,5	53,5	88,0	
2006	9,3	16,4	19,9	33,4	38,5	47,4	52,3	54,0	54,0	54,0	54,1	54,1	63,0	63,8	
2005	11,5	11,5	11,6	18,1	23,7	33,8	37,5	37,9	38,2	40,4	41,6	44,5	45,9	52,9	
2004	9,0	15,7	19,9	25,0	27,0	28,2	28,3	28,3	28,3	28,4	28,4	28,5	28,8	49,7	
2003	5,7	7,9	8,9	10,3	14,5	19,8	25,1	29,3	36,1	40,5	48,3	51,3	56,6	57,6	
2002	11,6	15,0	18,1	23,8	29,6	35,8	35,9	35,9	36,0	36,0	36,0	36,0	36,1	37,5	
2001	11,3	22,2	32,9	64,8	101,7	106,9	108,6	119,7	124,7	124,7	124,7	124,7	125,6	125,8	
2000	9,1	9,8	11,5	16,2	19,9	20,4	22,9	28,1	31,6	35,1	36,4	44,9	46,8	48,8	
1999	11,2	19,8	25,3	42,3	56,3	57,2	57,2	57,2	57,2	57,3	57,3	57,3	57,7	58,3	
1998	4,5	7,2	9,0	12,3	15,9	20,7	24,0	28,3	33,4	39,9	54,6	62,1	70,9	71,0	
1997	7,8	10,4	12,9	20,0	25,6	36,9	48,0	63,3	70,6	72,7	73,4	80,8	88,8	95,9	
1996	9,1	11,0	11,1	13,7	14,2	18,2	18,5	18,5	19,2	20,9	24,6	25,6	29,1	33,0	
1995	8,6	10,7	12,5	13,8	14,0	18,3	25,5	30,0	33,2	35,2	40,7	42,4	43,6	74,1	
1994	4,4	6,9	9,1	13,7	15,9	26,6	30,6	33,6	34,8	34,9	34,9	45,4	65,4	77,4	
1993	7,3	11,8	13,7	19,8	22,5	23,5	23,9	24,4	24,4	24,5	32,0	40,9	42,6	42,7	
1992	10,5	14,4	15,4	19,6	21,7	22,7	28,7	36,6	40,9	47,8	47,8	52,5	68,1	75,2	
1991	7,8	9,4	10,2	10,7	12,5	13,8	14,0	14,1	15,2	20,0	22,3	27,6	36,7	41,4	
1990	6,0	9,7	11,5	13,5	13,5	17,6	26,1	26,6	26,6	35,1	35,1	35,1	35,1	41,5	
1989	5,5	7,5	9,8	10,6	18,1	27,5	36,8	47,9	60,1	71,7	86,1	98,5	127,0	129,6	
1988	6,5	9,0	10,5	16,5	23,0	30,0	31,1	31,2	34,6	36,8	37,2	37,2	39,0	44,2	
1987	4,9	7,0	8,1	9,5	11,4	20,4	29,1	36,3	44,2	52,6	61,9	68,2	76,1	79,4	
1986	7,0	7,5	8,2	9,8	12,4	18,1	24,9	29,2	29,4	29,4	29,4	31,5	31,5	37,7	
1985	8,4	9,4	9,6	9,8	9,8	13,3	20,3	31,1	33,5	33,9	35,3	45,3	46,3	51,1	
1984	10,5	11,1	17,5	23,6	33,7	35,5	37,7	38,3	38,4	42,1	42,7	50,2	76,9	115,1	
1983	15,0	25,6	36,7	51,7	59,9	60,9	61,2	61,4	61,4	61,4	66,2	70,9	73,0	73,0	
1982	5,6	8,3	10,3	17,0	19,5	23,8	24,7	35,6	38,3	39,0	41,2	49,4	49,4	52,1	
1981	11,6	16,7	20,9	31,3	47,3	60,0	60,0	70,5	77,4	81,0	88,2	89,0	94,3	135,6	
1980	18,1	25,6	30,0	39,9	40,9	41,0	41,0	41,0	41,0	41,0	54,5	54,8	54,8	54,9	
1979	6,7	9,6	11,4	17,3	22,4	26,5	26,5	26,8	26,8	28,0	31,0	46,0	52,7	58,6	
1978	8,6	12,5	13,0	15,9	17,4	17,6	17,8	22,0	26,5	29,1	30,7	49,3	49,4	49,4	
1977	10,3	17,1	18,5	24,4	28,1	28,1	28,1	28,1	28,1	28,1	28,1	28,1	29,3	33,8	
1976	7,8	10,1	10,7	11,8	14,8	17,4	17,4	17,4	17,4	17,4	17,4	18,0	22,8	25,9	
1975	12,3	21,4	27,9	40,0	42,3	42,3	45,4	45,4	45,4	45,4	45,4	45,4	45,4	45,4	
1974	8,6	13,5	16,9	30,2	40,7	46,6	50,2	53,3	80,3	80,5	80,8	81,0	90,5	90,5	
1973	9,3	17,4	24,0	32,7	47,1	64,5	92,6	98,8	100,2	102,6	113,0	115,9	141,2	192,0	
1972	8,2	13,4	16,0	21,3	29,2	32,7	48,2	55,7	58,9	60,6	62,7	63,7	66,9	83,1	
1971	4,0	6,5	8,5	13,3	15,5	20,5	25,6	30,1	32,0	32,0	37,7	43,8	46,1	46,4	
1970	4,0	7,7	8,7	10,5	10,5	11,0	14,2	18,3	21,3	24,3	36,1	44,2	44,2	62,6	
1969	6,9	7,9	7,9	9,5	13,8	16,9	16,9	16,9	17,4	17,9	21,8	34,3	40,2	40,2	
1968	13,0	20,0	24,6	33,6	36,4	37,0	37,0	37,0	37,0	37,0	37,0	48,9	54,6	54,6	
1967	13,3	19,5	23,6	30,5	40,6	56,2	68,6	77,8	83,9	90,9	98,1	98,1	98,1	98,1	
1966	6,4	11,6	13,6	13,6	14,0	21,6	28,0	32,0	36,0	38,7	40,7	45,6	45,6	46,3	
1965	8,3	10,5	11,8	22,0	40,9	42,9	43,2	43,3	43,6	43,6	43,6	43,6	43,6	49,6	
1964	4,0	4,1	4,4	8,5	11,5	19,3	19,3	19,3	19,3	21,5	25,7	36,3	36,3	60,4	*
1963	7,6	10,0	11,4	13,4	15,6	16,0	18,4	18,5	20,9	28,2	33,5	48,0	50,0	53,0	
1962	9,9	14,5	16,5	24,8	32,4	36,6	36,6	36,6	36,6	36,6	36,6	45,2	67,7	67,7	
1961	9,9	15,3	16,8	23,8	26,5	28,4	29,2	35,8	36,8	38,0	38,5	42,4	42,4	42,4	
1960	6,7	8,1	8,6	16,4	18,9	18,9	18,9	18,9	18,9	18,9	18,9	18,9	19,7	36,3	

1959	5,7	9,7	13,3	14,3	14,3	15,1	16,8	17,4	18,2	20,8	22,4	26,5	26,5	35,3	
1958	9,5	14,3	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	23,4	26,6	28,8	28,8	
1957	4,6	9,2	9,2	13,8	13,8	13,8	16,9	21,3	26,9	34,3	39,1	50,4	58,8	69,3	
1956	5,5	8,4	9,6	9,9	11,4	14,9	14,9	14,9	14,9	14,9	18,2	19,6	21,9	21,9	
1955	6,2	11,5	11,7	14,5	14,7	18,0	18,0	18,0	18,0	18,0	18,0	20,2	25,9	25,9	
1954	3,8	7,5	8,3	15,1	17,3	18,1	22,4	28,9	35,4	41,1	46,5	52,8	61,1	71,4	
1953	9,5	11,1	13,5	14,5	14,5	14,5	16,9	18,5	19,6	19,9	20,4	24,3	32,2	32,2	
1952	4,5	5,3	7,3	7,3	9,3	12,3	16,4	18,9	21,5	26,6	26,6	30,0	33,0	33,0	
1951	9,2	9,5	9,9	10,5	17,5	18,8	18,8	22,2	26,1	30,6	31,1	39,3	41,2	48,1	
1950	11,0	17,0	23,0	40,2	53,6	69,6	77,8	79,3	80,6	82,6	84,2	86,5	93,3	93,3	
1949	8,9	17,7	17,7	19,5	32,5	44,7	44,8	46,8	58,0	71,2	83,6	91,2	111,2	125,5	
1948	7,5	9,8	10,0	12,5	16,7	17,2	18,5	20,4	24,6	24,9	28,1	30,0	38,9	49,7	
1947	7,2	7,2	7,2	7,2	7,2	12,6	12,6	12,6	12,6	12,6	16,7	19,6	19,6	19,6	
1946	1,5	2,6	2,6	4,8	7,3	14,5	14,5	14,5	14,5	19,5	25,6	31,1	38,3	38,3	
1945	6,2	7,7	11,7	12,3	12,3	12,3	14,1	15,2	18,4	22,4	24,0	26,0	29,0	29,4	
1944															
1943															
1942															
1941															
1940															
1939															
1938															
N	70	70	70	70	70	70	70	70	70	70	70	70	70	70	71
Y-ORT	8,3	12,3	15,0	20,7	25,7	29,9	33,1	35,9	38,5	40,8	43,8	48,2	53,5	60,6	60,6
Y-EB	18,1	25,6	36,7	64,8	101,7	106,9	108,6	119,7	125,0	124,7	124,7	124,7	141,2	192,0	192,0
Std.S	2,94	5,09	7,09	11,46	15,77	17,23	18,52	19,90	21,19	21,56	22,61	22,56	26,08	30,83	30,61
Car.K	0,59	0,83	1,16	1,47	2,00	1,78	1,80	1,86	1,74	1,64	1,58	1,38	1,40	1,76	1,77
UDF	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P	G2P
2 YIL	8,0	11,7	13,7	18,1	21,0	25,3	28,0	30,4	32,8	35,3	38,2	43,3	47,8	52,3	52,3
5 YIL	10,6	16,3	20,2	28,6	35,2	40,9	44,8	48,4	52,2	55,0	58,9	64,0	71,8	80,1	80,3
10 YIL	12,2	19,1	24,5	35,9	45,9	52,4	57,1	61,7	66,1	69,0	73,5	78,2	88,1	100,4	100,7
25 YIL	13,9	22,5	29,7	45,1	60,3	67,4	73,4	79,3	84,4	87,2	92,3	96,0	108,8	127,0	127,5
50 YIL	15,2	24,9	33,5	52,0	71,4	78,8	85,7	92,8	98,2	100,8	106,4	109,1	124,0	147,2	147,7
100 YIL	16,3	27,2	37,2	58,8	82,7	90,2	98,1	106,3	112,1	114,4	120,4	122,0	139,1	167,5	168,0
200 YIL	17,4	29,4	40,9	65,6	94,1	101,7	110,6	120,0	126,1	128,1	134,4	134,9	154,0	187,8	188,5
PLF	**0,12**	**0,18**	**0,24**	**0,35**	**0,46**	**0,52**	**0,57**	**0,62**	**0,66**	**0,68**	**0,73**	**0,76**	**0,86**	**1,00**	**1,00**
PLV	**0,16**	**0,23**	**0,28**	**0,38**	**0,45**	**0,52**	**0,57**	**0,61**	**0,65**	**0,69**	**0,74**	**0,82**	**0,90**	**1,00**	**1,00**

Extreme Meteorology Events Recorded in Kocaeli Meteorology Station

Long term extreme meteorology events report obtained from Kocaeli Meteorology Station is provided in Table 10.40.

Table 10.40. Extreme Meteorology Events Recorded at Kocaeli Station

Date	Location	Event	Description
19.03.1981	Kocaeli	Storm	Agricultural products, residential areas and surrounding environment damaged by storm
15.07.1981	Kocaeli	Rain and flood	Residential areas damaged due to flooding streams
15.12.1981	Kocaeli	Rain and flood	Residential areas damaged due to floods
11.10.1994	Kocaeli	Rain and flood	Residential areas damaged due to floods
25.01.1995	Kocaeli	Storm	Residential areas damaged due to storm
30.08.1995	Kocaeli	Storm	Agricultural products damaged by storm
07.09.1995	Kocaeli	Storm	Residential areas damaged by storm

Date	Location	Event	Description
04.11.1995	Kocaeli	Rain, flood and storm	Residential areas damaged by rain and flood. Agricultural products, residential areas and surrounding environment damaged by storm
27.07.1997	Kocaeli	Rain and flood	Agricultural products damaged by rain and flood
11.08.1997	Kocaeli	Rain and flood	Agricultural products damaged by rain and flood
15.10.1997	Kocaeli	Storm	Agricultural products damaged by storm
24.12.1997	Kocaeli	Storm	Residential areas damaged due to storm
06.02.1998	Kocaeli	Storm	Agricultural products damaged by storm
21.03.1998	Kocaeli	Storm	Agricultural products damaged by storm
19.04.1998	Kocaeli	Storm	Residential areas damaged by storm
19.05.1998	Kocaeli	Rain and flood	Residential areas damaged due to floods
15.09.1998	Kocaeli	Storm	Agricultural products damaged by storm
30.09.1998	Kocaeli	Storm	Agricultural products damaged by storm
04.10.1998	Kocaeli	Storm	Residential areas damaged due to storm
06.10.1998	Kocaeli	Storm	Agricultural products damaged by storm
31.10.1998	Kocaeli	Storm	Agricultural products damaged by storm
16.11.1998	Kocaeli	Storm	Residential areas damaged due to storm
09.02.1999	Kocaeli	Storm	Residential areas damaged due to storm
12.02.1999	Kocaeli	Storm	Agricultural products, residential areas and surrounding environment damaged by storm
19.02.1999	Kocaeli	Storm	Residential areas damaged due to storm
21.02.1999	Kocaeli	Storm	Residential areas damaged due to storm
23.02.1999	Kocaeli	Storm	Residential areas damaged due to storm
13.04.1999	Kocaeli	Storm	Agricultural products damaged by storm
23.06.1999	Kocaeli	Storm	Agricultural products damaged by storm
26.06.1999	Kocaeli	Rain and flood	Residential areas damaged by flood and rain
28.07.1999	Kocaeli	Storm	Agricultural products damaged by storm
24.11.1999	Kocaeli	Storm	Residential areas damaged due to storm
05.04.2000	Kocaeli	Storm	Residential areas damaged due to storm
13.07.2000	Kocaeli	Fire	Forest fire
13.07.2000	Kocaeli	Storm	Residential areas damaged due to storm
22.10.2000	Kocaeli	Rain and flood	Residential areas damaged by flooding stream
09.01.2001	Kocaeli	Storm	Broken tree branches
10.01.2001	Kocaeli	Storm	Broken tree branches
22.02.2001	Kocaeli	Storm	Broken tree branches
01.03.2001	Kocaeli	Storm	Roof tiles blown off
02.03.2001	Kocaeli	Storm	Some tents and some tiles from houses blown off
23.03.2001	Kocaeli	Storm	Blown-off tiles from houses
15.04.2001	Kocaeli	Storm	Broken branches in some trees and blown-off tiles in some houses
23.04.2001	Kocaeli	Storm	Roof tiles blown off from some houses, broken tree branches and shedding of flowers from trees
13.08.2001	Kocaeli	Intense rain	Many houses and workplaces damaged by flood
13.08.2001	Kocaeli	Storm	Broken branches in some trees
19.08.2001	Kocaeli	Rain	Some houses in low places flooded
24.11.2001	Kocaeli	Storm	Broken branches in some trees and blown-off tiles in some houses
25.12.2001	Kocaeli	Intense rain	Some houses and workplaces flooded and traffic hindered by the flood
23.03.2002	Kocaeli	Storm	Broken branches in some trees
14.07.2002	Kocaeli	Storm	Broken branches in some trees
28.07.2002	Kocaeli	Storm	Plantation areas vastly damaged, many trees and windows broken, many roof tiles blown off
04.08.2002	Kocaeli	Rain and flood	Many houses and workplaces flooded, many traffic accidents and difficulties in transportation
07.08.2002	Kocaeli	Storm	Roofs damaged in some houses and workplaces, difficulties in transportation and some trees tipped over
14.09.2002	Kocaeli	Storm	Blown off roofs, broken branches in tall trees and also some trees tipped over
05.02.2003	Kocaeli	Storm	Some house roofs and some vessels/boats in the marina damaged
22.02.2003	Kocaeli	Snow	Broken tree branches, traffic accidents and difficulties, electricity cutouts
03.07.2003	Kocaeli	Drought	Present agricultural situation requires rain
06.07.2003	Kocaeli	Storm	Broken branches in some trees and some roof tiles blown off
09.10.2003	Kocaeli	Storm	Damaged roofs in some houses, some broken trees, some vessels at the seas and coast destroyed, some buildings at the shore flooded, 1 person hurt due to the roof blown of by the storm
22.01.2004	Kocaeli	Snow	Broken tree branches and hindered traffic due to excessive & continuous snow precipitation
12.02.2004	Kocaeli	Snow	Broken tree branches due to excessive & continuous snow flow
24.03.2004	Kocaeli	Storm	Hindered marine transportation, broken tree branches, shedding of flowers

Date	Location	Event	Description
			from trees
07.05.2004	Kocaeli	Storm	Broken tree branches
19.06.2004	Kocaeli	Rain and flood	Residential areas damaged
15.08.2004	Kocaeli	Hail	Animals hurt
16.08.2004	Kocaeli	Storm	Trees uprooted
18.08.2004	Kocaeli	Rain and flood	Residential areas damaged
28.08.2004	Kocaeli	Hail	Residential areas damaged
15.11.2004	Kocaeli	Storm	Broken tree branches
20.11.2004	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged
12.01.2005	Kocaeli	Fog	Motorway transportation hindered
26.01.2005	Kocaeli	Storm	Broken tree branches
15.02.2005	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged
16.02.2005	Kocaeli	Storm	Broken tree branches
27.02.2005	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged
13.04.2005	Kocaeli	Rain and flood	Residential areas damaged
07.05.2005	Kocaeli	Storm	Broken tree branches
11.06.2005	Kocaeli	Storm	Broken trees
19.06.2005	Kocaeli	Rain and flood	Motorway transportation hindered
05.07.2005	Kocaeli	Rain and flood	Residential areas damaged
16.07.2005	Kocaeli	Rain and flood	Residential areas damaged
25.08.2005	Kocaeli	Storm	Greenhouses damaged
22.09.2005	Kocaeli	Rain and flood	Motorway transportation hindered
08.12.2005	Kocaeli	Storm	Broken tree branches
18.12.2005	Kocaeli	Storm	Broken tree branches
19.12.2005	Kocaeli	Snow	Motorway transportation hindered
25.01.2006	Kocaeli	Snow	Motorway transportation hindered
28.01.2006	Kocaeli	Frost	Vegetable gardens damaged by frost
26.02.2006	Kocaeli	Storm	Residential areas damaged
12.04.2006	Kocaeli	Storm	Maine transportation hindered
28.06.2006	Kocaeli	Rain and flood	Residential areas damaged
08.08.2006	Kocaeli	Rain and flood	Residential areas damaged
24.09.2006	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged.
31.10.2006	Kocaeli	Rain and flood	Residential areas damaged
26.12.2006	Kocaeli	Storm	Broken tree branches
26.12.2006	Kocaeli	Snow	Transportation vehicles damaged
03.01.2007	Kocaeli	Storm	Marine transportation hindered
23.03.2007	Kocaeli	Storm	Residential areas damaged
27.08.2007	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged.
11.11.2007	Kocaeli	Storm	Broken tree branches
17.02.2008	Kocaeli	Snow	Motorway transportation hindered
21.03.2008	Kocaeli	Rain and flood	Residential areas damaged
25.03.2008	Kocaeli	Storm	Residential areas damaged
23.05.2008	Kocaeli	Hail	Vegetable gardens damaged.
27.05.2008	Kocaeli	Lightning strike	Animals hurt.
08.06.2008	Kocaeli	Hail	People and animals hurt, transportation and residential areas damaged.
10.06.2008	Kocaeli	Rain and flood	Residential areas damaged
17.09.2008	Kocaeli	Rain and flood	Residential areas damaged
27.09.2008	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged.
05.10.2008	Kocaeli	Storm	Broken tree branches
15.10.2008	Kocaeli	Rain and flood	Residential areas damaged
26.10.2008	Kocaeli	Rain and flood	Residential areas damaged
22.11.2008	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged.
12.02.2009	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged.
01.05.2009	Kocaeli	Storm	Transportation vehicles damaged
28.06.2009	Kocaeli	Hail	People and animals hurt, transportation and residential areas damaged.
29.06.2009	Kocaeli	Lightning strike	Communication and energy transfer lines damaged
05.07.2009	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged.
08.09.2009	Kocaeli	Lightning strike	Forest fire
30.10.2009	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged
21.11.2009	Kocaeli	Fog	Marine transportation hindered
20.12.2009	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged
01.01.2010	Kocaeli	Storm	Marine transportation hindered
01.02.2010	Kocaeli	Landslide	People and animals hurt, transportation and residential areas damaged
01.06.2010	Kocaeli	Storm	Communication and energy transfer lines damaged
01.06.2010	Kocaeli	Lightning strike	Residential areas damaged

Date	Location	Event	Description
06.06.2010	Kocaeli	Rain and flood	Residential areas damaged
09.06.2010	Kocaeli	Rain and flood	Residential areas damaged
20.06.2010	Kocaeli	Lightning strike	Communication and energy transfer lines damaged
22.06.2010	Kocaeli	Storm	Communication and energy transfer lines damaged
22.06.2010	Kocaeli	Hail	Industrial plants damaged
23.06.2010	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged
28.06.2010	Kocaeli	Rain and flood	Motorway transportation hindered
28.06.2010	Kocaeli	Lightning strike	Residential areas damaged
27.10.2010	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged
06.11.2010	Kocaeli	Fog	Marine transportation hindered
29.01.2011	Kocaeli	Rain and flood	Motorway transportation hindered
08.03.2011	Kocaeli	Snow	People and animals hurt, transportation and residential areas damaged
14.04.2011	Kocaeli	Storm	Marine transportation hindered
12.06.2011	Kocaeli	Rain and flood	Motorway transportation hindered
03.08.2011	Kocaeli	Rain and flood	Motorway transportation hindered
11.08.2011	Kocaeli	Rain and flood	Marine transportation hindered
23.09.2011	Kocaeli	Lightning strike	People and animals hurt, transportation and residential areas damaged
01.12.2011	Kocaeli	Fog	People and animals hurt, transportation and residential areas damaged
06.01.2012	Kocaeli	Storm	Communication and energy transfer lines damaged
31.01.2012	Kocaeli	Snow	People and animals hurt, transportation and residential areas damaged
28.02.2012	Kocaeli	Snow	People and animals hurt, transportation and residential areas damaged
01.04.2012	Kocaeli	Storm	People and animals hurt, transportation and residential areas damaged
18.04.2012	Kocaeli	Snow	Motorway transportation hindered
18.05.2012	Kocaeli	Hail	People and animals hurt, transportation and residential areas damaged
19.05.2012	Kocaeli	Rain and flood	People and animals hurt, transportation and residential areas damaged
28.05.2012	Kocaeli	Storm	Communication and energy transfer lines damaged
31.05.2012	Kocaeli	Rain and flood	Motorway transportation hindered
03.08.2012	Kocaeli	Hail	Transportation vehicles damaged
12.08.2012	Kocaeli	Lightning Strike	People and animals hurt, transportation and residential areas damaged
13.11.2012	Kocaeli	Fog	Marine transportation hindered
03.12.2012	Kocaeli	Storm	Marine transportation hindered
20.12.2012	Kocaeli	Snow	Communication and energy transfer lines damaged
13.06.2013	Kocaeli	Whirlwind	People and animals hurt, transportation and residential areas damaged
19.06.2014	Kocaeli	Hail	Plantation areas damaged
07.08.2014	Kocaeli	Storm and Whirlwind	People and animals hurt, transportation and residential areas damaged
01.02.2015	Kocaeli	Storm and Whirlwind	Residential areas damaged
23.06.2015	Kocaeli	Intense rain and flood	Residential areas damaged
29.09.2015	Kocaeli	Intense rain and flood	Residential areas damaged
29.09.2015	Kocaeli	Intense rain and flood	People and animals hurt, transportation and residential areas damaged

10.2.3. Potential Impacts

10.2.3.1. Land Preparation and Construction Phase

During the construction phase of the project, GHGs will be generated as a result of operation of construction machinery and equipment for motorway construction, operations in quarries and material transportation.

The total GHG emissions for the construction of a 1 km section of each type of road is estimated by *The World Bank Group (2011)* and presented in Table10.41. When compared to other road types, during construction, motorways are the roads where higher GHGs are emitted. It is also possible to present the breakdown of emission factors for different phases of construction such as earthworks, pavement, road furniture etc. Breakdown of GHG emissions for different steps of road construction for motorways is

provided in Table 10.42. As can be observed from the table, pavement and construction of road structures are steps where highest GHG emissions are generated.

Table 10.41. Typical Unit GHG Emissions o0 Construction of Various Road Categories (WB Group, 2011)

	Expressway*	National Road	Provincial Road	Rural Road-Gravel	Rural Road-
Emission (ton CO_2eq/km)	3234	794	207	90	103

**Expressway is defined as divided highway used by high-speed traffic with controlled or partially controlled access.*

Table 10.42. Typical Breakdown of GHG Emissions for Expressways* (ton CO_2eq/km) (WB Group, 2011)

Construction Activity	Emission Factors (ton CO_2eq/km)
Earthworks	161
Pavement	1334
Culverts	238
Structures	1068
Road Furniture	432
TOTAL	3234

**Expressway is defined as divided highway used by high-speed traffic with controlled or partially controlled access.*

Distribution of GHG emissions for different life cycle stages of construction off motorways such as transportation, fabrication/extraction of construction materials, machinery and equipment operations is provided in Table 10.43. As can be observed, material extraction is the main contributor to GHG emissions.

Table 10.43. Distribution of GHG Emission Factors for Construction Activities (WB Group, 2011)

Construction Activity	Emission Factors (ton CO_2eq/km)
Transport Emissions	1004
Material Extraction Emissions	2122
Machinery and Equipment Emissions	109
TOTAL	3234

In order to predict the amount of GHG emissions generated during the construction of the motorway project, emissions are calculated for each section according to the length of the motorway to be constructed and presented in Table 10.44.

Table 10.44. GHG Emissions from Road Construction Activities

Motorway Section	Length of the Section (km)	GHG Emissions (ton CO2eq)
Section 4	21,9	70.825
Section 5	36,8	119.011
Section 6	62,9	203.419
Total	121,6	393.254

Total GHG gas emission generated as a result of road construction activities for Asian Section of the North Marmara Motorway Project is estimated as 393.250 tons CO_2eq which corresponds to annually approximately 130 thousand tons CO_2eq. It should be noted that GHG emissions from the extraction of construction materials are accepted

as the main contributor while transportation of materials is also a significant GHG producer. Distribution of GHG emissions for road construction activities is presented in Table 10.45.

Table 10.45. Distribution of GHG Emissions from Road Construction Activities

Construction Activity	GHG Emissions (ton CO2eq)			
	Section 4	Section 5	Section 6	Total
Transport Emissions	21.988	36.947	63.152	122.086
Material Emissions	46.472	78.090	133.474	258.035
Machinery and Equipment Emissions	2.387	4.011	6.856	13.254
Total	70.825	119.011	203.419	393.254

Distribution of GHG emissions indicate that highest emissions are allocated to material extraction phase while when compared to transportation and material extraction, machinery and equipments are found to be responsible from lower GHG amounts.

10.2.3.2. Operation Phase

Potential impacts of the project on climate change would be through greenhouse gas emissions emitted during operation phase. Greenhouse gas emissions from the project are estimated in terms of CO_2eq which represents all of the greenhouse gas emissions in CO_2 form.

Inevitably, the estimation of amount of greenhouse gas emissions generated from operation activities of the Motorway includes some assumptions. Below bullets provide the main assumptions made in scope of the assessment.

- Main motorway lengths are considered in the assessment and emissions from transportation on access roads are omitted since they are relatively smaller in length.
- Traffic load data is obtained from traffic forecast provided in the Feasibility Report prepared for the North Marmara Project. In order to represent the worst case scenario, traffic projections for 2038 are considered (highest traffic flow data)
- It is assumed that traffic load for 2038 will be valid for each section and that vehicles travel through the whole length of the road section. (This assumption represents the worst case, as in reality vehicles are not supposed to drive through the whole Motorway section)
- The Motorway is planned to be in operation after 2019. For the assessment, emission factor provided for 2020 in the WebTAG Databook Sheet A3.3. (Department for Transport, WebTAG Databook, Spring 2016, Release v1.6) is used (emission factors for further years are fixed and same as for 2020).
- Calculations were carried out by assuming all vehicles are passenger cars.
- Calculations were carried out for both petroleum and diesel fueled vehicles. (Proportion of LPG (liquefied petroleum gas) fueled vehicles are included in petroleum fueled vehicle amount. This can be accepted as a worst case scenario as LPG is known to result in smaller amount of emissions).

Emission factor for greenhouse gas emissions was obtained from the WebTAG Databook Sheet A3.3. (*Department for Transport, WebTAG Databook, Spring 2016, Release v1.6*).

According to TurkStat data (2015) representing the number of motor vehicles according to their fuel consumption types 47,9% percent of motor vehicles use diesel fuel while others use gasoline and LPG. This data is used to calculate the greenhouse gases generated by both types of vehicles. Traffic load data and distribution of the amount of petroleum and diesel vehicles are presented in Table 10.46

Table 10.46 Traffic Load Data and Distribution of the Amount of Petroleum and Diesel Vehicles

Motorway Section	Traffic Loads (cars/day)	Traffic Loads (cars/year)	Traffic Load of Petroleum Vehicles (cars/year)	Traffic Load of Diesel Vehicles (cars/year)
Section 4	135.651	49.512.615	25.797.202	23.715.413
Section 5	103.354	37.724.210	19.655.174	18.069.036
Section 6	55.076	20.102.740	10.473.986	9.628.754

GHG emissions from petroleum and diesel fueled vehicles are calculated for each motorway section and presented in Table 10.47 and Table 10.48. Within this scope, fuel consumption amounts, speed of vehicles and length of the motorway are taken into consideration.

Table 10.47. Greenhouse Gas Emissions from Petroleum Fueled Vehicles

Motorway Section	Length of the Section (km)	Fuel Consumption Amount* (L/km/car)	Design Speed (km/hr)	CO_2 Emission Factor (kg CO_2eq/L of fuel)	Traffic Load of Petroleum Vehicles (cars /year)	CO_2 Emissions (ton CO_2eq/year)
Section 4	21,9	0,08	120	2,071	25.797.202	92.225
Section 5	36,8				19.655.174	118.075
Section 6	62,9				10.473.986	107.547

*Fuel consumption amount for petroleum vehicles are calculated from data provided in WebTAG Databook Sheet A1.3.8. (*Department for Transport, WebTAG Databook, Spring 2016, Release v1.6)*

Table 10.48. Greenhouse Gas Emissions from Diesel Fueled Vehicles

Motorway Section	Length of the Section (km)	Fuel Consumption Amount* (L/km/car)	Design Speed (km/hr)	CO_2 Emission Factor (kg CO_2eq/L of fuel)	Traffic Load of Diesel Vehicles (cars/year)	CO_2 Emissions (ton CO_2eq/year)
Section 4	21,9	0,06	120	2,420	10.864.079	78.278
Section 5	36,8				8.334.162	100.218
Section 6	62,9				23.432.893	91.282

*Fuel consumption amount for diesel vehicles are calculated from data provided in WebTAG Databook Sheet A1.3.8. (*Department for Transport, WebTAG Databook, Spring 2016, Release v1.6)*

As can be seen in Table 10.47 and Table 10.48, annual amount of greenhouse gases emitted from petroleum and diesel vehicles within the scope of the Asia Section of North Marmara Motorway Project is around 320 thousand tons CO_2eq/year and 270

thousand tons CO_2eq/year, respectively. Total annual amount of emissions correspond to 0,59 million tons CO_2eq. This amount corresponds to 0,13 % of the total amount of greenhouse gas emissions reported by TurkStat (2014).

Carbon Capture Capacity

Carbon is retained in biomass, decomposing organic matter and soil in terrestrial ecological systems. Carbon stock in terrestrial ecological systems plays an important role in the global carbon cycle. Carbon is exchanged between ecological systems and the atmosphere through natural processes such as photosynthesis, respiration, decomposition and combustion. Human activities change the carbon stocks in ecological systems and alter the exchanges between the carbon pools and the atmosphere through land use and land use change. (*IPCC, 2000)*

North Marmara Motorway Project is considered to have a potential impact on regional carbon stocks through removal of forests for motorway construction. In this section, the loss in carbon capture and oxygen generation capacities due to deforestation activities are estimated. Loss of carbon capture capacity is based on a comparative analysis of this capacity with regard to the official data held by the District and Sub-District Directorates of Forestry regarding the capacity that has been calculated to exist in the region of responsibility of each directorate. The region of responsibility is the geographical area/region where the directorate is responsible for managing all the forest areas and assets in this region (including provision of permits in the forest areas, reforestation/afforestation activities, tree planting and removing). As a result of this evaluation, the significance assessment has been made based on the calculated availability of carbon capture capacity and the forest area to be lost.

Number of trees to be removed and the area they occupy are determined and calculated from forestry inventory data in forest management plans of the relevant directorates (Kanlica, Izmit, Adapazari and Akyazi District Directorates of Forestry) and summarized in Table 10.49.

Table 10.49. Number of Trees to be Removed, Area Occupied and Total Forest Area

Total Number of Trees Removed	Area Occupied by Trees Removed (ha)	Total Forest Area Under Responsibility of the Directorates (ha)
864.099	1.465,1	89.489,6

Loss in the amount of carbon capture capacity and oxygen generation capacity is estimated from the data provided in the forest management plans and the amount of forest area to be lost in scope of the project and presented in Table 10.50

Table 10.50. Loss of Carbon Capture Capacity and Oxygen Generation Capacity

Carbon Capture Capacity		
Total Carbon Capture Capacity of the Forest Area	**tons**	4.349.918
Loss of Carbon Capture Capacity	**tons**	83.795
Loss of Carbon Capture Capacity	**%**	1,93
Oxygen Generation Capacity		
Total Oxygen Generation Capacity of the Forest Area	**tons**	249.412
Loss of Oxygen Generation Capacity	**tons**	4.805
Loss of Oxygen Generation Capacity	**%**	1,93

As it can be seen in Table 10.50, loss of carbon capture capacity and oxygen generation capacity as a result of removal of forests corresponds to 1,93 % of the total carbon capture and oxygen generation capacities of the forests in the responsibility of District and Sub-District Directorates of Forestry.

10.2.4. Mitigation Measures

The following section describes the actions and strategies designed to avoid, minimize or offset the potential adverse impacts of the project on climate change, or to enhance potential project benefits.

10.2.4.1. Land Preparation and Construction Phase

GHG emissions generated during land preparation and construction phase of the project can be considered as relatively short term emissions when compared to the emissions of operation of the motorway. Within this regard the following measures are suggested to mitigate the potential impacts of the project on climate change through greenhouse gas emissions:

- Construction operations of the project will be in line with good industrial practices.
- Speed restrictions will be adopted by construction vehicles and equipment to optimize fuel efficiency.
- Regular maintenance of construction vehicles and equipments will be applied.
- Energy uses associated with construction vehicles and equipment will be monitored.
- Trainings will be performed on site personnel regarding energy efficiency.

10.2.4.2. Operation Phase

The contribution of the project on climate change is estimated in above sections and found to correspond to 0,13 % of the total amount of greenhouse gas emissions reported by TurkStat (2014). The GHG generated by transportation projects depend on a variety of issues such as vehicle fuel efficiency, motorway system improvements, travel behavior, speed regulations etc Therefore mitigation of climate change through GHG emissions should be considered in context of a comprehensive and extensive plan to be applied nationally and on a global scale.

On the other hand, project proposes measures to offset the potential impacts. In contrast to the loss in carbon capture capacity and oxygen generation capacity as a result of trees removed for motorway establishment in scope of the Afforestation Plan prepared the carbon capture and oxygen generation capacity of the region will be improved (see Annex-4 for the Afforestation Plan). Within the scope of this plan, number, type and location of trees planned to be planted within the scope of the project are determined. The application of this plan will increase the carbon capture capacity and oxygen generation capacity and compensate the potential impacts. Implementation of the Afforestation Plan will be initiated in the construction phase and may continue through the initial phases of

the operation period. The afforestation ratio will be 4 for every tree lost due to the construction of the Motorway. Practically it can be said that depending on the growing of trees, carbon capture and oxygen generation amounts to be reached with afforestation activities are expected to be 4 times the amount of loss.

It should also be noted that the traffic on existing road routes will shift on the planned motorway route. This means that the GHGs generated on the planned motorway would be emitted from existing road network.

10.2.5. Summary of Assessment and Residual Impacts

Total annual amount of greenhouse gas emissions resulting from the project correspond to 0,59 million tons CO_2eq. This amount corresponds to 0,13 % of the total greenhouse gas emissions reported by TurkStat (2014). Significance of the impact of the project on climate change is evaluated as low. Summary of assessments is provided in Table 10.51.

Table 10.51. Summary of Air Quality Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Local Communities	Land preparation and construction	Increase in PM_{10} concentration	Adverse	Local	Medium	Low (0-25 % exceedance of air quality standard)	Short term reversible	Intermittent	Moderate (B)	Medium (2) Kurnakoy, Kadilli, Demirciler, Tepecik, Sipahiler, Cayirkoy, Karaabdulbaki, Suleymaniye, Korucuk, Evrenkoy, Ikızce Osmaniye, Budaklar, Osmanbey	Medium (B2)	• Dust should be minimized from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house filters or cyclones) • Dust should be minimized from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content • Speed limitations will be defined and obeyed for construction vehicles. • Well and adequate maintained vehicles shall be used. Regular maintenance of machinery and equipments will be ensured. • The drop height of potentially dust generating materials will be kept as low as possible. • Construction vehicles will not be permitted to keep engines running while waiting to enter the site or waiting on-site. • Dust suppression methods (i.e. watering with water trucks, applying non-toxic chemicals, speed limits for mobile vehicles, use of well-maintained vehicles/machinery) will be applied at road construction sites, service roads and quarry/material borrow/storage sites to mitigate Project-related dust emissions. In this respect, upper layers of the work sites/materials will be kept at a humidity level of about 10%. Watering will be applied at any time necessary including night time, weekends or off-days by using pressurized distribution or spraying systems that would ensure even distribution of water. • If there is traffic flow on the existing roads near the work sites, dust suppression measures will be continuously applied to ensure traffic safety. If there is no traffic existing in the local roads, dust suppression measures will be applied only at local residential and business areas. • All the dust-emitting components of the crushing-screening plants will be put in closed spaces and equipped with dust suppression systems. • Loading and unloading operations will be performed without throwing/scattering. • During transportation, excavated materials will be covered with nylon canvas or materials with grain size larger than 10 mm. • In the supply of construction materials, local licensed quarries (existing or new) will be preferred to reduce transportation distance to minimize associated impacts and costs. • Wind shields/barriers will be placed at work sites such as material storage areas to prevent dust dispersion where necessary. • Relevant provisions of the Regulation on Air Pollution Control Sourced from Industry and Regulation on the Assessment and Management of Air Quality will be complied with to minimize air emissions sourced from construction machinery and trucks. • Blasting operations will be conducted in line with the legislation in force and good industry practices/modern techniques. • Roads to be used for access to quarry sites will be upgraded by the Project Sponsors to minimize dust emissions during transport. These roads will have sufficient width. • Driving through settlements will be avoided wherever alternative roads are present. • Any damage caused by insufficient or lack of dust suppression measures will be compensated.	Low
						Medium (25-50 % exceedance of air quality standard)			Moderate (B)	Medium (2) Kutluca	Medium (B2)		Low
						High (>50 % exceedance of air quality standard)			Major (A)	Medium (2) Taskisigi	High (A2)		Medium
										High (3) Durhasan	High (A3)		Medium
Ecologically Sensitive Areas			Adverse	Local	Medium	Low (0-25 % exceedance of air quality standard)	Short term reversible	Intermittent	Moderate (B)	Low (1) Sevindikli Pond, Sipahiler Pond, Bickidere Pond, Bayraktar Pond, Kurtdere Pond	Low (B1)		Low
									Moderate (B)	Medium (2) Omerli Dam, Denizli Pond, Ballikayalar Nature Park, Poyrazlar Lake and Nature Park	Medium (B2)		Low
Local Communities	Operation	Increase in concentrations of gasous pollutants	Adverse	Local	Long	Low (0-25 % exceedance of air quality standard)	Irreversible	Continuos	Moderate (B)	Medium (2) Demirciler, Tavsanli, Sepetci, Cayirkoy, Eseler, Karapinar, Karaman, Evrenkoy	Medium (B2)	• At the service areas, a green buffer strip will be formed between the outer lane of the Motorway and the facilities. This strip will be properly planted (e.g. with shrubs that start growing from the base and are resistant to dust and gaseous emissions) to form a barrier against dust to be sourced from the motorway traffic. • The application of automatic toll systems along the motorway will contribute to an optimization of traffic flows and thus lower emissions. • Tunnel ventilation system designed with the objective to remove/dilute vehicle emissions will be installed so that air quality within the tunnel complies with relevant air quality standards. • In order to ensure appropriate air quality near tunnel portals, need,	Low
										High (3) Durhasan	High (B3)		Medium
						Medium (25-50 % exceedance			Major (A)	Medium (2) Kadilli	High (A2)		Medium

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
						of air quality standard)						capacity and type of tunnel ventilation systems, dispersion techniques, air stacks and other technologies will be considered during the design of tunnels.	
						High (>50 % exceedance of air quality standard)			Major (A)	Medium (2) Kurnakoy, Korucuk	High (A2)		Medium
Ecologically Sensitive Areas			Adverse	Local	Long	Low (0-25 % exceedance of air quality standard)	Irreversible	Continuos	Moderate (B)	Low (1) Bickidere Pond, Bayraktar Pond,	Low (B1)		Low
										Medium (2) Omerli Dam	Medium (B2)		Low
						High (>50 % exceedance of air quality standard)			Major (A)	Medium (2) Denizli Pond, Ballikayalar Nature Park	High (A2)		Medium

CHAPTER 11

NOISE AND VIBRATION

CHAPTER 11. NOISE AND VIBRATION

This chapter assesses the likely impacts of the motorway project with respect to noise. Within this scope, construction and operation phases of the motorway are taken into consideration and impacts are evaluated accordingly. This chapter includes the following:

- Legislative framework for environmental noise assessment
- Baseline environmental noise measurements
- Assessment and quantification of potential project emissions
- Noise modeling with SoundPlan V 7.4 software for project land preparation and construction and operation phases
- Assessment of potential noise impacts
- Mitigation measures regarding noise impacts
- Residual impacts regarding noise impacts
- Assessment of potential impacts regarding vibration and relevant mitigation measures

11.1. Noise

Noise is defined as undesired sound that is loud or unpleasant or that causes disturbance. Sound consists of vibrations transmitted to the ear as rapid variations in air pressure. In other words, sound is a disturbance propagated through the air as a pressure wave. The fluctuations in atmospheric pressure are sensed by the ear. Frequency is the number of pressure fluctuations per second and is expressed in Hertz (Hz). In other words, the frequency of sound is the rate at which a sound wave oscillates, measured in number of cycles per second. The human ear is more sensitive to frequencies important for voice communication and hearing sensitivity decreases markedly at frequencies below about 250 Hz.. The upper frequency limit of audibility is around 20 kHz. The frequency of the pressure wave is converted to pitch and its amplitude to loudness. Human ear can respond to a wide range of amplitudes and frequencies of sound.

The response of the hearing system to the amplitude of sound pressure is non-linear and can be characterized by a logarithmic relationship. The relationship is also frequency dependent and an adjustment or weighting is applied to the response of a microphone to different frequency components of a sound in order to produce a scale that better reflects the hearing system. In addition, in order to characterize sounds that fluctuate in intensity, it is necessary to derive a statistic that applies over a period of time.

Sound pressures are measured in units of Pascals (Pa). In order to cope with such a range of sound pressure values it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as sound pressure levels in decibels (dB).

Several different weightings have been proposed to convert measured sound pressure to a measure that correlates with perceived loudness in different circumstances. The ‘A’ weighting can be accepted as the most commonly used and correlates well with the perceived noisiness of road vehicles.

Traffic noise is a general term used to define the noise from traffic using the road network. A broad indication of typical traffic noise levels likely to be encountered at various distances from the road for two different traffic conditions is presented in Figure 11.1. The first is representative of a heavily trafficked road (about 150,000 vehicles per day) and the second a lighter trafficked road (about 50,000 vehicles per day).

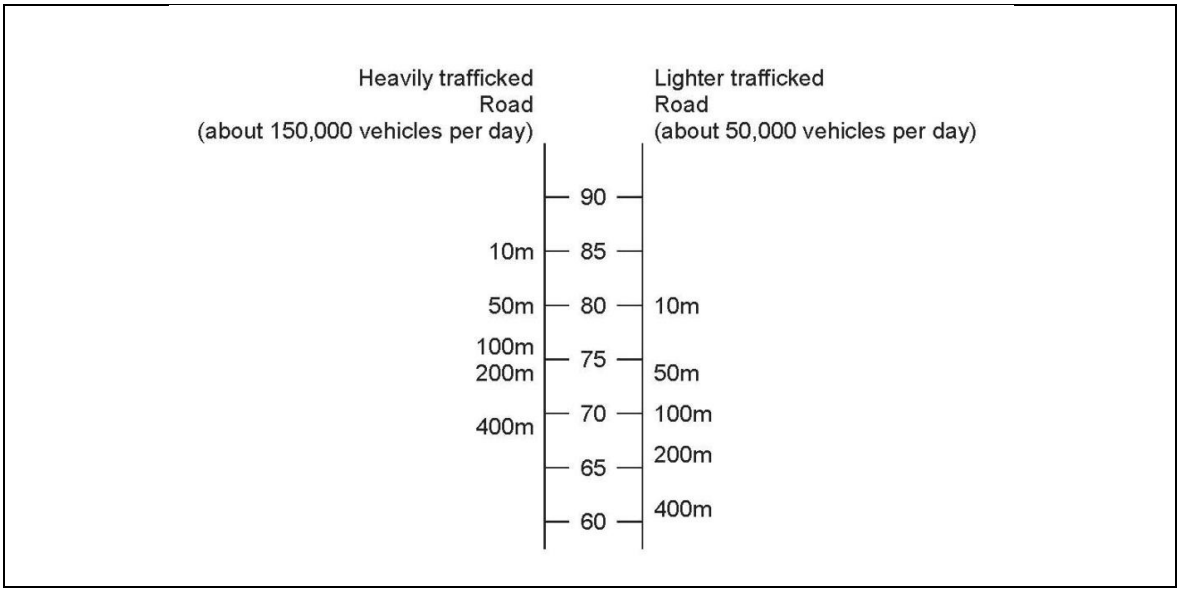


Figure 11.1. Example of Typical Traffic Noise Levels *(UK Highways Agency, 2011).*

11.1.1. Assessment Methodology and Data Sources

11.1.1.1. Legal Framework

Turkish Legal Requirements

Regulation on the Assessment and Management of Environmental Noise

Environmental noise in Turkey is regulated by the Regulation on the Assessment and Management of Environmental Noise (RAMEN) which is published on 04.06.2010 in Official Gazette No 27601). This regulation is intended to ensure that precautions are taken to prevent disturbance to peace and tranquility, and to ensure the physical and mental health of persons potentially exposed to environmental noise. For this purpose the regulation sets out requirements regarding noise mapping, acoustic reporting, environmental noise assessment for determination of noise exposure levels and preparation and application of action plans to prevent or mitigate negative impacts of noise exposure on human being and environment.

According to the Regulation on the Assessment and Management of Environmental Noise, noise limit values defined to prevent noise from road projects are defined in Annex VII, Table 1. Environmental noise limits are defined in the regulation for existing and new roads and presented in Table 11.1.

Table 11.1. Environmental Noise Standards for Roads

Areas	Planned/Renovated/Repaired Roads			Existing Roads		
	L_{day} (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)	L_{day} (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)
Educational, cultural and health facilities as noise sensitive areas, and places densely populated with summer houses and camp grounds	60	55	50	65	60	55
Areas densely populated with residences among the areas containing commercial structures and noise sensitive structures all together	63	58	53	68	63	58
Areas with dense work places among the areas containing commercial structures and noise sensitive structures all together	65	60	55	70	65	60
Industrial Areas	67	62	57	72	67	62

For construction activities noise limit values are defined in Table 5 Appendix- VII Regulation on the Assessment and Management of Environmental Noise and presented in Table 11.2.

Table 11.2. Environmental Noise Standards for Construction

Type of Activity (Construction, Demolition and Repair)	L_{day} (dBA)
Building	70
Road	75
Other sources	70

In Article 23 of the RAMEN, it is stated that “construction activities within residential areas and at their surroundings cannot proceed during the evening and night. after daytime intervals”. Therefore, it is important to make necessary notices regarding the project construction activities.

It is also stated in the same article that “With the condition of not working during the daytime interval, construction activities for projects of public interest like dams, bridges, tunnels, highways, intercity main roads, mass housing and construction activities which are likely to prevent traffic flow in cities, can be carried out by complying with values obtained by subtracting 5 dBA from the daytime values given in Table 5 of Appendix- VII for the evening, and subtracting 10 dBA for the night, after a related decision is obtained from the Provincial Local Environmental Board”. In this context, while the daytime limit value is set as 75 dBA, for the evening it is 70 dBA, and for the night it is set as 65 dBA, Abovementioned limit values are given in Table 11.3.

Table 11.3. RAMEN Noise Standards for Construction of Roads (dBA)

Time Interval	RAMEN Table 5 (dBA)
Day (7:00 – 19:00)	75
Evening (19:00 – 23:00)	70
Night (23:00 – 07:00)	65

IFC Standards

Noise limit levels are described under Environmental, Health and Safety (EHS) Guidelines, General EHS Guidelines: Environmental, Noise. The noise limit values are based on World Health Organization Guidelines for Community Noise. Noise levels defined by IFC are presented in Table 11.4.

Table 11.4. Noise Level Guidelines of IFC

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 7:00 – 22:00	Nighttime 22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70

IFC requires that noise impacts should not exceed the levels presented in Table 11.4, or result in a maximum increase in background noise levels of 3 dB at the nearest receptor location off-site.

The IFC EHS Guideline also presents examples of noise reduction options that should be considered where noise levels exceed these guideline values, along with recommendations for noise monitoring to be carried out either to establish existing ambient noise levels or to verify operational noise levels.

The IFC noise level guideline differentiates between two receptor categories, however, it is not specific to any particular source. In this regard, IFC guideline makes reference to noise from facilities and stationary noise sources and are commonly applied as design standards for industrial facilities. There is no indication that IFC noise level guidelines are applicable to road projects.

In addition to IFC General EHS Guideline, IFC EHS Guideline for Toll Roads gives guidance on noise for road projects. It provides management practices to prevent, minimize and control noise, however, does not define noise limit values. The guidance on noise levels in this document is limited to an example from America and was found to have limited applicability to this project.

When European Directives are reviewed, Directive 2002/49/EC namely, the Environmental Noise Directive states that “Member States shall designate at the appropriate levels the competent authorities and bodies responsible for implementing this directive: (a) making and, where relevant, approving noise maps and action plans for agglomerations, major roads, major railways and major airports; (b) collecting noise maps and action plans. As with IFC guidelines, the EU Environmental Noise Directive does not prescribe noise limits for new roads, such standards are foreseen to be set at national level (for member states). This directive requires that the Member States apply the noise indicators L_{den} and L_{night} for noise assessment.

To sum up, Turkish noise limits were used to assess the impacts of the project on environmental noise levels. Evaluation of noise model results was performed according to L_{den} and L_{night} noise indicators.

Significance Criteria

The significance criteria for the impacts regarding noise will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impacts, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 11.5.

Table 11.5 Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	Medium (2)	Low (1)
Human Receptors	Educational, cultural, health facilities, places densely populated with summer houses and camping areas and/or areas densely populated with residences	Areas with dense work places/ industrial areas and areas not densely populated with residences	Industrial areas

Evaluation of magnitude of impacts was based on increase in baseline noise levels measured in settlements close to the motorway. Magnitude of impact is defined as low, medium and high when the result of modeling study increases baseline noise levels of a specified location 3-6 dBA, 6-9 dBA and more than 9 dBA, respectively (see Table 11.6). In addition, regardless of the increase in baseline noise level, magnitude of impact is classified as high when results of noise modeling study indicates exceedence in noise limit values. According to IFC EHS Guideline impacts related to noise can result in a maximum increase in background noise levels of 3 dB at the nearest receptor location off-site. Therefore, it is accepted that increases in noise levels of a specified location up to 3 dB is acceptable (impact magnitude is defined as negligible).

Table 11.6. Impact Magnitude Criteria

Magnitude of Impact	Increase in Baseline Noise Level (L_{den} dBA)
Low	3-6 dBA
Medium	6-9 dBA
High	>9 dBA or noise modeling study indicates exceedance of noise limit values

11.1.2. Baseline Conditions

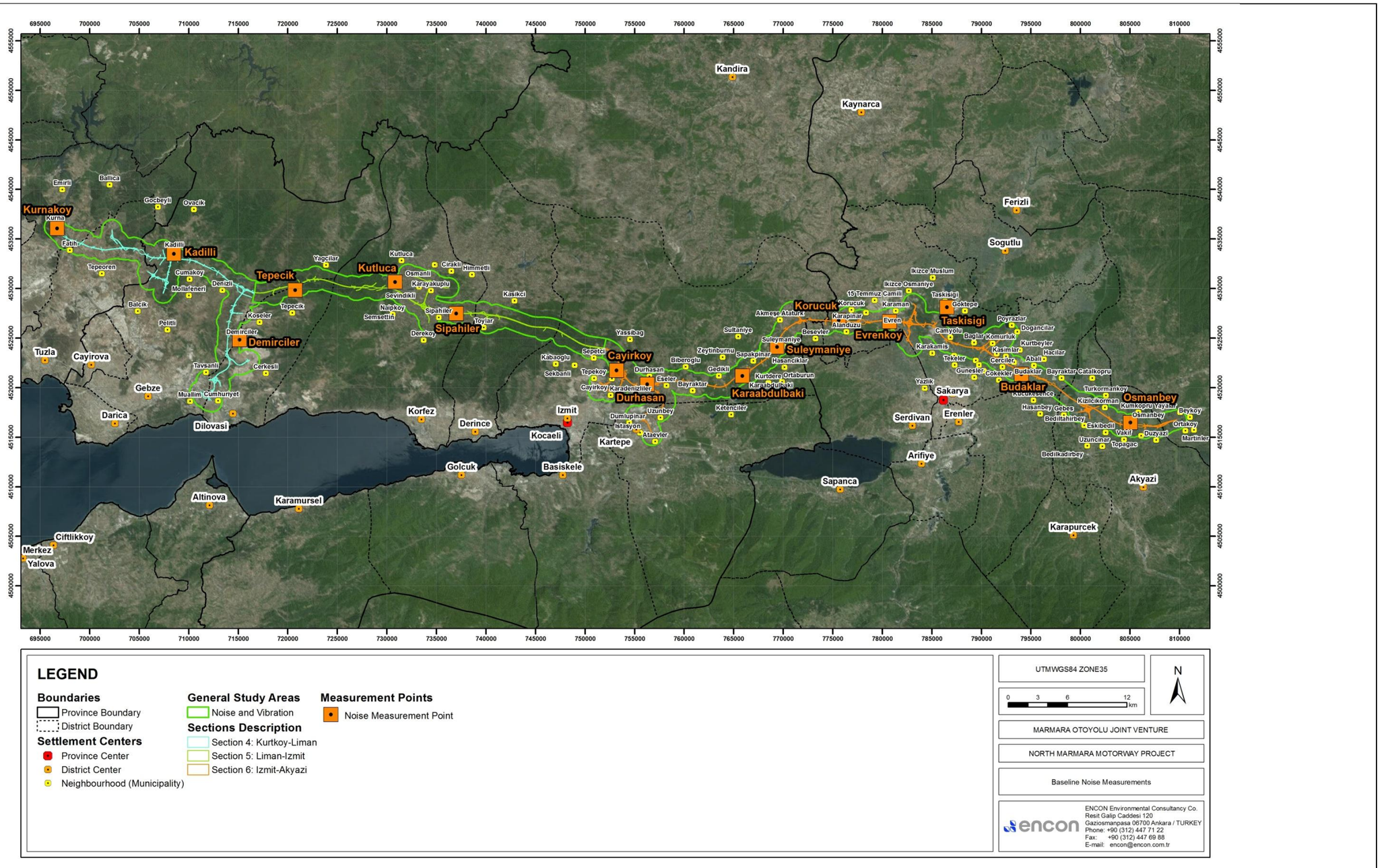
In order to assess baseline noise levels along the planned motorway route, baseline noise measurements were conducted. Within this scope, 24 hour noise measurements were conducted at 24 measurement points as can be seen in Figure 11.2. During noise measurements attention was paid to conduct measurements when wind speed is below 5 m/sec. Noise measurement device was installed at a height of 1.5 m at locations away from reflecting surfaces like nearby buildings.

Results of noise measurements are summarized in Table 11.7 according to time intervals defined in the Regulation on Assessment and Management of Environmental Noise (RAMEN) published on 04.06.2010 in Official Gazette No 27601.

Table 11.7. Noise Measurement Results

Districts	Neighborhoods	Coordinates	Date of Measurement	Measurement Results (dBA)		
				L_{eq} Day (7:00 – 19:00)	L_{eq} Evening (19:00-23:00)	L_{eq} Night (23:00-07:00)
Section 4						
Pendik	Kurnakoy	696759-4536269	31-01.02.2017	64,0	64,5	58,1
Gebze	Kadilli	708555-4533696	30-31.01.2017	62,5	55,3	50,0
Dilovası	Demirciler	715178-4525026	30-31.01.2017	58,9	56,2	51,8
Section 5						
Izmit	Tepecik	720798-4530037	31-01.02.2017	52,6	51,1	49,3
Korfez	Kutluca	730867-4530849	31-01.02.2017	58,6	57,5	45,6
Korfez	Sipahiler	737056-4527669	14-15.02.2017	53,9	48,9	46,5
Section 6						
Izmit	Cayirkoy	247102-4521917	14-15.02.2017	59,0	55,0	52,7
Izmit	Durhasan	250110-4520309	03-04.02.2017	74,8	57,2	54,7
Izmit	Karaabdulbaki	259732-4520490	13-14.02.2017	50,6	50,7	45,4
Izmit	Suleymaniye	263438-4523179	13-14.02.2017	53,4	51,6	49,9
Adapazari	Korucuk	269824-4525426	12-13.01.2017	49,9	49,1	48,8
Adapazari	Evrenkoy	247920-4524949	12-13.01.2017	57,2	58,2	54,4
Adapazari	Taskisigi	280806-4525988	12-13.01.2017	64,9	61,3	51,8
Adapazari	Budaklar	287838-4518759	11-12.01.2017	54,1	49,7	47,7
Akyazi	Osmanbey	298475-4513142	11-12.02.2017	55,6	50,3	50,1

When measurement results provided above are evaluated with limit values for planned/renovated/repaired roads (for areas densely populated with residences among the areas containing commercial structures and noise sensitive structures all together) it can be seen that measurement results exceed the limit values at some locations. Measurement results in Kurnakoy and Evrenkoy can be attributed to be close to urban areas and nearby roads. Measurement results in Durhasan can be related with industrial plants in the vicinity while, Taskisigi noise levels can be associated with operations in quarries in the vicinity of the settlement. In addition, it should be noted that measurement results also reflect temporary noise generation activities such as construction or daily weather conditions such as wind etc.



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

General Study Areas
- Noise and Vibration

Sections Description
- Section 4: Kurtkoy-Liman
- Section 5: Liman-Izmit
- Section 6: Izmit-Akyazi

Measurement Points
- Noise Measurement Point

UTMWGS84 ZONE35

N

0 3 6 12 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Baseline Noise Measurements

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Figure 11.2. Baseline Noise Measurements

11.1.3. Potential Impacts

Project land preparation and construction activities followed by the operation of the motorway are expected to result in increases in noise levels in the vicinity of the motorway route.

In order to predict the increase in noise levels in neighborhoods along the motorway route noise modeling was performed. For this purpose SoundPLAN V 7.4 (64 Bit) software was used. Modeling study aims the following:

- To predict noise levels due to construction activities of the project and preparation of noise maps.
- To predict noise levels during operation of the motorway and preparation of noise maps.
- To determine whether noise levels at a specified location exceed limit values defined in regulation and guidelines.
- Define mitigation measures to be used to decrease noise levels under acceptable values at specified locations.

Noise emissions for motorway, viaducts and tunnels were calculated with data provided in “Guide du bruit des transports terrestres, fascicule prevision des niveaux sonores CETUR 1980” which is a guidance suggested in RAMEN and EU Environmental Noise Directive and French standard -NMPB Road 96 - XPS31-133-.

Noise mapping and calculations were carried out in accordance with Guideline for Preparation of Noise Maps (prepared by the Ministry of Environment and Urbanization). According to NMPB Road 96 method and ISO ISO 9613-2 standard, noise modeling was performed at 4 meters height with 10*10 meter grids. Modeling results were evaluated according to noise limit values for mixed commercial and residential areas as defined in RAMEN (see Table 11.8)

Table 11.8. Noise Standards for Modeling

Areas	Planned/Renovated/Repaired Roads			Existing Roads		
	L_{day} (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)	L_{day} (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)
Areas densely populated with residences among the areas containing commercial structures and noise sensitive structures all together (mixed commercial/residential area)*	65	60	55	70	65	60

**Amendment in Environmental Noise Regulation (dated 18.11.2015, Official Gazette No: 29536) accepts residential areas as sensitive areas and noise limits are defined as 65, 60, 55 for day, evening and night, respectively.*

11.1.3.1. Land Preparation and Construction Phase

Noise modeling for construction phase was carried out by modeling noise levels of construction machinery and equipments used during construction of the motorway. To be on the safe side and represent the worst case scenario, maximum number of construction machinery and equipments were taken into account. List of maximum number machinery and equipments to be used in different sections of motorway are presented in Table 11.9. Noise intensity levels for the equipments are obtained from the database of SoundPLAN software. In scope of the worst case scenario, it is assumed that all equipments operate simultaneously with 50% efficiency.

Table 11.9. Maximum Number of Construction Machinery and Equipment

Type of Machinery	Asian Side		
	Section 4	Section 5	Section 6
Crawler excavator	35	16	30
Wheeled excavator	3	1	5
Grader	10	2	3
Dozer	12	3	6
Wheeled loader	10	5	8
Backhoe loader	3	2	2
Crawler loader		5	1
Roller	20	7	3
Truck	130	65	200
Rock Driller	8		4
Water Truck	4	5	6
Light tower	15		4
Trailer		1	4
Crane		2	3
Fueloil Tanker		2	4
Maintenance Vehicle		1	3
Concrete Pump		2	6
Others (ROC)		4	-
Total	**250**	**123**	**292**

Noise modeling for construction phase was performed with SoundPLAN software at 4 meters height with 10*10 meter grids. Equipments are assumed to be operating at different locations along the motorway route. In order to represent the worst case scenario, construction machinery and equipments are distributed to quarries, concrete and asphalt plants material storage areas and construction camp sites. Noise levels observed in nearest receptors which are all classified with high sensitivities are presented in Table 11.10.

Table 11.10. Noise Level Intervals Reaching Receptors for Construction

Receptor / Location	Noise Level (dBA)		Receptor / Location	Noise Level (dBA)	
	L_{den}	L_n		L_{den}	L_n
Cumakoy	45-50	40-45	Hasanciklar	50-55	45-50
Denizli	45-50	40-45	Ortaburun	45-50	35-40
Koseler	45-50	35-40	Suleymaniye	55-60	50-55
Demirciler	55-60	50-55	Taskisigi	60-65	55-60
Tavsanli	45-50	40-45	Goktepe	50-55	45-50
Kutluca	45-50	40-45	Ikizce Muslum	50-55	40-45
Sevindikli	40-45	35-40	Ikızce Osmaniye	45-50	40-45
Semsettin	40-45	<35	Camyolu	45-50	40-45
Yassibag	40-45	35-40	Karaman	40-45	35-40
Sepetci	50-55	45-50	Bayraktar	55-60	55-60
Cayirkoy	45-50	40-45	Hacilar	55-60	50-55
Tepekoy	40-45	35-40	Abali	55-60	50-55
Durhasan	35-40	<35	Kurtbeyler	55-60	50-55
Sultaniye	40-45	35-40	Haciramazanlar	65-70	60-65
Gedikli	55-60	50-55	Budaklar	55-60	50-55
Bayraktar	35-40	35-40	Cokekler	50-55	45-50
Zeytinburnu	45-50	45-50	Dogancilar	40-45	35-40
Sapakpinar	55-60	50-55	Kasimlar	55-60	45-50
Karaabdulbaki	60-65	55-60	Cerciler	55-60	45-50
Ketenciler	40-45	35-40	Celebiler	45-50	40-45
Kurtdere	50-55	45-50	Kucukesence	35-40	35-40

As can be observed from Table 11.10 and noise maps presented in Annex-8, day, evening and night time noise levels reaching the settlements close to the construction sites are below limit values defined in RAMEN. Therefore, noise impacts as a result of construction activities are evaluated as low. Noise assessment is carried out according to the worst case scenario where construction equipment and machinery are assumed to be working simultaneously with 50% efficiency at construction sites.

Furthermore, the case in which all construction equipment are working simultaneously at the same locations with maximum noise intensity levels is not likely to occur in reality. In addition to this, atmospheric absorption will result in a decrease in noise levels with distance as construction activities will be conducted outdoors. Similarly, topographic conditions and vegetation are other factors that decrease noise. Still, under the worst case conditions, noise levels in the settlements caused by the construction phase of the project is below regulatory limit values. It can be foreseen that, when these factors are considered, the effect caused by construction activities of the project on nearby settlements will be lower.

11.1.3.2. Operation Phase

Noise modeling for operation phase of the motorway project was performed for the worst case scenario and traffic projections for 2027 were considered which represents the highest traffic flow data in traffic forecast study (provided in the Feasibility Report prepared for the North Marmara Motorway Project) (see Table 11.11).

Table 11.11. Traffic Flow Data for 2027

Motorway Section	Description	Number of Vehicles					Heavy Vehicle Percentage (%)
		Passenger Car	Bus	Truck	Truck+Trailer, Tow Truck+Semi-Trailer	Total	
Section 4	Kurtkoy-Liman	69.852	1.688	11.589	4.132	87.261	25
Section 5	Liman-Izmit	51.163	1.178	8.430	2.884	63.655	24
Section 6	Izmit-Akyazi	16.006	383	1.933	937	19.259	20

Traffic flow data was distributed to day, evening and night according to percentages presented in Table 11.12.

Table 11.12 Distribution of Traffic Flow Data

Vehicle Type	Day (%)	Evening (%)	Night (%)
Light Vehicles	70	15	15
Heavy Vehicles	50	25	25

Assessment of noise impacts was performed by taking into account building use types along the motorway route and day, evening, night noise levels were compared with limit values defined in RAMEN. Residential areas and sensitive use areas were especially taken into account during the assessment. Results of modeling study and baseline noise measurements were evaluated and compared with limit values defined in RAMEN and mitigation measures were determined. Noise modeling was carried out within a 2 km study corridor (1 km at each side of the motorway centerline) and the study area was split into sections for noise mapping.

According to noise model results action plans and mitigation measures for areas where noise levels are above L_{den} 65 dBA and L_{night} 55 dBA. Noise levels reaching receptors are presented in Table 11.13. Magnitude of impacts are evaluated according to sensitivities of receptors and presented in Table 11.14.

Table 11.13. Noise Levels at Receptors for Operation – Results of Noise Modeling

Receptor / Location	Coordinates		Noise Level (dBA)			
	X (m)	Y (m)	L_{den}	L_d	L_e	L_n
Cayirkoy	247074.54	4521732.06	58,60	51,70	54,00	52,00
Evrenkoy	247892.53	4524764.04	42,30	35,10	37,60	35,70
Durhasan	250082.5	4520124.07	65,20	58,60	60,70	58,50
Karaabdulbaki	259704.48	4520305.08	62,50	57,20	58,20	55,40
Suleymaniye	263410.40	4522994.07	55,60	48,60	50,90	49,00
Korucuk	269796.42	4525241.07	65,80	59,80	61,30	58,90
Taskisigi	280778.36	4525803.08	33,80	26,60	29,00	27,20
Budaklar	287810.34	4518574.13	59,30	52,50	54,70	52,60
Osmanbey	298447.29	4512957.17	59,80	53,10	55,20	53,10
Kurnakoy	696716.23	4536081.56	71,80	67,10	67,50	64,60
Kadilli	708512.16	4533508.57	64,60	58,60	59,90	57,80
Demirciler	715135.13	4524838.62	60,00	54,10	55,30	53,10
Tepecik	720755.10	4529849.59	60,80	53,80	56,10	54,10
Kutluca	730824.04	4530661.59	52,80	46,20	48,20	46,10
Sipahiler	737013.01	4527481.61	75,70	70,10	71,30	68,70
Akfirat - 1	699419.00	4534658.00	72,80	67,30	68,20	65,80
Akfirat - 2	703566.00	4533409.00	64,90	58,50	60,10	58,20
Eseler	251938.00	4519957.00	64,90	58,50	60,10	58,20
Karaman	275662.00	4525395.00	54,90	49,30	50,60	47,90
Camyolu	280791.00	4522599.00	61,10	55,30	56,70	54,10

Table 11.14. Assessment of Impact Magnitude

Receptor / Location	Sensitivity of Receptor	Noise Level (dBA)				
		Noise Level (L_{den})	Noise Measurement Result	Cumulative Noise Level	Increase in Noise Level	Impact Magnitude
Cayirkoy	High	58,60	59,0	61,8	<3	Negligible
Evrenkoy	High	42,30	57,2	57,3	<3	Negligible
Durhasan*	High	65,20	74,8	75,3	<3	High
Karaabdulbaki*	High	62,50	50,6	62,8	>9	High
Suleymaniye	High	55,60	53,4	57,6	3-6	Low
Korucuk*	High	65,80	49,9	65,9	>9	High
Taskisigi	Medium	33,80	64,9	64,9	<3	Negligible
Budaklar	High	59,30	54,1	60,4	6-9	Medium
Osmanbey	High	59,80	55,6	61,2	3-6	Low
Kurnakoy*	High	71,80	64,0	72,5	6-9	High
Kadilli	High	64,60	62,5	66,7	3-6	Low
Demirciler	Medium	60,00	58,9	62,5	3-6	Medium
Tepekoy	High	60,80	52,6	61,4	6-9	Medium
Kutluca	Medium	52,80	58,6	59,6	<3	Negligible
Sipahiler*	High	75,70	53,9	75,7	>9	High
Akfirat – 1*	Medium	72,80	-	-	-	High
Akfirat – 2*	Medium	64,90	-	-	-	High
Eseler*	High	64,90	-	-	-	High

**Results of noise modeling study indicate exceedance of limit values.*

As a result of noise modeling, it was observed that noise levels in Durhasan, Karaabdulbaki, Korucuk, Kurnakoy, Sipahiler, Akfirat – 1, Akfirat – 2, Eseler exceed noise limit values. In order to mitigate impacts arising from noise during operation of motorway, proper action plans are planned to be applied at these sections. For this purpose, the measurements will be carried out at subject locations at the operation stage and in case the results are exceeding the limits and thresholds, the construction of the noise barriers will be done after the common decision is taken with the lenders/lenders advisors.

11.1.4. Mitigation Measures

11.1.4.1. Land Preparation and Construction Phase

In order to keep noise levels below acceptable national standards at the closest sensitive receptors to the source of noise, the following mitigation measures will be applied:

- Equipments and machinery with lower sound power levels and sound reduced models will be preferred.
- New vehicles, machinery and equipments will be used.
- Maintenance of construction machinery and equipments will be carried out regularly.
- Silencers will be installed on exhausts of vehicles and other equipment such as mechanical plants
- Portable barriers and acoustic enclosures will be used where appropriate (such as around equipments like generators)

- Speed limitations will be defined and obeyed for construction vehicles, particularly near sensitive use areas
- Traffic through residential areas will be avoided wherever possible and dedicated site access roads will be used to approach camp sites, quarries and storage areas. Construction of new access roads will be evaluated where required to avoid disturbance in residential areas.
- According to the environmental monitoring plan (see Chapter 20 “Environmental and Social Management System”), noise monitoring will be conducted during the construction phase and the effect of noise in near neighborhoods will be controlled regularly. In case of any inconsistencies with regulation limits, measures will be immediately taken to diminish the noise levels and to satisfy the standards.
- Potentially affected buildings such as hospitals, which are sensitive to night time disturbance, will be identified prior to construction works in the vicinity and night construction works will be limited accordingly.
- Construction vehicles will not be permitted to keep engines running while waiting to enter the site or waiting on-site.
- Ancillary components in camp sites such as generators will be established by taking into account potential noise disturbances
- Motorway alignment will be used for transportation whenever possible
- Roads used during construction of the motorway will be well maintained.
- Site personnel will be trained to undertake construction activities using methods to reduce noise.

11.1.4.2. Operation Phase

- At the service areas, a green buffer strip will be formed between the outer lane of the Motorway and the facilities. This strip will be properly planted (e.g. with shrubs that start growing from the base and are resistant to dust and gaseous emissions as well as noise) to form a barrier against noise to be sourced from the Motorway traffic.
- During design phase of the project advantage will be taken from natural topography as a noise buffer
- Route of motorway through residential areas will be prevented as much as possible
- Application of action plans near suggested locations as a result of noise modeling study will be evaluated during further stages of project development. In addition, noise barrier establishment will be considered according to results of noise monitoring at specified locations as detailed in Environmental and Social Monitoring Plan (see Chapter 20).
- Action plans in accordance with Technical Specifications of KGM will be applied where applicable.
- If any complaint related with noise is received through Project’s Grievance and Comment Mechanism, the complaint will be evaluated and where necessary, corrective actions will be planned and implemented.
- Annual noise measurements will be done at critical receptors determined by noise modeling during the whole operation phase and the noise barriers would be provided in case the measurements would approach (2Dba) to the

thresholds specified at IFC guidelines. If noise barriers are insufficient for reducing the noise level at those areas additional measures such as landscaping will be implemented. Therefore, noise modeling and critical receptors will be revised based on design changes or other mitigation measures applicable at critical locations.

11.1.5. Summary of Assessment and Residual Impacts

Although land preparation and construction phase have the potential to result in noise impacts, it is considered that implementation of above mitigation measures would ensure that noise limits defined in RAMEN would not be exceeded at noise sensitive receptors.

Regarding the operation of the motorway, after determination of receptors where noise levels exceed regulatory limits, further arrangements will be carried out for the application of action plans near suggested locations. For this purpose, the measurements will be carried out at subject locations at the operation stage and in case the results are exceeding the limits and thresholds, the construction of the noise barriers will be done after the common decision is taken with the lenders/lenders advisors.

Summary of noise assessments are presented in Table 11.21. Significance of residual impacts are evaluated as medium to low for construction and medium for operation phases.

11.2. Vibration

Vibration is a low frequency disturbance producing physical movement in buildings and residents. Vibration can be measured in terms of Peak Particle Velocity, or PPV (i.e. the maximum speed of movement of a point in the ground during the passage of a source of vibration).

Construction activities can result in varying degrees of vibration depending on the equipment and methods used. Vibration from construction spreads through the ground and diminishes in strength with distance. Vibration can result in disturbance in settlements close to the point of operation and may result in risk of damage to structures in close vicinity. However, ground vibrations from construction activities rarely reach the levels that can damage structures but can achieve audible ranges in buildings close to site. Construction activities which typically generate the most severe vibrations are blasting and piling operations.

Construction of the motorway has the potential to cause vibration impacts as a result of activities such as piling, operation of vibratory equipment, blasting and tunnel boring.

Operation of the motorway has the potential to cause nuisance through vibration. Vibration arising from motorway operation can be transmitted through air or through ground. Air vibration is generated by engines or exhaust of vehicles with frequencies of 50-100 Hz, while ground vibration is produced by interaction between vehicle wheels and road surface, observed in 8-20 Hz frequency range. *(UK Highways Agency, 2011).*

11.2.1. Assessment Methodology and Data Sources

11.2.1.1. Legal Framework

Turkish Legal Requirements

Regulation on the Assessment and Management of Environmental Noise

According to Article 25 of RAMEN vibrations standards defined in Annex VII Table 6 and Table 7 respectively for sensitive and very sensitive areas for blasting operations in mines and quarries and construction activities cannot be exceeded. Maximum allowed vibration for sensitive and very sensitive areas as a result of blasting in mines, quarries etc. are presented in Table 11.15. Maximum allowed vibration for sensitive and very sensitive areas generated from piling and other vibration causing activities during construction and heavy construction vehicles are presented in Table 11.16.

Table 11.15. Vibration Limits for Quarries

Frequency of Vibration (Hz)	Maximum Allowed Vibration (Peak Particle Velocity in-mm/s)
1	5
4-10	19
30-100	50

Table 11.16. Vibration Limits for Construction

Area/Receptor	Maximum Allowed Vibration (Peak Particle Velocity in-mm/s)*	
	Continuous Vibration	Discontinuous Vibration
Residential Areas	5	10
Industrial and Commercial Areas	15	30

**Frequency: 1-80 Hz*

IFC Standards

IFC Environmental, Health and Safety Guideline for Construction Materials Extraction states that the most significant vibration emissions are usually associated with blasting during material extraction and suggests techniques to minimize and control vibration impacts. IFC guidelines do not define any standards for vibration.

Significance Criteria

The significance criteria for the impacts regarding vibration will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impacts, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 11.17.

Table 11.17. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	Medium (2)	Low (1)
Residential Areas	Neighborhood/village part of it (>20)	More than few number (10-20) of residential buildings	Few (1-10) residential buildings

11.2.2. Baseline Conditions

Baseline conditions regarding vibration indicate that, currently, for 6, vibration can be observed as a problem due to the operation of quarries in Taskisigi area. In Section 4 and Section 5 no significant source was identified to cause vibration.

11.2.3. Potential Impacts

11.2.3.1. Land Preparation and Construction Phase

Land preparation and construction of the motorway has the potential to cause vibration impacts as a result of activities such as piling, operation of vibratory equipment, blasting and tunnel boring.

Construction of the motorway with operation of heavy vehicles is likely to affect a particular location for a relatively short term. Primary concern with regard to construction

vibration is building damage. In addition to building damage, nuisance to residents in close vicinity is also a concern.

Tunnel boring is another source of vibration. Construction of tunnels planned to be established in Section 5 and Section 6 will include boring and blasting which will cause vibration, however, no significant impacts are anticipated by Project Sponsors.

Blasting will be performed both during construction tunnel structures and in quarries. Material requirement for construction will be obtained from Kutluca Limestone Quarry, Taskisigi 1, 2 and 4 Quarries. Taskisigi neighborhood is located close to the quarries and vibration is likely to be anticipated by neighborhood residents.

The Construction Noise and Vibration *Guideline (NSW Government, Transport, Roads and Maritime Services, 2016)* recommends minimum working distances for vibratory construction equipments from sensitive receptors (see Table 11.18.). The minimum working distances vary according to particular equipment types and also local geotechnical conditions. It is observed that maximum 100 meter distance should be left to prevent human nuisance while building damages are generally likely to be observed in smaller distances.

Table 11.18. Recommended Minimum Working Distances for Vibratory Equipment from Sensitive Receptor

Equipment	Description	Minimum Working Distance	
		Cosmetic Damage	Human Response
Vibratory Roller	<50 kN (typically 1-2 tons)	5 m	15 m to 20 m
	<100 kN (typically 2-4 tons)	6 m	20 m
	<200 kN (typically 4-6 tons)	12 m	40 m
	<300 kN (typically 7-13 tons)	15 m	100 m
	<300 kN (typically 13-18 tons)	20 m	100 m
	<300 kN (>18 tons)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m	4 m
Jackhammer	Hand held	1	2 m

In order to evaluate the potential impacts with respect to vibration, buildings within 400 meter buffer (200 m from each side of motorway centerline to be on the safe side for assessment) are determined with Google Earth analysis. Sensitivity levels for each settlement are determined and presented in Table 11.19. Sensitivities of the receptors are classified according to the density of buildings located within 400 meter buffer.

Table 11.19. Sensitivity of Settlements to Vibration along the Motorway Route

Receptor / Location	Sensitivity of the Receptor
Section 4	
Kurnakoy	Medium (2)
Fatih	High (3)
Cumakoy	Medium (2)
Mollafeneri	Low (1)
Tavsanli	High (3)
Cumhuriyet	High (3)

Receptor / Location	Sensitivity of the Receptor
Muallim	Low (1)
Section 5	
Sevindikli	Low (1)
Karayakuplu	Low (1)
Tepecik	Low (1)
Sipahiler	Medium (2)
Section 6	
Çayırköy	Medium (2)
Karadenizliler	Medium (2)
Tepekoy	Low (1)
Durhasan	Medium (2)
Istasyon	High (2)
Ataevler	High (2)
Sepetci	Low (1)
Eseler	Medium (2)
Bayraktar	Low (1)
Gedikli	Low (1)
Karaabdülbaki	Low (1)
Süleymaniye	Medium (2)
Korucuk	Medium (2)
Karaman	Medium (2)
Evrenköy	Low (1)
Karakamis	Low (1)
Camyolu	High (3)
Komurluk	High (3)
Celebiler	Low (1)
Haciramazanlar	Low (1)
Kizilcikorman	Low (1)
Osmanbey	Low (1)
Vakif	Medium (2)
Topagaç	Low (1)
Budaklar	Low (1)

In the absence of mitigation measures, vibration damage and nuisance is possible, based on the worst case estimation of vibration at the building located very close to motorway construction areas. However, it should be noted that all impacts related with land preparation and construction phase will be intermittent and temporary (short-term reversible) impacts for at most 3 years.

11.2.3.2. Operation Phase

Vibration perceived in a building structure close to a road with heavy traffic load is generally below 1 mm/s and found to rarely exceed 2 mm/s. This corresponds to normal levels of vibration generated during normal use of a building (example, walking and closing doors). It is known that, structural damage caused by vibration to buildings can occur above 10 mm/s levels which correspond to 10 times higher vibration levels expected from roads. (*UK Highways Agency, 2011).* So, operation of a motorway is unlikely to cause significant vibration impacts on properties located in the vicinity.

Table 11.20 shows human response levels to continuous vibration from traffic. With vibration levels of 1-2 mm/s observed in heavy traffic roads, human response to vibration will be kept at perceptible levels and not reach annoying levels.

Table 11.20. Human Response to Continuous Vibration from Traffic *(Jones & Stokes, 2004)*

Vibration (PPV – mm/sec)	Human Response
10,16-15,24	Unpleasant
5,08	Annoying
2,54	Begins to annoy
2,03	Readily perceptible
0,15-0,48	Threshold of perception

11.2.4. Mitigation Measures

11.2.4.1. Land Preparation and Construction Phase

Blasting operations to be conducted at the quarries will result in intermittent vibration impact. Following measures will be taken to avoid and/or minimize relevant impacts on the local people:

- Prior to the blasting operations, sensitivity of nearby settlements/buildings against noise and vibration will be assessed. Aboveground blasting operations will not be conducted in close vicinity (within a 100 meter radius area) of the residential areas/neighborhoods if construction with other methods is feasible at that location.
- Accordingly, explosive charges will be optimized. Relevant records will be kept during the blasting operations and blasting related impacts will be monitored.
- Vibration due to blasting will be minimized by applying modern blasting techniques. Blasting operations will be conducted using millisecond delays with low charge weight to be determined based on the geological formation and rock density.
- Number of holes to be blasted at one shot and total charge amounts per shot will be optimized to ensure compliance with the regulatory limit values and minimize flyrock incidents. All blast vibrations will be monitored by using vibrometers to be placed at suitable locations and records on charge amounts, delays provided, distance to blasting locations and relevant vibration levels will be kept.
- During the blasting activities, limit values described in the Regulation for the Assessment and Management of Environmental Noise for ground vibrations will be complied with. Records on air shock and vibration measurements will be kept and compliance with regulatory limit values will be checked to minimize impacts on local people.
- Vibration due to blasting operations will be monitored and grievance mechanism will be active for any complaints related to vibration impacts. If any complaints related with vibration are received through Project's Grievance and Comment Mechanism, the complaint will be evaluated and where necessary, corrective actions will be planned and implemented.
- Construction works will be designed and scheduled to reduce vibration and adverse effects.
- Blasting will be carried out at dedicated times in order to prevent nuisance.
- Construction machinery and equipment will be operated by taking into account the recommended minimum working distances presented in Table 11.18.

11.2.4.2. Operation Phase

If any complaint related with vibration are received through Project's Grievance and Comment Mechanism, the complaint will be evaluated and where necessary, corrective actions will be planned and implemented.

11.2.5. Summary of Assessment and Residual Impacts

Main sources of vibration during construction can be listed as piling, operation of vibratory equipment, blasting and tunnel boring. As a result of the assessment, vibration arising from project construction activities is likely to result in short term disturbance at close settlements with different sensitivities which can be avoided by mitigation measures suggested above. Table 11.21 provides a summary on the vibration assessments. Residual impacts regarding vibration vary from medium to low for construction depending on the sensitivity of the receptor and type of activity.

Table 11.21. Summary of Noise and Vibration Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Local Communities	Land preparation and construction	Increase in noise levels	Adverse	Local	Medium	Low	Short term reversible	Intermittent	Moderate (B)	High (3) Tavsanli, Sevindikli, Sepetci, Cayirkoy, Tepekoy, Durhasan, Gedikli, Bayraktar, Sapakpinar, Karaabdulbaki, Suleymaniye, Camyolu, Karaman, Abali, Haciramazanlar, Budaklar, Kasimlar, Cerciler, Celebiler,	High (B3)	• Equipments and machinery with lower sound power levels and sound reduced models will be preferred. • New vehicles, machinery and equipments will be used. • Maintenance of construction machinery and equipments will be carried out regularly. • Silencers will be installed on exhausts of vehicles and other equipment such as mechanical plants • Portable barriers and acoustic enclosures will be used where appropriate (such as around equipments like generators) • Speed limitations will be defined and obeyed for construction vehicles, particularly near sensitive use areas • Traffic through residential areas will be avoided wherever possible and dedicated site access roads will be used to approach camp sites, quarries and storage areas. Construction of new access roads will be evaluated where required to avoid disturbance in residential areas. • According to the environmental monitoring plan under Project ESMS, noise monitoring will be conducted during the construction phase and the effect of noise in near neighborhoods will be controlled regularly. In case of any inconsistencies with regulation limits, measures will be immediately taken to diminish the noise levels and to satisfy the standards. • Potentially affected buildings such as hospitals, which are sensitive to night time disturbance, will be identified prior to construction works in the vicinity and night construction works will be limited accordingly. • Construction vehicles will not be permitted to keep engines running while waiting to enter the site or waiting on-site. • Ancillary components in camp sites such as generators will be established by taking into account potential noise disturbances • Motorway alignment will be used for transportation whenever possible • Roads used during construction of the motorway will be well maintained. • Site personnel will be trained to undertake construction activities using methods to reduce noise.	Medium
										Medium (2) Cumakoy, Denizli, Koseler, Demirciler, Kutluca, Semsettin, Yassibag, Sultaniye, Zeytinburnu, Ketenciler, Kurtdere, Hasanciklar, Ortaburun, Taskisigi, Goktepe, Ikizce Muslum, Ikizce Osmaniye, Hacilar, Kurtbeyler, Cokekler, Kucukesence	Medium (B2)		Low
		Vibration	Adverse	Restricted	Medium	High (3) Vibration due to blasting to be conducted in quarries	Short term reversible	Intermittent	Major (A)	Low (1) Taskisigi, Kutluca	Medium (A1)		Low
						Medium (2) Vibration due to blasting to be conducted for motorway excavation, tunnel constrcution		One off	Moderate (B)	High (3)	High (B3)		Medium
										Medium (2)	Medium (B2)		Low
										Low (1)	Low (B1)		Low
						Low (1) Vibration due to operation of heavy construction vehicles		One off	Minor (C)	High (3)	Medium (C3)		Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
										Medium (2)	Low (C2)	with regulatory limit values will be checked to minimize impacts on local people. • Vibration due to blasting operations will be monitored and grievance mechanism will be active for any complaints related to vibration impacts. If any complaints related with vibration are received through Project's Grievance and Comment Mechanism, the complaint will be evaluated and where necessary, corrective actions will be planned and implemented. • Construction works will be designed and scheduled to reduce vibration and adverse effects. • Blasting will be carried out at dedicated times in order to prevent nuisance. • Construction machinery and equipment will be operated by taking into account the recommended minimum working distances presented in Table 11.18.	Low
										Low (1)	Low (C1)		Low
	Operation	Increase in noise levels	Adverse	Local	Long	High	Irreversible	Continuous	Major (A)	High (3) Durhasan, Karaabdulbaki, Korucuk, Kurnakoy, Kadilli, Tepekoy, Sipahiler, Eseler	High (A3)	• At the service areas, a green buffer strip will be formed between the outer lane of the Motorway and the facilities. This strip will be properly planted (e.g. with shrubs that start growing from the base and are resistant to dust and gaseous emissions as well as noise) to form a barrier against noise to be sourced from the Motorway traffic. • During design phase of the project advantage will be taken from natural topography as a noise buffer • Route of motorway through residential areas will be prevented as much as possible • Usage of road surface material generating less noise will be used as appropriate. • Application of action plans near suggested locations as a result of noise modeling study will be evaluated during further stages of project development. In addition, noise barrier establishment will be considered according to results of noise monitoring at specified locations as detailed in Environmental and Social Monitoring Plan (see Chapter 20). For this purpose, the measurements will be carried out at subject locations at the operation stage and in case the results are exceeding the limits and thresholds, the construction of the noise barriers will be done after the common decision is taken with the lenders/lenders advisors. • Action plans in accordance with Technical Specifications of KGM will be applied where applicable. • If any complaint related with noise is received through Project's Grievance and Comment Mechanism, the complaint will be evaluated and where necessary, corrective actions will be planned and implemented.	Medium
						High			Major (A)	Medium (2) Akfirat-1, Akfirat 2	High (A2)		Medium
						Low			Minor (C)	High (3) Süleymaniye, Osmanbey, Kadili	High (C3)		Medium
						Medium			Moderate (B)	High (3) Budaklar, Tepekoy	High (B3)		Medium
						Medium			Moderate (B)	Medium (2) Demirciler	Medium (B2)		Low
		Vibration	Adverse	Restricted	Long	Low (1) Percentage of heavy vehicles in total traffic load <25%	Irreversible	Intermittent	Moderate (B)	High (3)	High (B3)	If any complaint related with vibration are received through Project's Grievance and Comment Mechanism, the complaint will be evaluated and where necessary, corrective actions will be planned and implemented.	Medium
										Medium (2)	Medium (B2)		Low
										Low (1)	Low (B1)		Low

CHAPTER 12

PROTECTED AREAS, LANDSCAPE AND VISUAL ENVIRONMENT

12. PROTECTED AREAS, LANDSCAPE AND VISUAL ENVIRONMENT

12.1. Protected Areas

In order to identify and evaluate the protected areas within the Project Area and its immediate vicinity, desktop studies and literature research are carried out within the scope of the Project. For this purpose, sensitive area list available in Appendix V of EIA Regulation (issued in Official Gazette No: 29186 dated November 25, 2014) is used as reference. This list covers areas that need to be protected in accordance with international conventions that Turkey is contracting party and nationally declared protected areas.

Utilized data sources within the scope of the desktop studies are listed below:

- Database of General Ministry of Forestry and Water Affairs, Directorate of Nature Conservation and National Parks (*http://www.milliparklar.gov.tr*)
- Database of Ministry of Forestry and Water Affairs (*geodata.ormansu.gov.tr*)
- Map of Prohibited and Open Hunting Areas for years 2016-2017
- Database of Ministry of Culture and Tourism
- Database of General Directorate of Cultural Heritage and Museums (*http://www.kulturvarliklari.org/kve*)
- Official letters and files that were obtained from relevant authorities
- Kml files of the Motorway Route and Google Earth Software

Protected Areas around the Project Area are determined from above mentioned sources. The land use characteristics for each section of the Motorway were identified in the study area/corridor (having a total width of 400 meters being 200 meters on each side of the motorway axis) and protected areas in this corridor are presented with detailed information. Other protected areas in Istanbul Province (Asian part) are presented with their location and distance to the project corridor.

12.1.1. Baseline Conditions

As mentioned above, sensitive area list available in Appendix V of the EIA Regulation was used as reference to identify the Protected Areas around the Project Area. Identified Protected Areas in accordance with this sensitive area list are described below.

Areas under protection in accordance with International Conventions that Turkey is a Contracting Party

Some relevant conventions in this context can be listed as follows:

- Convention on the Conservation of European Wildlife and Natural Habitats" (Bern Convention)
- Convention for the Protection of the Mediterranean Sea against Pollution" (Barcelona Convention)
- Protocol concerning Specially Protected Areas in the Mediterranean

- 100 Historic Sites of Common Mediterranean Interest announced by United Nation Environment Programme and selected in accordance with the Geneva Declaration
- World Cultural and Natural Heritage Convention
- The Convention on Wetlands of International Importance (RAMSAR Convention)
- European Landscape Convention

There are no protection areas in the project area/route identified by any international convention/agreement, including the ones listed above, that Turkey is signatory.

Protected Areas in accordance with National Legislation

a) "National Parks", "Nature Parks", "Nature Monuments" and "Nature Conservation Areas" identified in accordance with the second and third articles of National Parks Law

There is no national park in Asian part of the Project Area. There are many nature parks in the three cities the motorway is passing through. The list of the nature parks in Asian part of the Project Area is given in Table 12.1 below. Ballikayalar Nature Park (Kocaeli Province) and Poyrazlar Lake Nature Park (Sakarya Province) are the closest nature parks to the Project route.

Table 12.1. List of the Nature Parks in Asian Part of the Project Area

Istanbul Province		
Name of Nature Park	**Approximate Distance to the closest Project Unit**	**Direction with respect to the closest Project Unit**
Elmasburnu Nature Park	32 km to Section 4 (129+650)	Northwest
Polonezkoy Nature Park	18 km to Section 4 (129+650)	Northwest
Avcikoru Nature Park	17 km to Section 4 (129+650)	Northeast
Mihrabat Nature Park	26 km to Section 4 (129+650)	Northwest
Hacet Deresi Nature Park	7 km to Section 4 (133+500)	Northeast
Goztepe Nature Park	24 km to Section 4 (129+650)	Northwest
Kocaeli Province		
Name of Nature Park	**Approximate Distance to the closest Project Unit**	**Direction with respect to the closest Project Unit**
Ballikayalar Nature Park	Adjacent to Liman Access Road	West
Beskayalar Nature Park	17 km to Izmit Access Road	Southwest
Eriklitepe Nature Park	26 km to Izmit Access Road	Southwest
Kuzuyayla Nature Park	12 km to Izmit Access Road	Southeast
Suadiye Nature Park	10 km to Izmit Access Road	South
Uzuntarla Nature Park	7 km to Section 6 (KM 202+000)	Southeast
Gazilerdagı Nature Park	7,1 km to Liman Access Road	West
Uzunkum Nature Park	38 km to Section 6 (KM 218+000)	North
Sakarya Province		
Name of Nature Park	**Approximate Distance to the closest Project Unit**	**Direction with respect to the closest Project Unit**
Il Ormani Nature Park	14 km to Section 6 (KM 219+000)	South
Kuzuluk Nature Park	13 km to Section 6 (KM 251+000)	South
Poyrazlar Golu Nature Park	400 m to Adapazari-Karasu Access Road	Northwest

Ballikayalar Nature Park's border is located adjacent to Liman Access Road between KM 0+500 and KM 7+000. Between KM 5+000 and KM 6+000, the route goes through the border of the Nature Park's protection area for just about 1 km. Regarding this area, General Directorate of State Highways (KGM) has made applications to the related authorities to obtain their official views and permissions and the process is still underway. Location of the Ballikayalar Nature Park with respect to the route of Liman Access Road is demonstrated on the map presented in Figure 12.1.

Ballikayalar Nature Park is located in Gebze District of Kocaeli Province and the Park is registered in 1995. The Park is classified as 1st Degree Natural Site and covers an area of 1.603 hectares in total. The Park is located in a valley formation that has 1,5 km length and 40-80 meters width. Height of this valley varies between 5-10 meters and 80-100 meters. Therefore, climbing is a popular activity in the Park.

Phytogeographical characteristics of the Nature Park is mainly reflected by European-Siberian and Mediterranean elements. There are 531 taxons belonging to 315 genus of 79 families in the nature park. Phytogeographical regions of these taxons are as follows;

- 312 (58,8 %) – Multiple regions
- 109 (20,5%) - Mediterranean,
- 44 (8,3%) - East Mediterranean,
- 58 (10,9%) - European-Siberian,
- 5 (0,9%) - Irano-Turanian and
- 3 (0,6) - Euksin elements

Spread over the wide area within the Nature Park, particularly cyprus oak, hungarian oak, cermes oak, other small trees and shrubberies exist. Additionally, hornbeam, chestnut, maple, ash, linden, oak, badger, yellow pollack, fir, alder, willow, plane species are found widely. Endemic Species in Ballikayalar Nature Park are presented in Table 12.2.

Table 12.2. Endemic Species in Ballikayalar Nature Park

Species	**Common Name (In Turkish)**	**Protection Status**		
		Endemism	**BERN**	**IUCN**
Anchusa leptophylla subsp. *incana*	Sığır dili	Endemic	-	-
Onosma isauricum	Emzik otu	Endemic	-	-
Asyneuma linifolium subsp. *linifolium*	Ketendegnegi	Endemic	-	-
Campanula lyrata subsp. *lyrata*	Can cicegi	Endemic	-	-
Knautia degenii	Esek kulagi	Endemic	-	-
Onobrychis armena	Evliya otu	Endemic	-	-
Scrophularia cryptophila	Siraca otu	Endemic	-	-
Crocus pestalozzae	Safran	Endemic	-	-
Gagea bithynica	Altin yildiz	Endemic	-	-

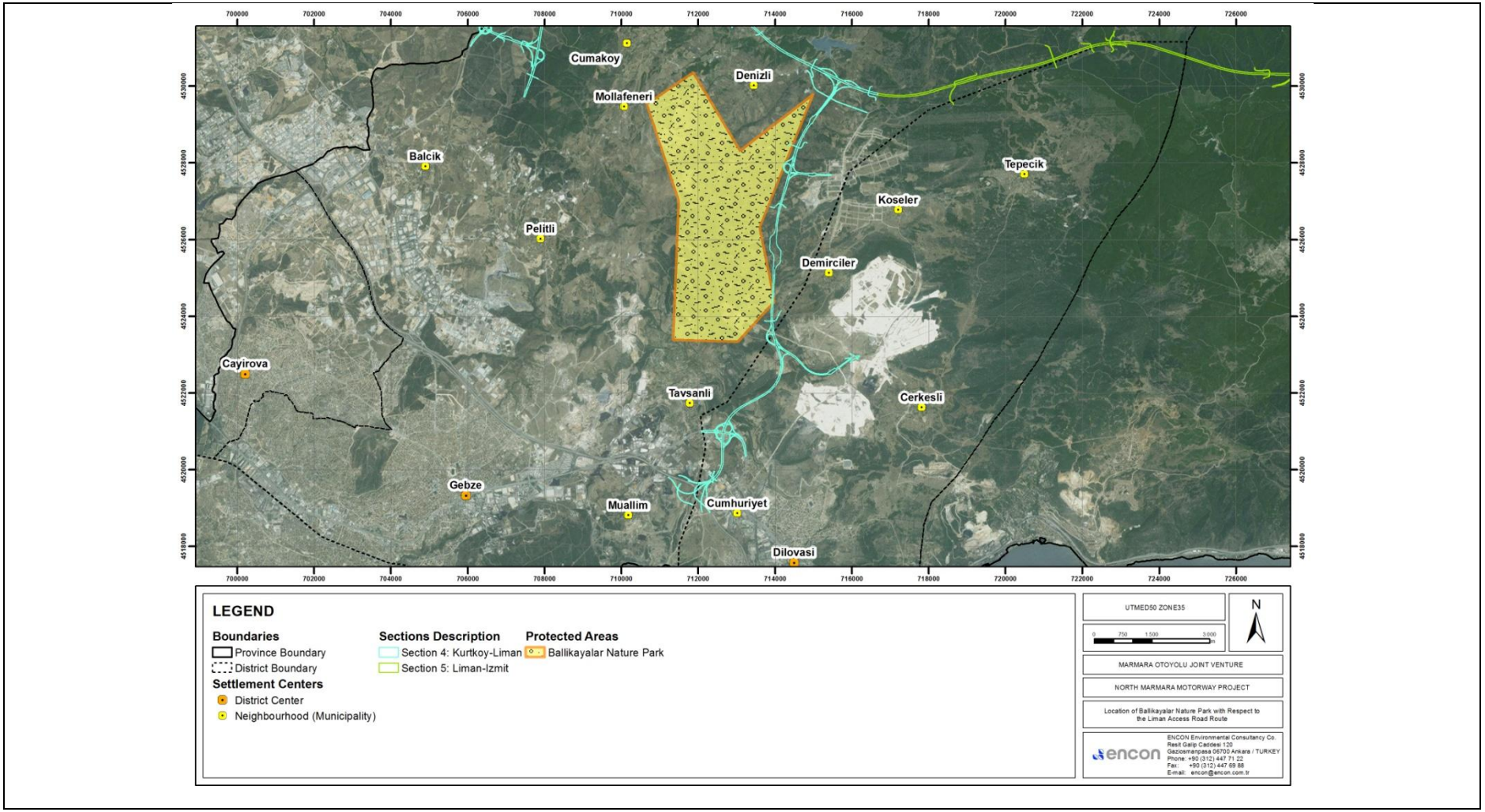


Figure 12.1. Location of Ballikayalar Nature Park with Respect to Liman Access Road Route

Poyrazlar Lake Nature Park is located approximately 400 meters north-west of Adapazari-Karasu access road in Section 6. The Park is a daily recreational area with a natural lake with facilities for the daily users. Total area of the Park is 231 ha and surface area of the lake is 67 ha in total. The area is registered as 1st Degree Natural Site in 1993.

The only nature conservation area in the region is Beykoz Abies Nature Conservation Area. The area is located in close vicinity of Beykoz District. However, the area is located approximately 30 km to the motorway route.

The only nature monument in Asian part of the Project Area is Dogancay Waterfall Nature Monument. The nature monument is located approximately 20 km south of Section 6 of the project route.

b) "Wildlife Protection Areas, Wildlife Development Areas and Wild Animal Nestling Areas" identified in accordance with the Land Hunting Law

There are two wildlife development areas in Asian part of the Project Area. Sakarya-Kaynarca Acarlar Lake Wildlife Development Area is located approximately 30 km north of Section 6. Kocaeli-Kandıra-Seyrek Wildlife Development Area is located approximately 34 km north of Section 5.

There are three wild animal nestling areas in Asian part of the Project Area. Two of the three wild animal nestling areas are in Kocaeli Province and the other one is in Sakarya Province. The one in Sakarya Province is located approximately 45 km south of Section 6. One of the nestling areas in Kocaeli Province is located approximately 5 km northeast of Section 5 and the other is located 11 km south of Section 5 connection road. Wild animal nestling areas are shown on map of prohibited and open hunting areas in Figure 12.2 with yellow color.

c) Areas defined as "Cultural Property", "Natural Property", "Protected Site" and "Protected Area" according to 2863 numbered Law on Protection of Cultural and Natural Properties dated July 21 1983, Article 3, Paragraph 1, Clause (a); Sub-clauses 1, 2, 3 and 5; and areas identified and registered in the same Law and amendments

KGM 1st Regional Directorate has sent an official letter to the General Directorate of Cultural Heritage and Museums and Kocaeli and Istanbul (numbered 1, 2 and 5) Regional Boards for Preservation of Cultural Assets to identify any sites of concern corresponding to the Project route. According to the official letter of the Regional Directorate, there is no Natural Property or Protected Site on the project Route.

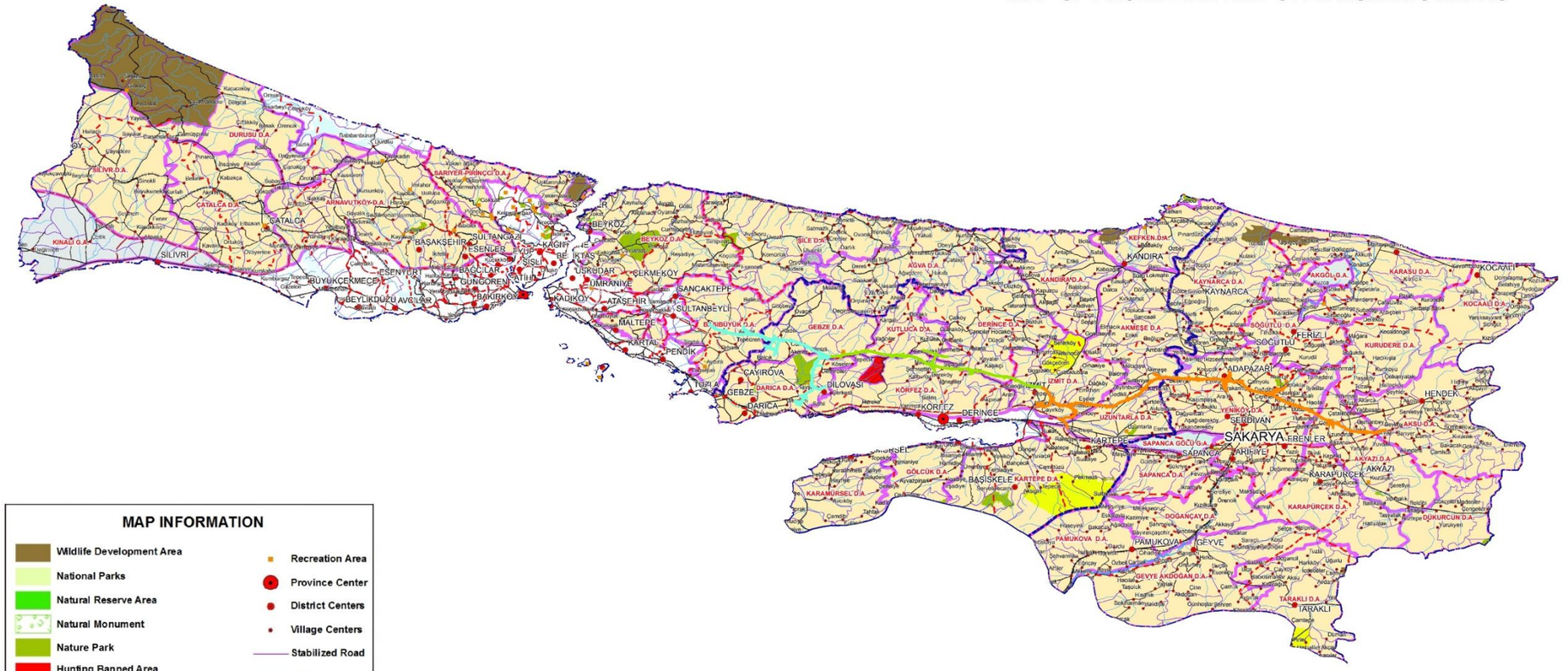
Further detailed assessment about Cultural Heritage regarding the Project and potential impact area is presented in Chapter 13.

d) Aquacultural Production and Breeding Sites in the scope of Aquaculture Law

There are no inland water bodies around Asian Part of the Motorway Route except those in Sakarya Province. Annex-4 of the 3/2 Numbered Communique that Regulates Amateur Water Aquaculture Hunting (Communique Nr: 2012/66) lists the inland water bodies of Sakarya where hunting is completely forbidden and this list is provided in Table 12.3.

REPUBLIC OF TURKEY
MINISTRY OF FORESTRY AND WATER WORKS
GENERAL DIRECTORATE OF NATURE PROTECTION AND NATIONAL PARKS

I. REGIONAL DIRECTORATE
(ISTANBUL-KOCAELI-SAKARYA)
MAP OF PROHIBITED AND OPEN HUNTING AREAS



MAP INFORMATION

Wildlife Development Area	Recreation Area
National Parks	Province Center
Natural Reserve Area	District Centers
Natural Monument	Village Centers
Nature Park	Stabilized Road
Hunting Banned Area	Highway
State Hunting Area	Paved Road
General Hunting Area	Expressway
Wild Animal Settlement Area	Railway
Sample Hunting Area	Stream - Creek
Special Hunting Area	River - Flood
Specially Protected Environment Areas	Dam - Pond
Province Boundaries	Lakes
District Boundaries	

Figure 12.2. Map of Prohibited and Open Hunting Areas in Asian Part of the Project Area (2016-2017)

Table 12.3. Inland Water Bodies of Sakarya where Amateur Hunting is completely Forbidden

District	Name of Inland Water
Hendek	Aksu River Goksu River Golceagac River Kiliselik River Kocakoyak River Kurtkoy River Kurtkoy Dam Golyayla Lake Sakaoglu River Uludere River
Geyve	Akcay Creek Gumusdere Creek
Tarakli	Karagol Upland Pond, Kayabogazi Pond

Areas where a ban on hunting is applied by the 2/1 Numbered Communique that Regulates Commercial Aquaculture Hunting (Comminuque Nr: 2008/48) is provided in Table 12.4.

Table 12.4. Inland Water Bodies where Commercial Hunting is completely Forbidden

Province	Area
Sakarya	Acarlar, Poyrazlar, Sapanca, Taskisigi (Calticak) Lakes
Kocaeli	Yuvacik Dam and Cakirkoy Pond
Istanbul (Asian Part)	Elmali II, Darlik, and Omerli Dams

e) Areas in accordance with the 17th, 18th, 19th and 20th Articles in the Water Pollution Control Regulation

The 17th, 18th, 19th and 20th Articles of the Water Pollution Control Regulation are identifying protection borders of the drinking water bodies. The only drinking water body in accordance with these articles is Omerli Dam around the Asian part of the Motorway Route. Omerli Dam is located approximately 1,6 km to Section 4. Therefore, the Motorway Route is located in the long distance protection zone of the Omerli Dam.

f) Areas in accordance with the scope of Air Quality Assessment and Management Regulation

According to the 7th Article of Air Quality Assessment and Management Regulation, zones and sub-zones for air quality identification are listed in Annex-1 of Memorandum 2013/37. This memorandum divides Turkey into various zones and sub-zones to identify pollution profiles of provinces by the Ministry of Environment and Urbanization. According to the evaluations made by the Ministry in this extent, Istanbul, Kocaeli and Sakarya are included in the “high pollution potential provinces” list.

g) There are no Specially Protected Areas in accordance with the 9th Article of Environment Law and no protected areas within the scope of Bosporus Law.

h) Areas where construction is prohibited in accordance with the Coastal Law

According to the official letter of Sakarya Governorship, Provincial Directorate of Environment and Urbanization, Sakarya River is in the scope of Coastal Law (Law Number: 3621). The Motorway Route passes above the river with a bridge and Activities around the river will be conducted in compliance with this law.

i) Areas designated in accordance with the Regulation of Wetland Conservation

According to the list of wetlands of international importance of Turkey, important wetlands in Asian part of the Motorway Route are Sapanca Lake and Sakarya Delta, which are also nature protection areas. Sapanca Lake is located approximately 8 km south of Section 5 of the Motorway Route. Sakarya Delta Wetland Area Protection Zone boundaries are approximately 24 km away from the Motorway Route in north direction.

Another important wetland is located in Izmit Bay, which is an important area for migrating birds especially. The area is located approximately 7 km west of Section 5 and Anatolian Motorway (0-4) connection.

j) Areas where construction is prohibited in accordance with Approved Environmental Plans (to protect existing characteristics such as, biogenetic reserve area, geothermal site etc.)

Currently 1/100.000 Scale Environmental Plan of Sakarya Province and 1/100.000 Scale Environmental Plan of Istanbul Province are available. The Motorway Route is already included in the Environmental Plan of Sakarya Province. Therefore, the Motorway Route does not overlap with protected areas on the plan or areas subjected to construction ban. However, there are some areas where construction is prohibited around the Motorway Route which are flood areas. One of the flood areas is between KM 240+000 and KM 243+000 and the other is between KM 231+000 and KM 234+000.

Approximately 10 km part of the Motorway Route is located in Istanbul Province in Asian part. Some parts of the Motorway Route in this part are located on areas subjected to construction prohibition or restriction due to being a basin rehabilitation area, or geological inconvenience for settlement or being a critically important area for environmental sustainability. These areas are listed below and representation of the Motorway Route on environmental plans is presented in Annex-2;

- Rehabilitation area in basin
- Geologically inconvenient area for settlement
- Critically important area for environmental sustainability

Map of Protected Areas around the Project Area is presented in Figure 12.3.

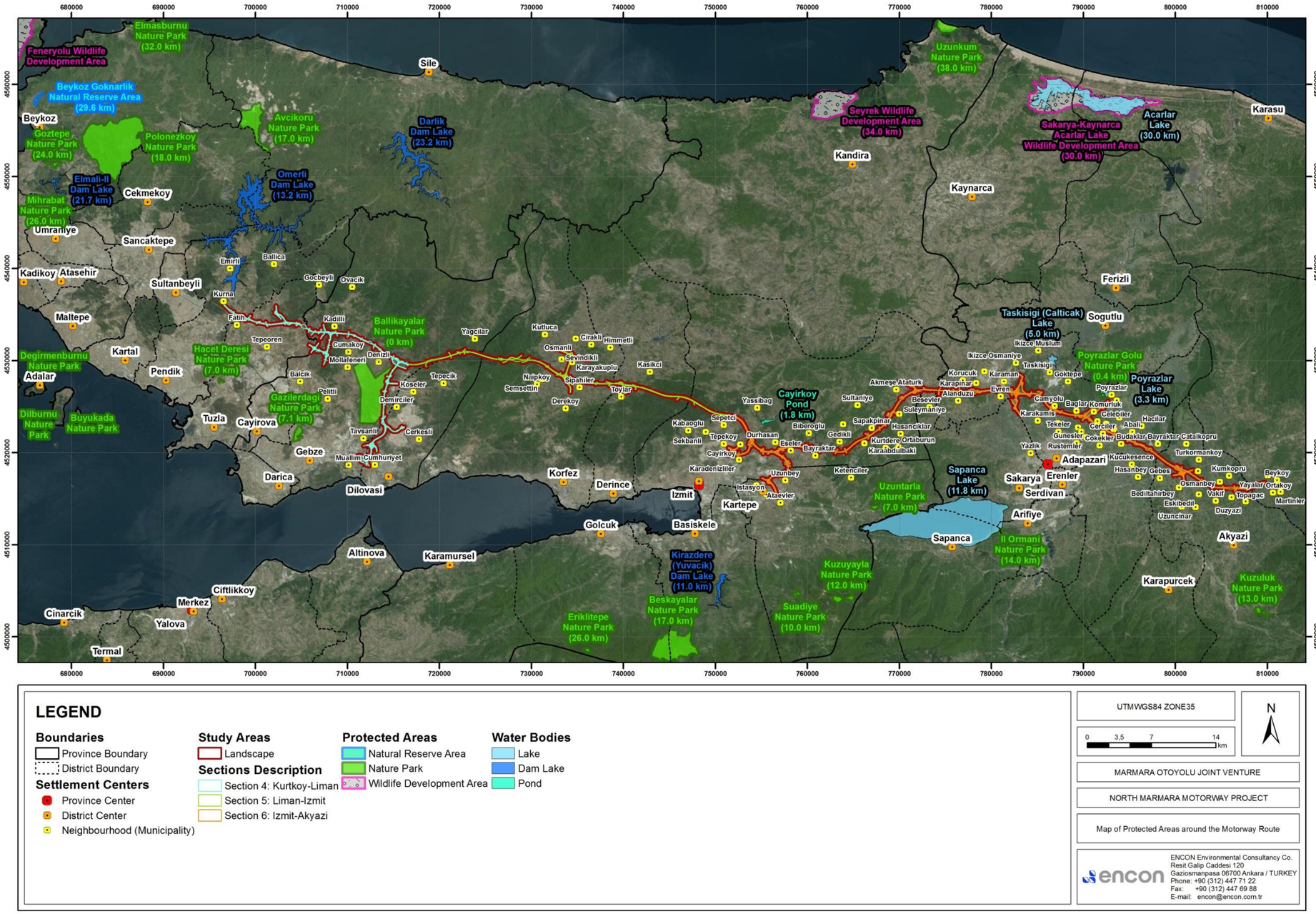


Figure 12.3. Map of Protected Areas around the Motorway Route (Asian part)

12.1.2. Potential Impacts and Mitigation Measures

The primary aim in project development is not to have any significant impact on any protection area or area of environmental, social and cultural importance. The Project has also aimed to establish a balance between the crossing of sensitive forest areas and impact on agricultural lands to avoid significant ecological and socio-economic impacts associated with Project land take. In this regard, potential direct impacts on protected areas described in the previous chapter are assessed by GIS techniques. The potential impacts of the project on any of the identified protection areas have been mitigated through changing the route of the motorway and through design changes. The mitigation measures that have been taken are explained below.

Section 4

In this section, Liman Access Road is located adjacent to the Ballikayalar Nature Park's borders between KM 0+500 and KM 7+000. The initial route at the feasibility stage of the Project was crossing the Ballikayalar Nature Park with a viaduct. Then, at the tendering stage revisions were made on the route to minimize interaction of the route with the nature park. The final route has been shifted outside the protection area of the nature park, with the exception of the section between KM 5+000 and KM 6+000, where the route intersects with the Nature Park.

Other important criteria considered in route selection process of this section were the geotechnical risks and reuse potential for excavated materials. In this respect, approximately 3,5 km part of the Liman Access Road has been revised due to geotechnical risks and to avoid the need for additional fill materials and allow the reuse of materials to be excavated. No quarry will need to be used for materials extraction as a result of the final design.

Section 5

A major change in the route has been done in this section between KM 173+000 and KM 191+000. The former route was passing a few kilometers north and crossing mainly agricultural lands. The route has been revised to pass through a valley within the Kocaeli City Forests resulting in avoidance of socio-economic interactions and associated costs for expropriation. This change increased use of forest lands, where bare areas within the forests have been preferred to the extent possible for camp sites and such associated facilities. The new route necessitated integration of several successive tunnels in order to minimize physical interaction with forest lands and cope with the topographical conditions.

Section 6

Following the major route change done in the last 20 kilometers of Section 5, this initial part of Section 6 (KM 195+500-213+000) was also changed avoiding crossing of mainly forest lands and DSI's Akmese Dam and Reservoir.

12.2. Landscape and Visual Environment

Motorway itself and its large components such as viaducts, tunnels, toll plazas, and service areas will be a source of change in the existing visual environment. Because of the experiential nature of visual resources, the human response to visual changes in the landscape cannot be quantified, even though the visual changes associated with a development can be described. The areas having unique or high landscape value, such as national parks, nature parks or natural forests, recreational areas, etc. are generally the ones that are most important with regard to potential visual effects of the Motorway and its components. The Project route selection has been done in due consideration of the protected areas, where a significant distance has been maintained with the Motorway components and the protected areas.

12.2.1. Assessment Methodology and Data Sources

First of all the project information including route maps, locations of structures were reviewed together with the available literature regarding the conditions in the area. Then, a site survey was conducted in early February to obtain existing landscape inventory (both photographically and in note format). Viewpoints were selected as representative of viewers of recreational areas and urban areas. During the field survey, there were some limitations regarding seasonal conditions, ongoing construction activities and dense forest areas. In spite of these limitations, relevant and representative data were collected along the project route. For some photographs, where good visibility was limited due to cloudy weather conditions, image enhancement was applied for providing a better view of surrounding landscape.

The assessment addresses the whole project components including the Motorway Route and related facilities. In this context, in addition to the route, the assessment will consider the following elements:

- Toll Plazas
- Interchanges and access roads
- Viaducts and bridges
- Quarries and Camp Sites

Based on the assessment mitigation measures are recommended for the purpose of integrating the Motorway into the wider landscape. The mitigation measures will be mainly in the form planting and minimizing any visual disturbance or disturbance of the natural landscape and will also serve to visually screen the Motorway from nearby viewers, mainly residents of nearby neighborhoods.

Significance Criteria

The significance criteria for the impacts on landscape, visual aesthetic and protected will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on landscape, visual aesthetics and protected areas, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 12.5.

Table 12.5. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	**Moderate (2)**	**Low (1)**
Landscape	Natural landscape character areas	Semi-natural landscape character areas (e.g. undeveloped rural settlement areas)	Unnatural and/or semi-natural landscape character areas (e.g. developed rural settlement areas, urban areas)
Visual Aesthetic (Residents of Settlements)	Settlements located at a distance between 0-400 meters from Motorway Axis and visual impact occurance according to topography, artificial and natural barriers	Settlements located at a distance between 400-700 meters from Motorway Axis and visual impact occurance according to topography, artificial and natural barriers	Settlements located at a distance between 700-1000 meters from Motorway Axis and visual impact occurance according to topography, artificial and natural barriers
Protected Areas	Unique protected areas (e.g. historical sites)	Protected areas that have some unique features	Areas that are not unique, however still considered as a protected area (e.g. nature parks that have recreational usage, drinking water dams)

12.2.2. Baseline Conditions

The landscape of the study area has been analyzed and described in terms of the key features and overall character. The landscape character around the Motorway Route is identified with reference to the Motorway KMs in Table 12.6, Table 12.7 and Table 12.8 below. Map of the field survey points are presented in Annex-9.1 and panoramic views of the field survey points are presented in Annex-9.2.

Table 12.6. Section 4: Kurtkoy-Liman

KM Chainage	Description
130-139	**Semi-urban areas of Tuzla and Pendik Districts of Istanbul** **Field Survey Points 1, 2 and 3** This part of the Motorway Route is located at southwestern parts of Istanbul Province. The area mostly consists of small agricultural lands between large housing estates, greenhouses and shrubberies/woodlands.
139-144	**Forestlands of Cataldag** **Field Survey Points 4, 5** This part is at the southern edge of a bigger forest texture in the north. There are agricultural lands beyond western edges of forestlands.
144-147	**Farmed plains of Cuma neighborhood** **Field Survey Point 6** This part of the Motorway Route is passing through the south-north oriented small plain near Cuma neighborhood. There are some horse farms and greenhouses in the area and boundaries of Ballikayalar Nature Park is near to east edge of the plain.

Table 12.6. Section 4: Kurtkoy-Liman (continued)

KM Chainage	Description
147-151 Liman Access Road	**Afforested hills of Denizli neighborhood** **Field Survey Points 7, 8, 9 and 10** This part of the Motorway Route is passing through afforested hills around Denizli Pond and Denizli neighborhood. Ballikayalar Nature Park is adjacent to Liman Access Road in south direction. Valley formation of nature park constitutes a natural barrier between the Motorway Route and the Park. Eastern parts of Liman Access Road are mostly consisting of industrialized buildings and open storage areas.

Table 12.7. Section 5: Liman-Izmit

KM Chainage	Description
151-167	**Dense Forest Lands Across Existing Kocaeli-Cayirova Road** **Field Survey Points 11 and 12** This part of the Motorway Route consists of hilly forest lands only. There are no settlements in close vicinity. Closest neighborhood Yagcilar is approximately 1.5 km to the Motorway Route.
167-177	**Hilly farmlands of Sevindikli and Sipahiler neighborhoods** **Field Survey Points 13, 14 and 15** There are contiguous, but small, farmlands on hilly landform around Sevindikli and Sipahiler neighborhoods and two ponds with the same names. Small woodlands are also seen. These two ponds have recreational use for activities such as cycling, scouting and water sports.
177-187	**Dense Forest Lands Across Existing Kocaeli-Cayirova Road** **Field Survey Point 16** This part of the Motorway Route consists of hilly forest lands. Tthis section of the project will mostly consist of tunnel passes. One exception is approximately 2 km part between KM 179 and KM 181.
187-191	**Valley formation and Bickidere Pond** **Field Survey Point 17** There are farmlands and greenhouses in the valley formation with a pond at the south. The Pond has recreational and agricultural importance. This part of the Motorway will be consisting of viaduct and tunnel structures.
Izmit Access Road	**Northern part of Izmit Province** **Field Survey Point 18** The access road is located at the northern edge of urbanized areas of Izmit Province. There are semi urbanized hilly lands including public and commercial buildings.
191-196	**Northeast edge of Urbanized Areas of Izmit Province** **Field Survey Point 19** This part is a mixture of farmlands and some commercial structures such as a large switchyard and organized industrial zone.

Table 12.8. Section 6: Izmit-Akyazi

KM Chainage	Description
196-200	**Flat farmlands of Eseler and Bayraktar neighborhoods** **Field Survey Point 20** This section is located at rural areas of Izmit Province. There are relatively flat farmlands and some greenhouses around mid-scale neighborhoods.
200-215	**Hilly farmlands and forest lands** **Field Survey Points 21, 22 and 23** The area consists of mixture of farmlands and small forestlands on hilly land form. There are some neighborhoods at upper parts of hills.
215-225	**Northern development areas and farmlands of Sakarya Province** **Field Survey Point 24** The area is a mixture of urban development areas, small forest areas and farmlands. This section is located northwest of Sakarya Provincial Center. There are urban development areas at the north of the Motorway Route and small forest lands and farmlands at the south of the Motorway Route.

Table 12.8. Section 6: Izmit-Akyazi (continued)

225-235	**Sakarya River and North edge of Sakarya Provincial Center** **Field Survey Points 25 and 26** Route passes between north edge of Sakarya Province and the hill formation with forest lands at north. Sakarya River is an important element of the local landscape at this area. However the river is not present a vista due to trees on river bank. Also there are farmlands between nearby neighborhoods.
235-251	**Flat farmlands of Adapazari and Akyazi** **Field Survey Points 27, 28 and 29** End of the Section 6 is located at flat farmlands of Adapazari and Akyazi Districts of Sakarya Province. These farmlands are very productive and therefore there are many neighborhoods around the farmlands. Also there are many water bodies in the area. Trees between farmland parcels obstruct long distance views.

12.2.3. Potential Impacts and Mitigation Measures to be taken

Construction of the Motorway and its components will result in the changes in the existing land use. Accordingly, landscape character of these areas will change permanently. North Marmara Motorway will have a length of 274,4 km, including the main carriageway and the access roads (as of end of March 2016). The width of the expropriation corridor changes between 100 meters to 350 meters depending on the scale of excavation and fill requirements and siting of the road structures such as interchanges, service areas, etc. Therefore, landscape in the mentioned area will be affected. However, the sections where tunnels are built would be exceptional. There will not be any considerable impacts on landscape caused by tunnel passing. Only tunnel portals will have impacts on landscape. In addition, quarries and camp sites will have potential impacts on landscape.

Land Preparation and Construction Phase

Potential Impacts

Construction activities will be completed in 3 years thus the changes in the landscape due to construction activities will be relatively temporary in nature. However, there will be disruption to the local landscapes in the immediate vicinity of the Motorway Route. These will mainly result from;

- Camp Sites
- Large earthmoving activities
- Construction machinery
- Quarry sites
- Construction works of tunneling, bridge and viaduct
- Temporary fences around construction areas
- High visibility cones or concrete blocks
- Construction of toll plazas and associated buildings
- Construction of parking areas and the service areas

Mitigation Measures to be taken

Main aims of the mitigation measures regarding landscape and visual impacts are keeping the changes as small as possible and limiting the visibility of the adverse changes while ensuring the design and construction of the project in a manner that the project melts into the landscape. In this regard, protecting existing landscape features such as shrubs, trees, and natural topography and avoiding unnecessary earthmoving activities are the main components of mitigation strategy. During the period of construction, following measures will be taken to reduce impacts of the works on the landscape and on viewers:

- Existing vegetation to be protected will be fenced with temporary protective fencing before work commences on site, so that as much vegetation as possible could be protected to maintain the integrity of the landscape and the existing visual screening.
- Working areas will be kept as small as practicable. Visual barriers will be implemented if the area is subjected to high visual impacts.
- The construction sites will be kept tidy and workers will have necessary knowledge/training about the issue.
- Temporary fencing will be implemented to obstruct intense construction activity areas

Operation Phase

Potential Impacts

Operational phase impact sources will be the motorway itself and the associated structures for operation of the motorway. The impacts during the early operation phase of the Project will be the highest in terms of visual impacts since implementation of the mitigation measures, such as planting of trees, will be in the early stages. In the continuing years of operation the visual impacts would be further decreased. The components of the project that would cause impacts can be summarized as follows:

- Motorway alignment
- Interchanges
- Bridges
- Viaducts
- Tunnel inlet portals
- Culverts
- Parking areas
- Toll plazas
- Service areas
- Lighting around interchanges, service areas and toll plazas

Mitigation Measures to be taken

General Directorate of State Highways (KGM) has technical specifications for landscaping works and a motorway maintenance handbook. These specifications cover project design, implementation and operation/maintenance phases. Therefore, all mitigation measures about landscaping have been provided in the technical attachments of the contract and Project Sponsors are responsible to implement and keep these measures. According to KGM handbook, side slopes that wider than three meters should be afforested. In case side slope is narrower than three meters, side slope should be planted with groundcover species, shrub and tree clubmoss. Similarly, central reserves that wider than three meters should be planted with shrub and three species.

In this regard, landscaping activities will be conducted along the Motorway route in order to minimize the potential impacts of the Project on the natural environment, ensure slope stability, form a barrier against noise and gaseous emissions, avoid monotonous driving conditions and develop aesthetic appearance. In the scope of the activities, existing local soil conditions, natural vegetative structure, existing plant species on the cultivation areas and irrigation/watering requirements of the potential species to be planted are going to be considered. The following can be outlined as the major mitigation measures for the Project:

- Planting will be implemented to restore or compensate for lost habitats.
- Planting mixes will be selected using native species and planting will be set out to establish new and enhance existing native habitats. The use of native species throughout the area is important in order that the Motorway planting will, over time, become almost indistinguishable from the vegetation naturally occurring in the surrounding area.
- Planting will be implemented to reconnect hedgerows or areas of planting formerly severed as a result of the construction works in order to maintain wildlife corridors and reinstate local landscape character.
- Non native species will be used in locations where their presence is of local relevance. For example, in an urban area, non native or ornamental species will be used to match non native or ornamental planting in that urban area.
- Landscape design will be coherent with regional landscape identity to the extent possible.
- Planting treatments will be designed to visually screen road structures and earthworks from nearby housings and settlements.
- Planting treatments will be interrupted to open up key views and vistas which reinforce local identity and minimize driver monotony.

Residual Impacts

Temporary impacts of the construction phase can be mitigated to acceptable levels by means of proper rehabilitation of the construction sites. Therefore, residual visual and landscape impacts would be mostly low. Visual changes due to the motorway and permanent structures will cause a long-term impact on the landscape, either positive or negative, for different parts of the Motorway. However, since the Motorway Projects are linear projects, visual impacts will occur in a narrow (1.000 meters of each side of the Motorway Axis) but long corridor. Thus, residual impacts for the operation will be low or medium.

Siting of the Motorway has minimized the significance of impacts on areas having unique or high landscape value. It should be noted that for certain parts of the motorway sections, such as former/abandoned mining sites and waste disposal areas (especially in Section 2 and Section 7), the overall impact will be a positive one as the rehabilitation works to be conducted following the completion of the construction phase will improve the former unpleasant landscape character at such sites.

Especially at the areas where rural landscape character is observed, the landscape character will change considerably at certain sections. Therefore, residual adverse impacts at these sections will be medium in construction phase. However, once landscape works are completed in operation phase (in 5-15 years), residual adverse impact at these areas will be low.

Summary of the landscape, visual aesthetics and protected areas assessments is presented in Table 12.9.

Table 12.9. Summary of the Landscape, Visual Aesthetics and Protected Areas Assessments

Affected Ecosystem Component		Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
					Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Landscape*		Land Preperation and Construction	Change of existing landscape	Adverse	Local	Medium	Medium	Irreversible	Continuous	Major	Medium to Low	High (A2) to Medium (A1)	Existing vegetation to be protected will be fenced with temporary protective fencing before work commences on site, so that as much vegetation as possible could be protected to maintain the integrity of the landscape and the existing visual screening. Temporary fencing will be implemented to obstruct intense construction activity areas	Medium
Landscape*		Operation	Change of existing landscape	Adverse	Local	Long	High	Irreversible	Continuous	Major	Medium to Low	High (A2) to Medium (A1)	Planting will be implemented to reconnect hedgerows or areas of planting formerly severed as a result of the construction works in order to maintain wildlife corridors and reinstate local landscape character.	Low
Visual Aesthetics	Kurnakoy (Section 4)	Land Preperation and Construction	Change of visual aesthetics	Adverse	Wide	Medium	Low	Long term reversible	Intermittent	Moderate	High	High (B3)	Working areas will be kept as small as practicable. Visual barriers will be implemented if the area is subjected to high visual impacts. The construction sites will be kept tidy and workers will have necessary knowledge/training about the issue.	Medium
	Tepeoren (Section 4)										High	High (B3)		Medium
	Akfırat (Section 4)										High	High (B3)		Medium
	Denizli (Section 4)										Low	Low (B1)		Low
	Muallim (Section 4)										Low	Low (B1)		Low
	Demirciler (Section 4)										Low	Low (B1)		Low
	Tepecik (Section 5)										High	High (B3)		Medium
	Cayirkoy (Section 6)										Medium	Medium (B2)		Low
	Durhasan (Section 6)										High	High (B3)		Medium
	Eseler (Section 6)										High	High (B3)		Medium
	Bayraktar (Section 6)										Medium	Medium (B2)		Low
	Karaabdulbaki (Section 6)										High	High (B3)		Medium
	Sapakpinar (Section 6)										High	High (B3)		Medium
	Akmese Ataturk (Section 6)										Low	Low (B1)		Low
	Korucuk (Section 6)										High	High (B3)		Medium
	Karapinar (Section 6)										Low	Low (B1)		Low
	Evrenkoy (Section 6)										High	High (B3)		Medium
	Karaman (Section 6)										High	High (B3)		Medium
	Camyolu (Section 6)										High	High (B3)		Medium
	Dagdibi (Section 6)										Low	Low (B1)		Low
	Poyrazlar (Section 6)										High	High (B3)		Medium
	Dogancilar (Section 6)										High	High (B3)		Medium
	Komurluk (Section 6)										Low	Low (B1)		Low

Table 12.9. Summary of the Landscape, Visual Aesthetics and Protected Areas Assessments (Continued)

Affected Ecosystem Component		Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
					Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Visual Aesthetics	Celebiler (Section 6)	Land Preperation and Construction	Change of visual aesthetics	Adverse	Wide	Medium	Low	Long term reversible	Intermittent	Moderate	High	High (B3)	Working areas will be kept as small as practicable. Visual barriers will be implemented if the area is subjected to high visual impacts. The construction sites will be kept tidy and workers will have necessary knowledge/training about the issue.	Medium
	Kasimlar (Section 6)										High	High (B3)		Medium
	Cerciler (Section 6)										High	High (B3)		Medium
	Haciramazanlar (Section 6)										High	High (B3)		Medium
	Budaklar (Section 6)										High	High (B3)		Medium
	Abali (Section 6)										Medium	Medium (B2)		Low
	Bediltahirbey (Section 6)										Low	Low (B1)		Low
	Turkormankoy (Section 6)										Low	Low (B1)		Low
	Kizilcikorman (Section 6)										High	High (B3)		Medium
	Vakif (Section 6)										High	High (B3)		Medium
	Osmanbey (Section 6)										High	High (B3)		Medium
	Topagac/Ramasli (Section 6)										Medium	Medium (B2)		Low
Visual Aesthetics	Kurnakoy (Section 4)	Operation	Change of visual aesthetics	Adverse	Wide	Long	Low	Long term reversible	Intermittent	Moderate	High	High (B3)	Planting will be implemented to restore or compensate for lost habitats. Native species will be used and planting will, over time, become almost indistinguishable from the vegetation naturally occurring in the surrounding area. Non native species will be used in locations where their presence is of local relevance. For example, in an urban area, non native or ornamental species will be used to match non native or ornamental planting in that urban area. Planting treatments will be designed to visually screen road structures and earthworks from nearby housings and settlements. Planting treatments will be interrupted to open up key views and vistas which reinforce local identity and minimize driver monotony.	Medium
	Tepeoren (Section 4)										High	High (B3)		Medium
	Akfırat (Section 4)										High	High (B3)		Medium
	Denizli (Section 4)										Low	Low (B1)		Low
	Muallim (Section 4)										Low	Low (B1)		Low
	Demirciler (Section 4)										Low	Low (B1)		Low
	Tepecik (Section 5)										High	High (B3)		Medium
	Cayirkoy (Section 6)										Medium	Medium (B2)		Low
	Durhasan (Section 6)										High	High (B3)		Medium
	Eseler (Section 6)										High	High (B3)		Medium
	Bayraktar (Section 6)										Medium	Medium (B2)		Low
	Karaabdulbaki (Section 6)										High	High (B3)		Medium
	Sapakpinar (Section 6)										High	High (B3)		Medium
	Akmese Ataturk (Section 6)										Low	Low (B1)		Low
	Korucuk (Section 6)										High	High (B3)		Medium
	Karapinar (Section 6)										Low	Low (B1)		Low
	Evrenkoy (Section 6)										High	High (B3)		Medium
	Karaman (Section 6)										High	High (B3)		Medium

Table 12.9. Summary of the Landscape, Visual Aesthetics and Protected Areas Assessments (Continued)

Affected Ecosystem Component		Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	
					Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Visual Aesthetics	Camyolu (Section 6)	Operation	Change of visual aesthetics	Adverse	Wide	Long	Low	Long term reversible	Intermittent	Moderate	High	High (B3)	Planting will be implemented to restore or compensate for lost habitats. Native species will be used and planting will, over time, become almost indistinguishable from the vegetation naturally occurring in the surrounding area. Non native species will be used in locations where their presence is of local relevance. For example, in an urban area, non native or ornamental species will be used to match non native or ornamental planting in that urban area. Planting treatments will be designed to visually screen road structures and earthworks from nearby housings and settlements. Planting treatments will be interrupted to open up key views and vistas which reinforce local identity and minimize driver monotony.	Medium
	Dagdibi (Section 6)										Low	Low (B1)		Low
	Poyrazlar (Section 6)										High	High (B3)		Medium
	Dogancilar (Section 6)										High	High (B3)		Medium
	Komurluk (Section 6)										Low	Low (B1)		Low
	Celebiler (Section 6)										High	High (B3)		Medium
	Kasimlar (Section 6)										High	High (B3)		Medium
	Cerciler (Section 6)										High	High (B3)		Medium
	Haciramazanlar (Section 6)										High	High (B3)		Medium
	Budaklar (Section 6)										High	High (B3)		Medium
	Abali (Section 6)										Medium	Medium (B2)		Low
	Bediltahirbey (Section 6)										Low	Low (B1)		Low
	Turkormankoy (Section 6)										Low	Low (B1)		Low
	Kizilcikorman (Section 6)										High	High (B3)		Medium
	Vakif (Section 6)										High	High (B3)		Medium
	Osmanbey (Section 6)										High	High (B3)		Medium
	Topagac/Ramasli (Section 6)										Medium	Medium (B2)		Low
Protected Areas*		Land Preperation and Construction	Impacts (e.g. dust/noise emission) on flora and fauna elements in the protected area	Adverse	Wide	Medium	Medium	Short term reversible	Intermittent	Moderate	Low	Low (B1)	Mitigation measures for emissions Restriction of construction areas	Low
Protected Areas*	Section 4 (KM 0+500 and KM 7+000) Ballikayalar Nature Park	Operation	Intersection with Protected Areas	Adverse	Restricted	Long	Low	Irreversible	One-off	Moderate	Low	Low (B1)	The initial route at the feasibility stage of the Project was crossing the Ballikayalar Nature Park with a viaduct. Then, at the tendering stage revisions were made on the route to minimize interaction of the route with the nature park. The final route has been shifted outside the protection area of the nature park, with the exception of the section between KM 5+000 and KM 6+000, where the route intersects with the Nature Park.	Low
	Section 6 (KM 195+500-213+000) Forest lands and Akmese Dam												Following the major route change done in the last 20 kilometers of Section 5, this initial part of Section 6 (KM 195+500-213+000) was also changed avoiding crossing of mainly forest lands and DSI's Akmese Dam and Reservoir.	

**Sensitivities of these ecosystem components are designated with considering their existence in overall Motorway Route*

CHAPTER 13

ARCHAEOLOGICAL AND IMMOVABLE CULTURAL HERITAGE

CHAPTER 13. ARCHAEOLOGICAL AND IMMOVABLE CULTURAL HERITAGE

This Chapter identifies the current status of archaeological and immovable cultural heritage that may be relevant to North Marmara Motorway Project and defines potential influences of the Project activities on the archaeological assets and immovable cultural heritage located within the Project's area of influence. Studies on the archaeological and immovable cultural heritage within the scope of the ESIA process have been conducted by the expert group of REGIO Cultural Heritage Management Consultancy Company. Findings of the study are summarized in the following sections and the Study Report on the Archaeology and Immovable Cultural Heritage, covering both the Asian and European sections to ensure integrity of the data, is presented in Annex-10.

13.1. Assessment Methodology and Data Sources

The institutional and legal framework regarding the conservation of movable and immovable cultural and natural assets in Turkey has been previously provided in Chapter 2 ("Institutional and Legal Framework"). In the scope of the cultural heritage assessments, mainly the Law on Preservation of Cultural and Natural Assets (Law No: 2863; amended by law numbered 3386) and the Principle Decision (No: 658) that govern the principles regarding the classification and protection of archaeological sites according to their significant features have been taken into consideration together with other relevant regulations. In addition to national legislation, the following international guidelines have been taken into consideration during the study:

- International Finance Corporation-IFC, Performance Standard 8
- European Bank for Reconstruction and Development- EBRD, Environmental and Social Policy, PR08, Cultural Heritage
- UK Department for Transport, Design Manual for Roads and Bridges Part 2 HA 208/07 Cultural Heritage
- Guidance on Heritage Impact Assessments for Cultural World Heritage Properties, International Council on Monuments and Sites (ICOMOS) January 2011.

The study area for the archaeological and immovable cultural heritage assessments has been identified as the 400 m corridor (200 m from each side of the Motorway axis), which would also cover Project construction area where the direct effects of the activities would occur. The methodology followed in the scope of the studies has consisted of the following five phases as detailed in the subsequent paragraphs:

a) Desktop Studies
b) Field Surveys
c) Archaeological Potential Modeling
d) Impact Assessment
e) Reporting

a) Desktop Studies

In this phase of the studies, the archaeological publications relevant to Project route and the study area were collected and reviewed to assess the archaeological potential of the region where the Project route is located. In addition, by contacting relevant regional boards for conservation of cultural assets, which are Istanbul Regional Board No: 5 and Kocaeli Regional Board for Conservation of Cultural Heritage, (as summarized in Table 13.1), existence of archaeological or immovable cultural assets, which were previously registered in the Project area and its vicinity were examined. The sources of information used during the literature review are as follows:

- Academic publications
- Historic maps
- Reports on the previous Cultural Heritage Studies and Results of Field Surveys
- Inventory records of Museums and Conservation Boards

Table 13.1. Regional Boards for Conservation of Cultural Assets and their Responsibility Areas on the Project Route

Section	Km	Province	District	Regional Board for Conservation of Cultural Assets
6	251+143-241+250	Sakarya	Akyazi	Kocaeli Regional Board for Conservation of Cultural Heritage
	241+250-215+500		Adapazari	
	215+500-187+000	Kocaeli	Izmit	
5	187+000-183+250	Kocaeli	Izmit	Kocaeli Regional Board for Conservation of Cultural Heritage
	183+250-175+500		Derince	
	175+500-162+500		Korfez	
	162+500-156+500		Gebze	
	156+500-151+500		Dilovasi	
4	151+500-139+500	Kocaeli	Gebze	Kocaeli Regional Board for Conservation of Cultural Heritage
	139+500-132+750	Istanbul	Tuzla	İstanbul Regional Board No: 5 for Conservation of Cultural Heritage

**Kilometers are given in the order of the field study route.*

b) Field Surveys

During the field surveys, which were conducted along the North Marmara Motorway route in order to identify potential archaeological and immovable cultural assets, the methods of “Field Walking”, “Intensive Field Survey” and “Extensive Field Survey” and were implemented. These works were conducted within the 400 m study corridor (200 m from each side of the Motorway axis), which includes the Project construction area, along the Motorway route. The details of the Route Walk, Intensive Field Survey and Extensive Field Survey are presented in the following paragraphs.

Field Walking

The “Field Walking” was used as the main research method during the field survey conducted within the 400 m study corridor of the Motorway Project route, which covers the Project’s construction area. During the field survey, the field survey team leader walked alongside the main axis of the motorway construction using a GPS device, while the two specialists of the archaeology team walked at both edges of the 400 m corridor. The instant communication between the members of the field team, who moved forward in parallel, was provided by walkie-talkies.

During the field walking, all archaeological traces (ceramic shards spread to the surface, architectural elements or traces, graves or traces of graves, mounds, tumuli, etc.) observed on the surface were noted on the Field Find Forms and Archaeological Status Table (for the forms and table, see Annex-3 and Annex-4 of the Study Report on the Archaeology and Immovable Cultural Heritage is presented in Annex-10 of this ESIA Report). In case archaeological traces were encountered in a region, the method of Intensive Field Survey, which is defined below, was used to collect the data.

Intensive Field Survey

This method was followed when an archaeological site was encountered within the study corridor and the Project construction area. The aim of this method is to determine the width of the archaeological site, identifying its association with the Project route on the map, revealing the area of distribution of archaeological surface findings and completing entire documentation, which would aid in interpreting the history of the site on the basis of archaeological artefacts on the surface. During this activity, by taking sufficient number of GPS coordinates (at least four different points) from each site, surface area of the site in current geography, and its location were determined. Moreover, detailed photographs of each site were taken from different angles and archived to be used in the reports. The area was divided into 10x10 m wide squares in the north-south direction and the samples of archaeological material such as pottery, stone tool shards etc. on the surface were systematically documented (photographing, etc). During all these works, the “Field Find Forms” and “Archaeological Status Table” (see Annex-10 of this ESIA Report), which were prepared by the research team, were filled separately for each site and all information related to the observations made in every site were recorded in these forms. In addition to the daily reports, these forms were also used as reference sources in preparation of the impact assessment report and its annexes after the survey. By processing the GPS coordinates which were taken on site (WGS 1984, 6 degree TM) in the Esri ArcGIS software, the locations of the sites in association with the motorway construction area were prepared in digital media and used as base in impact assessment studies.

Extensive Field Survey

Greater part of the works for identifying the archaeological and immovable cultural assets within the 400 m study corridor alongside the Motorway route was completed by using the method of field walking. In cases when walking was not possible (private property requiring permission, flood basins, forested/bush lands and places where walking is impossible due to the geographical features) (see Table 13.2) the method of “Extensive Field Survey” was followed. In this method, in order to determine the presence of archaeological and immovable cultural assets, the archaeological traces on the surface were observed from the most accessible points of the areas, where the field walking could not be conducted. The archaeological data retrieved from desk research and the results of archaeological potential modeling were taken into consideration in estimating the observed areas. For the sections, where the field survey was conducted using this method, the “Archaeological Potential Modeling” works were also implemented in order to develop risk projection for these sections.

c) Archaeological Potential Modeling

As mentioned previously, the field surveys were conducted within the 400 m study corridor alongside the Motorway axis in the form of field walking as much as possible. However, in the cases, when field walking could not be done due to certain restrictions (such as the areas, which are covered with snow or vegetation; the areas, where water streams block the route etc), “archaeological potential modeling” studies were conducted in the areas that may possess potential archaeological or cultural heritage. The detailed information on the sections where modeling were conducted is given in the Table 13.2.

Table 13.2. Areas where Extensive Field Surveys and Archaeological Potential Modeling Were Conducted

Sections	Start Km	Finish Km
Section 7	71+256	60+400
Section 2	57+500	47+000
	47+000	45+300
Section 1	26+100	24+500
	23+500	21+000
	15+000	0+000

The possible locations of potential archaeological sites within the 400 m study corridor (including the Project construction area) were attempted to be detected by using the modeling maps presented in Annex-5 of the Study Report on the Archaeology and Immovable Cultural Heritage given in Annex-10 of this ESIA Report. The model developed was implemented by using the ESRI ArcGIS software for the kilometer intervals given in the Table 13.3, within a corridor of 400 m wide, which covers the project construction area. Five predictive parameters were taken into consideration in the modeling, namely:

- Existence of water supply and proximity to water supplies,
- Slope of the terrain, land classification (forest land, pasture land, arable land, irrigated farming land etc.),
- Proximity to ancient roads and known archaeological settlements, and
- Proximity to modern settlements.

Each parameter was divided into sub-categories and associated with grade points. Positively weighed values were defined as positive impacts and negatively weighed values were identified as negative impacts in the evaluation. For instance, in classification of terrain, while the forest land was graded with -2 point, dry farming land was given +2 point. Because there are many ancient settlements, etc. around and nearby modern villages at present, this modeling was built upon the hypothesis that the modern inhabited locations have similar environmental conditions with the ancient inhabited locations.

After defining the grade points of sub-categories, the Project construction and its impact area was divided into the grids having the sizes of 500x400 m. For each square, the grade points corresponding to the sub-categories associated with the character of the area were summed and, in the end, positive and negative total grade points were obtained for every grid.

The grids with positive grade points were identified as the “Areas of High Archaeological Potential”, while those with negative grade points were defined as the “Areas of Low Archaeological Potential”. The predictive parameters and sub-categories that were taken into consideration in modeling and corresponding grade points are presented in Table 13.3.

Table 13.3. Predictive Parameters and Sub-Categories Taken into Consideration in Modeling

Predictive Parameters	Predictive Sub-category	Critical Value	Predictive Weight
Hydrology/ Proximity to Water	Stream Order 1	750 m	2
	Stream Order 2	1000 m	2
	Stream Order 3	1000 m	1
	Stream Order 4	1000 m	2
	Stream Order 5	1500 m	-1
	Stream Order 6	1750 m	-2
	Lake/Sea Order 7	2 km	3
Slope	Slope	0-10	0
	Slope	10-90	-5
Land Classification	Patch Agriculture	Yes	2
	Fruit Tree Grove	Yes	2
	Arable Non-Irrigated	Yes	2
	Arable Irrigated	Yes	-2
	Forest Area	Yes	-2
	Grasslands	Yes	-2
	Barren Land	Yes	-2
	Wetlands or Water	Yes	-4
	Industry/Built Area	Yes	-4
	City Area	Yes	-4
	Proximity to wetlands	1 km	2
Proximity to Rural/Ancient Roads	Proximity to rural and or ancient roads	1 km	2
Proximity to Mountain Base	Proximity to mountain base	0-2 km	2

d) Impact Assessment

The Project activities may have potential impacts on the sites, which have been identified to be located within the Project construction area or study corridor. The influence of the construction activities on the identified sites and the degree of importance of the sites were identified in accordance with the criteria proposed in the “Guidance on Heritage Impact Assessments for Cultural World Heritage Properties”, which is also suggested to be used by the Ministry of Culture and Tourism in order to properly assess the impact of the construction projects on cultural heritage sites. The results of the assessments are summarized in Section 13.3. Detailed information on the assessment findings are contained within the Study Report on the Archaeology and Immovable Cultural Heritage (see Annex-10).

Significance Criteria

In the assessment of impacts on archaeological and immovable cultural heritage, the general methodology described in Chapter 4 ("ESIA Methodology") will be principally followed. On the other hand, the Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (HIACWHP) (*ICOMOS, 2009*) will be based on for the determination of magnitude and assigning value of the receptor. In this respect, the scale and severity of the change/will be evaluated in accordance with the criteria given in Table 13.4.

Table 13.4. Magnitude Criteria Used in the Assessment

Scale of Impact	Magnitude
%0-%20	No Change
%20-%40	Negligible
%40-%60	Minor
%60-%80	Moderate
%80-%100	Major

For assigning the value of the heritage assets, criteria given in Table 13.5 in accordance with the HIACWHP will be used.

Table 13.5. Criteria for Value of the Heritage Assets

Description of the Criteria	Value
-The importance of the asset has not been ascertained.	Unknown Potential
-Assets with little or no surviving archaeological interest.	Negligible
-Designated or undesignated assets of local importance. -Assets compromised by poor preservation and/or poor survival of contextual associations -Assets of limited value, but with potential to contribute to local research objectives.	Low
-Nationally-designated Archaeological Monuments protected by the State Party's laws -Undesignated sites of the quality and importance to be designated. -Assets that can contribute significantly to acknowledged national research objectives.	High
-Sites of acknowledged international importance inscribed as WH property. -Individual attributes that convey OUV of the WH property. -Assets that can contribute significantly to acknowledged international research objectives.	Major

Final assessment of the significance of impacts will be done according to the impact significance categorization matrix given in Chapter 4 ("ESIA Methodology").

e) Reporting

The data on the archaeological or immovable cultural assets located within the 400 m study corridor that includes the Project construction area were collected directly from the field surveys and from Regional Boards for Conservation of Cultural Assets. These data were evaluated in GIS and the relationship between these sites (including the sites previously registered by the Ministry of Culture and Tourism) and Project route; the degree of importance and vulnerability of the sites, impact of the construction activities on these sites and possible mitigation methods to be followed in the construction phase were determined and reporting works were finalized.

13.2. Baseline Conditions

As provided in the following sections, baseline conditions along the North Marmara Motorway Project route and its vicinity have been characterized based on desk based information obtained through literature review and findings of the field surveys conducted, as provided below.

13.2.1. Archaeological and Historical Background

The route of the North Marmara Motorway Project is located in a geography, which witnesses almost all historical periods of Anatolia. The exact locations, numbers, and conditions of archaeological and immovable heritage of the region are not clearly known at present because of intense migration, rapid and unplanned urbanization, industrial facilities covering large territories and the limited number of studies on the cultural inventory of the region.

Within the scope of the archaeological and cultural impact assessment studies conducted for the North Marmara Motorway Project, the historical geography of the Project area and its close vicinity was studied based on the information retrieved from literature reviews and archives of the regional conservation boards.

According to the ancient sources, the geography which the Project route is located covers two different regions. In the ancient sources, the eastern side of the Bosporus was named “Bithynia”, and the western side was called “Thrace”. The Bosporus is the borderline separating the two regions. For this reason, the historical background of the Project route was investigated in accordance with the ancient definitions (Figure 13.1).

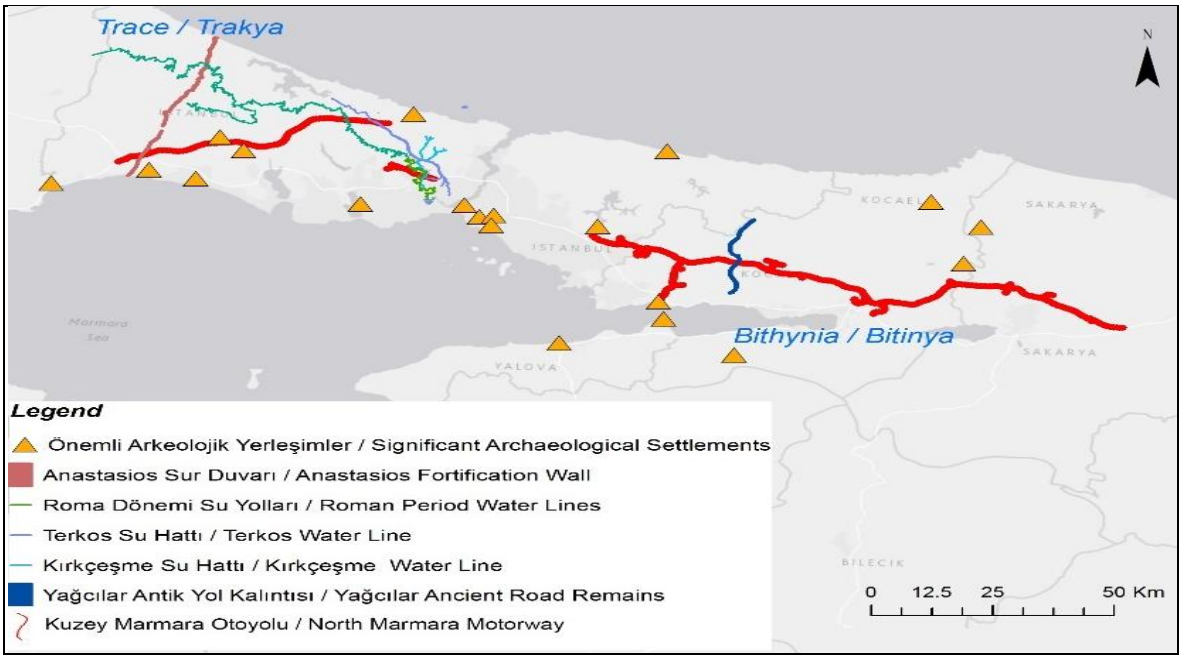


Figure 13.1. Archaeological and Historic Sites in the Region where North Marmara Motorway Project is Located

Bithynia Region

The ancient Bithynia region covered Anatolian side of Istanbul, the provinces of Kocaeli, Yalova, Sakarya, Düzce and Bolu and greater parts of the provinces of Bartın, Zonguldak and Bursa. Kocaeli is located in the centre of the Bithynia region. In the ancient sources, the borders of Bithynia are defined as the Bosporus and the Marmara Sea (Propontis) in the west, Black Sea (Pontus Euxinus) in the north, Bartın Stream (Parthenius) in the east and Orhaneli River (Rhyndacus) in the south (*Beksac, 2015*). The region was named after "Bithyni Tribe" of Thracian origin, which left the Thrace in order to escape from the Scythians and took shelter in Anatolia (*Guclu, 2007*). Asian sections of the Project (4, 5 and 6) are located within the borders of Bithynia Region.

The traces of the Palaeolithic and subsequently the Mesolithic (Epi-Palaeolithic) Period in the region were discovered in Parganlı-Kerpe (Kocaeli, Kandıra), Kefken-Cebeci (Kocaeli, Kandıra), İbonun Rampası (Yalova, Akköy), Çallıca (Yalova, Çınarcık), İçerenköy (İstanbul, Kadıköy), Göksu (İstanbul, Ümraniye, Dudullu), Hacet Creek (İstanbul, Pendik), Fikirtepe (İstanbul, Kadıköy), Domalı-Alaçalı (İstanbul, Şile), Ağadere (Sakarya, Kaynarca), Dağazlı 1st and 2nd Localities (Sakarya, Kaynarca) and Ayıyatağı Locality (Sakarya, Kaynarca). Stone hand axes and sharp objects were discovered in these settlements (*TAY I*).

At present, the traces of the Neolithic Period are accumulated in the coastline leading to the Marmara Sea and around İznik Lake. Fikirtepe, Pendik-Temenye and Tuzla settlements, which were recently discovered to be in association with the European side of Istanbul via the Neolithic Period findings unearthed during the Marmaray construction works, were marine-based, interesting and authentic local civilizations. On the other hand, it was revealed that, there was a unique culture different from previous civilizations in the settlements located around the Iznik Lake despite of certain relationships (*Beksac, 2015*). The traces of the Neolithic Period in the region and its close vicinity were encountered in Dudullu (İstanbul, Ümraniye), İçerenköy (İstanbul, Kadıköy), Fikirtepe (istanbul, Kadıköy), Tuzla (İstanbul), Temenye (istanbul, Pendik), Göztepe (Yalova), Ilıpınar (Bursa, Orhangazi), Yüğücek (İznik), Barcın Mound (Bursa, Yenişehir), Maramarcık (Bursa, Yenişehir), Menteşe (Bursa,Yenişehir), and Tepetarla (Kartepe, Kocaeli).

Although scarce, findings dated to the Chalcolithic Period and Early Bronze Age were identified in the region. Most of the findings of these periods are from around İznik Lake. In addition to these settlements, findings dated to these periods were discovered in the excavations conducted in the vicinity of Karamursel within the boundaries of Kocaeli and nearby Geyve within the provincial borders of Sakarya. On the other hand, the traces of Chalcolithic Period in the region and its close vicinity were identified in Ilıpınar (Bursa, Orhangazi). The traces of the Early Bronze Age, which followed the Chalcolithic Period, were detected in Elmabahçesi Locality in Taraklı Distric of Sakarya (*TAY II*).

The region was inhabited by the Thracian tribes between 1200 and 700 BCE. The region, which was annexed to Lydia until the 7th century BCE, fell under the Persian rule around 513 BCE. After Alexander the Great defeated the Persian army near river Granicus (Biga River) (334 BCE), the region became independent in 326 BCE. Chalcedon (Kadıköy), Chrysopolis (Üsküdar), Lybissa (Diliskelesi), Dacibyza (Gebze), Nicomedeia (İzmit), Kalpe (Kerpe), Olbia (Başiskele), Astacos (Gölcük), Prainetos (Karamürsel), Pylai-Strobilos (Çiftlikköy/Karakilise), Drepanon (Hersek), Chios-Prusias ad Mare (Gemlik), Apameia/Myrleia (Mudanya), Prusa ad Olympium (Bursa), Helicore-Nikaia (İznik), Prusias ad Hypium (Konuralp), Bithynion-Claudiupolis (Bolu), Dia-Diospolis (Akçakoca), Teion-Tieion-Tion (Filyos/Hisarönü), Herakleia (Ereğli), Otroia (Yenişehir), Modrene (Mudurnu), Malagina (Mekece), Agrilion (Bilecik), and Kabaia (Geyve) were among the most important ancient cities in the region.

Because of the harbours for marine trade, rich water resources, fertile agricultural lands and being located in the vicinity of important trade routes, the region has been intensively inhabited since the ancient periods. Sangarios (Sakarya River), Aisepos (Gönen Stream), Hypios (Melen stream), Makestos (Susurluk-Simav Stream), Parthenios (Bartın Stream), Siberis (Aladağ Stream), Psillis (Ağva), Kalpas (Anadere stream near Kefken), Lykos-Rhyndakos (Orhaneli Stream), Rhebas (Riva), Kaleks (Gülünç Stream), Billaios (Filyos Stream), Artanos (Hiciz Creek), Askania (İznik Lake), Sophon /Sunensis (Sapanca Lake), and Apolyont (Ulubat Lake) are among the most important fresh water resources in the region. On the other hand, Olympos of Mysia (Uludağ), Astacus (Samanlı Mountains), and Sophon (Kartepe) are the most prominent heights of the region.

In addition to the settlements, there are ruins of road networks, bridges, defensive outposts and fortifications, and harbours belonging to the Roman Period in the region which was annexed to the Roman Empire in 74 BCE. The “Roman Road” ruins, which is located in Yağcılar Village nearby Kandıra District of Kocaeli and also situated on the North Marmara Motrway Project route, is one of the significant remains of this period. In the 6th century, in the reign of the Byzantine emperor Justinian (527-565), important buildings were constructed and development activities were conducted in Sakarya and its vicinity. “Justinian Bridge” (Karaaptiler Köyü, Sakarya), which was constructed on Sakarya River (Sangarios), is one of the most important monuments of this period. In addition, it is known that, during this period important defensive buildings were constructed in settlements such as Çobankale (Geyve, Sakarya), Paşalar (Pamukova, Adapazarı) and Mekece (Pamukova, Adapazarı) in the region (*Cetin, 1999*).

The region, which was ruled by the Byzantine Empire between the 5th and 11th centuries, was conquered by Anatolian Seljuk state in 1078. In 1354, except for Istanbul (Constantinople), the entire region came under the control of the Ottoman Empire.

One of the most important settlements in Bithynia region throughout its history has been İzmit (Kocaeli). Izmit has been a centre of attraction in all periods because of its geographical position, its natural harbour (İzmit Bay), forests, and convenience for transportation. There are important Ottoman buildings in İzmit, such as "Orhan Mosque", which was constructed by Suleyman Paşa, son of Orhan Gazi, in the 14th century; "Akçakoca Mosque", which is located in Akçakoca Neigbourhood, Yukarı Pazar and was constructed between 1327 and 1328 by Akçakoca, who conquered İzmit region; and "Imaret Mosque", which was constructed in the city centre in the 16th century. It is known that, following the conquest of İzmit in the 14th century, many military, civil and administrative buildings, majority of which were religious, civil and water structures, were constructed in İzmit and its vicinity in the Ottoman Period.

The North Marmara Motorway Project route also passes through the provincial borders of Sakarya (Adapazarı) that is located in the east of the ancient Bithynia region. In Adapazarı (Sakarya) region, which was limitedly inhabited in the antiquity and medieval periods because Sakarya River frequently changes its bed and because of the marshlands in the area, the number of settlements increased after the 16th century as a result of the removal of forested areas and bush lands. Katip Çelebi in his "Cihannuma", which he wrote in the 17th century, mentions Sakarya as a popular place. It is known that a great devastation took place in the region in 1640 as a result of flooding of Sakarya River. This flood caused disappearing of many historic buildings (*Cetin, 1999*).

In his famous "Seyahatname", Evliya Çelebi presents information on settlements such as Sapanca and Hendek and describes Sarı Rüstem Paşa Mosque, Pertev Paşa Han in the region and important Ottoman monuments in Geyve. The region, which was occupied by Greek forces in March 1921, was liberated in June 1921.

Thrace Region

In general scholarship, Thrace is defined as the region located between Macedonia and Bosporus. Although only European sections of the overall North Marmara Motorway Project (1, 2 and 7), which are subject of a separate ESIA Report, are located within the borders of Thrace Region, information on the Thrace Region is also given in this report to characterize the entire region.

Thrace is composed of large plains and arable lands. Apart from these flatlands, the main heights are Mons Aticus (Istranca Mountains) in the north, Hieron Oros (meaning Holy Mountain, modern name is Ganos Mountain) in the south and Koru Mountains (the ancient name is not known) in the southwest (*Sevin, 2000*). While the highlands are covered with intense forest vegetation, interior parts and plains near the coastline are covered with steppes. These plains are very inhabitable because of their suitability to agricultural production. Lumber, which is produced in forestlands, is one of the important trade goods (*Sevin, 2000*). While the eastern part of the region displays Black Sea climatic conditions of heavy rainfall, a very large part near the Marmara Sea features a climate called Marmara transition climate, which resembles the climate of the Mediterranean. In the interior parts between these two climatic belts, which is isolated from the sea, continental climatic conditions are observed.

The rivers of the region, flowing in the north-south direction are Tonzos (Tunca), Ardeskos (Arda), Hebros (Meriç). Agrianes (Ergene) flows in the east-west direction. In addition to these, there are minor rivers. These are: Arzos (Çorlu Stream), Tearos (Kaynarca), Apsinthos (Derbent Creek), Melas (Kavak Stream), Athyra (Çekmece Creek), Kydaris (Alibey Creek), and Barbyses (Kağıthane Creek). Apart from these rivers, the lakes located in the region are Delkos (Terkos) and Stentaris (Gala) (*Sevin, 2000*).

There are important mining areas in the region. It is known since the antiquity that, there are copper and zinc mines in Mons Asticus (Istranca Mountains); copper mines in Dereköy, Şükrüpaşa and Armutveren; iron mines in Demirköy and gold mines near Rezve Creek.

Agricultural production has a crucial role in the economy of the region. Ancient historians Herodotus and Xenophon mention that barley, wheat, and hemp were cultivated in the region (*Sevin, 2000*). The Thrace region, which was very advanced in viniculture, was also famous for vine production. In terms of livestock, sheep and horse breeding is important in the region (*Sevin, 2000*). It is known that fishery is an important means of living in the coastal districts. Ancient historian Strabo states that Keras (Haliç) was rich in terms of tuna fish and Atlantic bonito (*Sevin, 2000*).

Important settlements were established in the Palaeolithic, Neolithic and Chalcolithic periods in the Thrace region. Balkan Peninsula is very suitable for human habitation for its climatic and geographical conditions since the 4th geological era (Quaternary) (*Erzen, 1994*). The ancient settlements in Eskice Ridge near Büyükçekmece Lake and Kefken and Gümüş Dere near Kilyos confirm this information. The findings unearthed from those settlements together with those found in Yarımburgaz Cave explain the diffusion of mankind from the Near East to Europe. There were very few settlements in Thrace in the Palaeolithic Period. The most important Palaeolithic settlement is Yarımburgaz Caves, which include a natural place for habitation and defence. Findings belonging to the further phases of the Palaeolithic Period were encountered in Ağaçlı Village located near the Black Sea coastline in the north of Kemerburgaz. These sites are Mesolithic (Epi-Palaeolithic) Period settlements discovered on the fossilized dunes stretching alongside the Black Sea coast (*TAY I*). It is revealed that there were a multitude of habitations around the Black Sea, which was a fresh water lake in this period, when the present climatic conditions start to become dominant in the region. The richest findings dated to this period are collections of “small” tools found in the dunes of Ağaçlı. This collection, which is named “Ağaçlı Culture”, constitutes the richest finding set belonging to this period in Turkey (*Ozdogan, 2000*).

It is known that the number of settlements in Thrace increased after this period. Some of the known prehistoric settlements are Hoca Çeşme Mound, Toptepe, Aşağı Pınar, Kanlıgeçit, and Çardakaltı. During the 7th and 6th millennia, the Balkan Peninsula and Carpathian region were inhabited by the Neolithic farmers coming from the Near East. During this period, Marmara was an important junction point (*Hoddinott, 1981*). Menteşe, Ilıpınar, Fikirtepe and Pendik were among the most important archaeological settlements in Marmara dated to this period, which was one of the most important turning points in the human history and named “agricultural revolution” (*Ozdogan, 2000*).

Scientific literature suggest that a new wave of immigrants from the Central Anatolia and Aegean regions arrived at the region at the end of the Neolithic Period; the local cultures developed and continued their existence but eventually left their place to the newcomers in the beginning of the Chalcolithic Period. It was revealed through the field surveys and excavations conducted in the region that all the settlements in Thrace were demolished by fire at the end of the Chalcolithic Period (*Ozdogan, 2000*).

Gladina Locality within the provincial boundaries of Büyükçekmece District, Kanallı Bridge (Kınalı Bridge) near Silivri District and Selimpaşa Mound located within the municipal boundaries of Selimpaşa Municipality, Silivri are among the important Early Bronze Age settlements in Thrace. In addition to that, traces of the Early Bronze Age were encountered in the necropolis area above İncegiz Caves, which are located in a deep valley in the north of Çatalca District and in Kartepe (Karatepe) Caves, which are located in mountainous and forested terrain in the northeast of Dağyenice Village (*Aydingun, 2014*)

The 2nd Millenium BCE (the Middle and Late Bronze Ages) is the period during which empires such as Hittites and Mycenaean flourished in Anatolia and Aegean region. On the other hand, although it was believed until recently that the entire Thrace was inhabited only by nomadic communities, discovery of ceramics and figurines belonging to the Hittite Period in the excavations conducted in Bathonea (Küçükçekmece, İstanbul) revealed the existence of Hittite civilization in Thrace (*Aydingun, 2015*). In around 1200s BCE Thrace was inhabited by Thracian tribes coming from the north (Erzen, 1994). It is known that, by the 8th century BCE, the Thracian settlements continued their existence as Hellenized colonies (*Sevin, 2000*). In the 4th century BCE, an independent Thracian state was established in the region (*Erzen, 1994*). In order to eliminate an unrest that took place in the region, Alexander the Great launched a military campaign in 333 BCE. After Alexander's death, the region became autonomous (*Sayar, 2008*). In the 1st century BCE, Thrace fell under the Roman influence and eventually became a Roman Province in 45 BCE. In the Roman Period, **"**Via Egnatia," the main road connecting the centre of the Empire, Rome with Anatolia passed through this region (*Aydingun, 2015a*).

In 333 CE, Roman emperor Constantine the Great (Constantine I), with an anticipation that the Empire could not be governed through Rome, renamed Byzantium after his name as Constantinople and declared it the Capital of the empire, and with this act he caused the empire to be divided into two as the Eastern and Western Roman Empires (Sayar, 2008). This division is at the same time considered the most important event in the establishment of the Byzantine Empire. After the division of the Roman Empire, Thrace left in the boundaries of the Eastern Roman Empire (Byzantine Empire). In 394 CE, Theodosius I unified the Eastern and Western Roman Empires for the last time, however, right after the death of Theodosius I, in 395 CE, the Roman Empire was divided into two as the Eastern and Western Roman Empires again for the last time.

In the Byzantine Period, great defensive systems were constructed in the region. Silivri, with its ancient name Selymbria or Selybria, was known as the citadel protecting the Istanbul road throughout the Byzantine Period (Eyice, 1969). In addition to Silivri Citadel, the defensive system named Anastasian Wall were commissioned by the Byzantine Emperor Anastisus I (491-518) in order to protect Constantinople from the invasions coming from Thrace. It is known that the Anastasian Wall, which was 56 km long, started in the Black Sea coast, passed through Fenerköy and Kurfalı villages and ended in the Marmara Sea.

Although their traces have not been identified yet, Hagias Spyrion Church and Fatih (Hunkar) Mosque are among the most important Byzantine Period buildings in the region. Fatih (Hunkar) Mosque was the biggest church of the Silivri Citadel but after the conquest of Silivri in 1453 it was converted to a mosque by Sultan Mehmed the Conqueror. Fatih Mosque started to ruin and disappeared after 1920s, its minaret was demolished in 1960s, and its stones were used as spolia in other buildings (*Eyice, 1969*). Although it is known that important monuments from the Byzantine Period were located in Silivri, Selim Paşa and close vicinity, most of them were demolished because of the rapid urbanization.

The region remained under the control of the Byzantine Empire until the 14th century and then it was taken over by the Ottoman Empire after the conquest of Istanbul in 1453.

Apart from the ancient ruins, there are trenches and military bunkers constructed for defence purposes in the Balkan Wars and the World War II in the region. The “Çatalca Entrenchment Line” which was constructed in 1877 was controlling an area of totally 50km between Terkos in the north and Büyükçekmece Lake in the south, in 35-40 km west of Istanbul. The outposts and fortifications forming the entrenchment line were constructed intermittently in a 6,5 km long corridor. There were 10 redoubts in total through the defence line. The redoubts were equipped with machine guns and light artilleries. The redoubts were constructed on the top of hills. Below the redoubts, armouries were constructed. Underground telephone and telegram lines provided communication between the redoubts and with the hinterland (*Akyuz, 2012*). Another important defence line in the region was “Çakmak Line”. It was constructed as an entrenchment line as a precaution against possible German invasions during the World War II by the government of the period from the Black Sea to Marmara, parallel to the Anastasian Wall and Çatalca Entrenchment Line. It was named “Çakmak Line” after Marshall Fevzi Çakmak, the Chief of General Staff of the period. Çakmak Line was composed of two lines of bunkers, trenches, and outposts starting from Durusu Lake and ending in Büyükçekmece Lake. Some of the bunkers, trenches and outposts are located within the impact area of the North Marmara Motorway route.

13.2.2. Field Survey Findings

The field surveys were conducted in the 400 m study corridor (including the Project construction area) between January 23rd 2017 and March 2nd 2017. Four different definitions for the classification of identified sites have been developed as a result of the observations that were made by taking the surface materials into consideration. The definitions about the sites are presented in Table 13.6.

Table 13.6. Site Definitions According to the Features of the Surface Material

Definition of Site	Type of the Surface Material	Size of the Site Taken into Consideration	Intensity Rate of the Surface Material
Potential Archaeological Site	Ceramic, roof tile, architectural stone block, glass object shards, stone object shards, metal object shards, bone etc.	10x10 m	Between 1-10 pieces (Low Intensity)
Archaeological Site	* Ceramic, roof tile, architectural stone block, glass object shards, stone object shards, metal object shards, bone etc. **Architectural remains, etc.	10x10 m	*Between 10-100 pieces (High Intensity) ** 1 tumulus, 1 wall, 1 cistern, etc.
Historic/ Other Sites	Sites including the remains of Bridge, Redoubt, Blockhouse, Entrenchment, grave etc.		
Registered Sites/ Sites in the Process of Registration	Sites that are protected by the Law no: 2863 or those in the process of being covered by this law.		

In the following paragraphs, the sites which were identified during field surveys are presented in detail by their location. Under the annexes of the Study Report on the Archaeology and Immovable Cultural Heritage presented in Annex-10 of this ESIA Report, locations of the sites are further clarified as one of the follows:

- Within the Project construction area of the Motorway (may be on the main axis or on access road)
- Outside the construction corridor of Motorway but within the 400 m study corridor

Sakarya

The interval between 251+143 km and 215+500 km of the Section 6 of the Project route is located within the provincial borders of Akyazi and Adapazari districts of the Sakarya, as summarized previously in Table 13.1. In total, 8 sites in total were identified in this section of the route. Among those sites, 5 are identified as potential archaeological sites, 2 as archaeological sites and 1 as a historic/other site (see Table 13.7). There is neither a registered site nor a site in registration process in this Section. Further presentation of the findings of the field surveys are provided in the annexes of the Study Report on the Archaeology and Immovable Cultural Heritage presented in Annex-10 of this ESIA Report.

Table 13.7. Archaeological/Immovable Cultural Heritage Sites in the City of Sakarya *(Asian Sections)*

Name of the Site	Registration Status		District/Neighborhood	KM Chainage
	Registered	Non-Registered		
Section 6				
Osmanbey Potential Archaeological Site		x	Akyazı/Osmanbey	250+520-246+827
Cayirlar Locality Archaeological Site		x	Adapazarı/Budaklar	238+720-239+127
Budaklar Potential Archaeological Site		x	Adapazarı/Budaklar	236+747-236+850
Celebiler Potential Archaeological Site		x	Adapazarı/Celebiler	232+970-233+550
Komurluk Modern Cemetery		x	Adapazarı/Komurluk	232+000 access road KM 1+500
Komurluk Potential Archaeological Site		x	Adapazarı/ Komurluk	232+000 access road KM 0+250-1+150
Besihane Potential Archaeological Site		x	Adapazarı/Camyolu	229+000-239+450
Azizbey Hill		x	Adapazarı/ Camyolu	226+550-226+670
Number of Sites	**0**	**8**		

The sites named “Osmanbey” between the 250+520 and 246+827 km points, “Budaklar” between the 236+747 and 236+850 km points, “Çelebiler” between the 232+970 and 233+550 km points, “Kömürlük” between the 0+250-1+150 km points of the access road belonging to the 232+000 km and “Besihane” between the 229+000 and 239+450 km points of the Project route were identified. On the surfaces of all these sites, scant number of ceramic shards from the Late Ottoman Period were observed.

Çayırlar Locality is located between the 238+720 and 239+127 km points of the project route, 2 km east of Budaklar neighbourhood. Ample amount of glazed and non-glazed ceramic shards and two pieces of glass bracelet from the Byzantine Period were encountered on the surface of the site. The site is located within the construction site of the access road at the 238+700 km point. For this reason, archaeological monitoring in the aforesaid kilometre intervals during the project construction activities is suggested as an expert opinion.

There is a “family cemetery” belonging to “Turk” family at 1+500 km point of the access road that is located at the 232+000 km point of the project route. The cemetery is 1 m away from the construction corridor.

Azizbey Hill, which was discovered around the 226+500 kilometre is most possibly a settlement dated to late 19th century and early 20th century. Ceramic and roof tile shards and remains of the stone foundations of a building, which were possibly dated to this period, were encountered on the surface of the site.

Kocaeli

The Project route between 215+500 km point of the Section 6 and 139+500 km point of the Section 4 is located within the provincial borders of Kocaeli, districts of Izmit, Derince, Korfez, Gebze and Dilovasi as summarized previously in Table 13.1. In total, 27 sites were identified alongside this section of the route. Of these sites, 25 were discovered for the first time during the field surveys within the scope of the Project and 2 were cultural sites that were registered by the Ministry of Culture and Tourism. Of the newly discovered 25 sites, 5 are defined as potential archaeological sites, 18 as archaeological sites and 2 as historic/other sites (see Table 13.8). Further presentation of the findings of the field surveys are provided in the annexes of the Study Report on the Archaeology and Immovable Cultural Heritage presented in Annex-10 of this ESIA Report.

Table 13.8. Archaeological/Immovable Cultural Heritage Sites in the City of Kocaeli *(Asian Sections)*

Name of the Site	Registration Status		District/ Neighborhood	KM Chainage
	Registered	Non-Registered		
Section 6				
Süloğlu Bridge		X	İzmit/Akmeşe	214+700
Deredağ Potential Archaeological Site		X	İzmit/Akmeşe	213+750-213+950
Adaparmak Ridge Potential Archaeological Site		X	İzmit/Akmeşe	212+300-212+600
Kabaklı Locality Potential Archaeological Site		X	İzmit/Akmeşe	211+950-212+150
Köprübaşı Hill Potential Archaeological Site		X	İzmit/Akmeşe	210+500-210+550
Mancarcı Locality Potential Archaeological Site		X	İzmit/Mancarcı	199+560-199+780
Gedikli 1 Archaeological Site		X	İzmit/Bayraktar	198+950-199+100
Gedikli 2 Archaeological Site		X	İzmit/Bayraktar	198+600-198+810
Biberoğlu Archaeological Site		X	İzmit/Bayraktar	197+970-198+060
İğriköz Creek Archaeological Site		X	İzmit/Bayraktar	197+560-197+640
Doruk Archaeological Site		X	İzmit/Eseler	195+700-196+000
Kesimahlar Archaeological Site		X	İzmit/Çayırköy	195+000 access road km 1+000
Solaklar Archaeological Site		X	İzmit/Eseler	193+460-194+000
Çayırköy Archaeological Site		X	İzmit/Çayırköy	192+300-192+500
Kocaeli RBCCA Registered Site No: 1	x		İzmit/Çayırköy	192+000 on the Access Road
Section 5				
Toylar Archaeological Site		X	Körfez/Toylar	174+150-174+370
Sipahiler 1 Archaeological Site		X	Körfez/Sipahiler	171+690-171+850
Sipahiler 2 Archaeological Site		X	Körfez/Sipahiler	171+220-171+330
Kocadere Archaeological Site		X	Körfez/Sipahiler	170+000-170+100
Martılar Archaeological Site		X	Körfez/Martılar	169+000 Access road km 41+750+ 42+800
Yağcılar Historic Road Remains (Kocaeli RBCCA Registered Site No: 2)	x		İzmit/Yağcılar	161+800
Section 4				
Demirciler Archaeological Site		X	Dilovası/Demirciler	150+000 access road km 1+200
Uluyan 1 Archaeological Site		X	Gebze/Denizli	149+950-150+000
Uluyan 2 Archaeological Site		X	Gebze/Denizli	149+700-149+850
Karapınar (Molla Fenari) Archaeological Site		X	Gebze/Molla Fenari	147+550- 147+900
Cumaköy Cemetery		X	Gebze/Cumaköy	145+750
Kuzgunçay Tumulus		X	Gebze/Cumaköy	144+100
Number of Sites	**2**	**25**		

Süloğlu Bridge is located nearby 214+700 km point of the Project, 4 km west of Akmeşe Atatürk neighbourhood near the provincial borders of Kocaeli and Sakarya. Some of the piers of the bridge are demolished and sunken in the creek. Remains of a masonry stone wall belonging to the bridge were discovered in the North bank of the creek. Moreover, remains of a retaining wall, which was probably built to prevent floods damaging the bridge by decreasing their magnitude, were discovered in the southern bank of the creek. Although no information on the bridge could be retrieved from relevant sources, with respect to its architectural properties, it was dated to the late 19th century and early 20th century. Between the 213+750 and 213+950 km points of the project route the site named "Deredağ", between the 212+300 and 212+600 km points "Adaparmak", between 211+950 and 212+150 km points "Kabaklı", 210+500 and 210+550 km points "Köprübaşı" and between 199+560 and 199+780 km points "Mancarcı" were discovered. Ample amount of roof tile shards and small quantity of ceramic shards from the Late Ottoman Period were encountered on the surfaces of these sites. Apart from these, no architectural remains were detected in these sites. This situation points to the probability of use of wooden architecture in these sites.

The site named Gedikli 1 is located between 198+950 and 199+100 km points of the Project route. The site is composed of three different hills. Plenty of ceramic and roof tile shards were discovered on the surface of the site. Gedikli 2, on the other hand, is located between the 198+600 and 198+810 km points of the project route. Ample number of ceramic shards and roof tile belonging to the ancient period were observed on the surface of the site. Plenty of ceramic and roof tile shards were observed on the surface of Biberoğlu archaeological site, which is located between the 197+970 and 198+060 km points of the project route. Similar to other sites, ample amount of ceramic, and roof tile shards were encountered on the surface of Solaklar site, which is located between 193+460 and 194+000 km points of the project route. Additionally, some cut stone, which might belong to the buildings, were observed. The ceramics encountered on the surface of the site are most probably dated to the Byzantine Period. Human bones, mineral cinders and a bronze coin from the Roman Period were also discovered on the surface of the site. The legend of the coin reads "Caesar Augustus". The coin was delivered to the Directorate of Kocaeli Archaeology and Ethnography Museum on February 3rd 2017 against a document of receipt (see Annex-10).

İğriköz Creek is located between the 197+560 and 197+640 km points of the Project route. Plenty of ceramic bowl and roof tile shards, which exhibited the features of the Late Roman Period, were observed on the surface of the site. On the other hand, on the surface of Doruk archaeological site, which is located between 195+700 and 196+000 km points of the project route, glazed ceramics and capstones for graves that are dated to the Byzantine Period were encountered. Kesimahlar archaeological site is, on the other hand, located on the 1st km of the access road at the 195+000 km of the project route. Human carved rock surfaces, rows of stone foundation walls belonging to buildings, ample amount of ceramic, and roof tile shards that are dated to the Roman or Byzantine Period were observed on the surface of the site. Çayırköy, another archaeological site, is located between 192+300 and 192+500 km points of the Project route. Pieces of terracotta water pipe roof tile and ceramic shards were observed on the surface of the site. Some of the ceramic shards were glazed and dated to the Byzantine Period. There is a well in the southwest of the site.

Glazed and non-glazed ceramic and roof tile shards dated to the Byzantine Period were discovered on the surfaces of the archaeological sites of “Toylar” which is located between the 174+150 and 174+370 km points and Sipahiler 1, which is located between the 171+690-171+850 km points of the project route. Furthermore, on the surface of Kocadere archaeological site, which is located between the 170+000 and 170+100 km points of the project route, plenty of glazed and non-glazed ceramic and roof tile shards, which are dated to the Byzantine Period, were observed. Moreover, mineral cinders were also encountered on the surface of the site. Martılar archaeological site is located between the 41+750 and 42+800 km points of the access road that is situated at the 169+000 km point of the project route. Ceramic shards and roof tiles dated to the Byzantine Period were observed on the surface of the site. Moreover, sarcophagi and column parts from the Roman Period, which were used as spolia, were encountered in the Martılar Village that covers the site.

Demirciler archaeological site is located within the construction impact area at the 1+200 km point of the access road nearby the 150+000 km point of the project route. Illegal excavation pits were observed in the northwestern part of the site. Around one of these pits, architectural cut stones and some ceramic and roof tile shards were encountered. The site of Uluyan 1, which is located between 149+950 and 150+000 km points of the project route, is probably a “tumulus” type monumental grave. Roof tile and ceramic shards were observed on the surface of the site. It was noted that the top part of the site was damaged as a result of illegal excavations. Uluyan 2 is located nearby the site of Uluyan 1, between 149+700 and 149+850 km points of the project route. On the surface of the site, which is located within the construction corridor, ample amount of roof tiles and remains of foundations of buildings were observed. On the other hand, in the site of Karapınar (Molla Fenari), which is located between the 147+550 and 147+900 km points of the project route, plenty of ceramic shards, remains of a historic road, remains of foundations that were built with brickdust mortar and plenty of roof tiles were encountered. Kuzgunçay Tumulus was identied at the 144+100 km point of the project route, within the construction impact area. There are illegal excavation pits on the tumulus.

The information about the sites was evaluated by Kocaeli Regional Board for Conservation of Cultural Assets and with decision no: 2887 dated March 21st 2017, the council decided to conduct excavation, test pit and geophysical studies under the supervision of the Kocaeli Archaeological Museum at the archaeological sites of Gedikli 2, Biberoğlu, Solaklar, Sipahiler 1, Sipahiler 2 and Karapınar (Molla Fenari).

The sites of Deredağ, Adaparmak, Kabaklı, Köprübaşı Tepesi, Mancarcı Mevkii, Gedikli 1, Toylar, Martılar, Uluyan2, Süloğlu Köprüsü, İğriköz Deresi, Doruk, Kesimahlar, Çayırköy, Kocadere, Demirciler and Uluyan; and any physical intervention should be avoided in the Süloğlu Köprüsü, İğriköz Deresi, Doruk, Kesimahlar, Çayırköy, Kocadere, Demirciler and Uluyan archaeological sites are located outside of the Project construction area and within 400 m study corridor.

Cumaköy Cemetery, where graves from the 18th and 19th centuries are located was identified during the studies at the 145+750 km point of the Project route. The cemetery is located within the study corridor and outside of the Project construction area.

There are also two sites, which were previously registered by Kocaeli Regional Board for Conservation of Cultural Assets, in the part of the project remaining within the provincial borders of Kocaeli. Of these sites, the first one is the remains of a "water channel" located in the impact corridor of the access road at 192+000 km point of the project route within the borders of Çayırköy Neigbourhood of Izmit District, Kocaeli.

Another registered site on the Project route is "Yağcılar Historic Road Remains 1st Degree Archaeological Site", which is located between 161+850 and 161+900 km points. The historic site is located in the Project construction area.

Istanbul

There are 4 sites identified on this section of the Project route within the 400 m study corridor. All these sites were discovered for the first time during the field surveys within the scope of the Project, of which 3 are defined as archaeological sites and 1 as potential archaeological site (see Table 13.9). Further presentation of the findings of the field surveys are provided in the annexes of the Study Report on the Archaeology and Immovable Cultural Heritage presented in Annex-10 of this ESIA Report.

Table 13.9. Archaeological/Immovable Cultural Heritage Sites in the City of Istanbul *(Asian Sections)*

Name of the Site	Registration Status		District/ Neighborhood	KM Chainage
	Registered	Non-Registered		
Section 4				
Akfırat III Archaeological Site		x	Tuzla/Akfırat	138+900-139+180
Akfırat I Archaeological Site		x	Tuzla/Akfırat	135+500-135+900
Akfırat II Archaeological Site		x	Tuzla/Akfırat	135+190-135+450
Tepeören Potential Archaeological Site		x	Tuzla/Tepeören	134+390-134+480

Akfırat III archaeological site is located between the 138+900 and 139+180 km points, Akfırat II is located between 135+190-135+450 km points, and Akfırat I is located between 135+500-135+900 km points of the Project route. On the surfaces of all sites, ceramic and roof tile shards, which were dated to the Byzantine Period, were observed. In addition, architectural building stones were encountered in the site of Akfırat III. Akfırat I is located within the project impact are while Akfırat III and II are located within the Project construction area.

13.3. Potential Impacts

The North Marmara Motorway Project may interact with the registered or non-registered archaeological assets and immovable cultural heritage located along the Motorway route or its surroundings during the land preparation and construction phase. Potential impacts of the Project on these components are assessed in the following sections.

13.3.1. Land Preparation and Construction Phase

As a result of field surveys, presence of 39 sites within the 400 m study corridor of the Project route was identified. Among these, 37 new sites, which are not recorded (non-registered sites) in the inventories of relevant Regional Boards for Conservation of Cultural Assets, working with the Ministry of Culture and Tourism, were discovered during the field survey. During the desktop research, the information retrieved from the conservation boards were studied and 2 sites, which are registered or in registration process by the conservation boards were identified. Numerical distribution of the sites, which were identified within the 400 m study corridor are presented in the Table 13.10.

Table 13.10. Distribution of Sites within the 400 m Study Corridor

Section	Registered Sites/Sites in the Process of Registration	Unregistered Sites			Total Number of Sites
		Potential Archaeological Site	Archaeological Site	Historic/Other Site	
4	0	1	8	1	10
5	1	0	5	0	6
6	1	10	10	2	23
Total	**2**	**11**	**23**	**3**	**39**

Among the 39 sites located within the study corridor, 25 sites correspond to Project construction area. These sites may be directly affected by the activities. Numerical distribution of the sites, which are located within the Project construction area, is given in Table 13.11.

Table 1.11. Distribution of Sites that Correspond to Project Construction Area

Section	Registered Sites/Sites in the Process of Registration	Unregistered Sites			Total Number of Sites
		Potential Archaeological Site	Archaeological Site	Historic/Historic/ Another Site	
4	0	0	5	0	5
5	1	0	4	0	5
6	0	9	6	0	15
Total	**1**	**9**	**15**	**0**	**25**

The adverse impact of the construction activities on the archaeological and cultural heritage sites which are located within the Project construction corridor and study corridor were assessed considering sizes of the identified sites and the size of the sections which may be damaged as the result of construction activities in reference to the Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (HIACWHP) (*ICOMOS, 2009*). Detailed outcomes of this assessment are presented in the annexes of the Study Report on the Archaeology and Immovable Cultural Heritage is presented in Annex-10.

In the assessment done according to ICOMOS (2009), the scale and severity of the change/impact and value of the heritage sites have been evaluated in accordance with the criteria described in Chapter 4 (“ESIA Methodology”).

Archaeological Modeling

During the field surveys conducted within the 400 m study corridor, Archaeological Potential Modeling was conducted on the areas where field walking method could not be followed due to certain reasons. The probabilities of existence of archaeological or immovable cultural heritage assets, which were estimated as the result of the modeling studies are presented in the Table 13.12.

Table 13.12. Potential Archaeological Risk Scales for Not Surveyed Sections of the Study Corridor

Start KM	End KM	Risk Scale
Section 4		
137+000	138+000	Low
141+500	144+500	Low
146+500	147+000	Low
148+500	149+000	Low
Section 5		
150+500	160+500	Low
160+500	161+500	Very High
161+500	163+500	Moderate
163+500	165+500	Low
165+500	166+000	Moderate
166+000	167+500	Low
167+500	168+000	Moderate
168+000	169+500	Low
169+500	171+000	Moderate
173+500	174+500	Moderate
179+500	188+500	Low
188+500	189+000	Moderate
189+000	190+000	Low
190+000	191+000	Moderate
191+000	191+500	High
191+500	192+000	Very High
192+000	192+500	Low
Section 6		
200+000	200+500	Very High
200+500	202+000	Low
202+000	204+000	Moderate
204+000	204+500	Low
204+500	206+000	Moderate
206+000	206+500	Low
206+500	207+500	Moderate
207+500	208+000	Low

Start KM	End KM	Risk Scale
213+500	214+000	Low
214+700	215+250	Low
215+600	216+600	Moderate
216+600	217+600	High
217+600	218+100	Moderate
218+100	218+600	Low
219+000	219+500	Low
220+000	220+500	Moderate
220+500	221+500	Moderate
222+000	222+500	Low
222+500	223+500	Moderate
223+500	225+500	Low
225+500	226+000	Moderate
226+000	226+500	Low
228+000	228+500	Moderate
229+000	229+500	Low
229+500	230+000	High
232+000	233+000	High
234+000	236+000	Moderate
239+000	239+500	Moderate
239+500	240+500	High
240+500	242+000	Moderate
242+000	242+500	High

13.3.2. Operation Phase

In the operation phase of the Project, no significant risks or impact is anticipated on the cultural heritage sites. On the other hand, it is anticipated that the cultural heritage sites located in the vicinity of the Motorway route are likely to gain increased access with the operation of the Motorway.

13.4. Mitigation Measures

Mitigation measures will be taken for the sites identified during the ESIA studies in order to avoid and/or minimize the adverse impacts of the Project on those sites. General mitigation measures to be taken for different types of sites are listed in Table 13.13. In addition, requirements of the Regional Board for Conservation of Cultural Heritage mentioned in their decisions/official views (i.e. additional research) given for the Project in the scope of the Law No: 2863 will also be complied with regarding the sites to be potentially affected.

Table 13.13. Mitigation Methods to be Applied for Different Types of Archaeological/Cultural Heritage Sites

Definition of Site	Location		General Mitigation Methods
	Within 400 m	Within Project Construction Area	
Registered Sites/ Sites in the Process of Registration	2	1	-Following the decisions of the Conservation Board -Avoiding physical intervention -Archaeological Monitoring
Archaeological Site	23	15	-Archaeological Monitoring -Following the decisions of the Conservation Board -Avoiding physical intervention -Test or salvage excavation
Potential Archaeological Site	11	9	-Archaeological Monitoring
Historic/ Other Sites	3	0	-Archaeological Monitoring -Following the decisions of the Conservation Board -Avoiding physical intervention

In compliance with the legislation, the information about the archaeological and historic sites on the Project route and within the 400 m study corridor, which was collected as a result of field surveys, was delivered to relevant conservation boards and the official decision processes for these sites were started. In this respect, all field data were delivered to the Kocaeli Regional Board for Conservation of Cultural Assets and Istanbul Regional Board No:5 for Conservation of Cultural Assets through KGM's 1st Regional Directorate Immediately after the delivery of field data to the conservation boards, additional field surveys were planned together with Kocaeli Regional Board for Conservation of Cultural Assets and these surveys were realized between March 8th 2017 and March 9th 2017.

Archaeological monitoring will be conducted at site located within the Project construction area or 400 m study corridor. For the cemeteries/graves corresponding to the route, physical intervention will be avoided where possible. If physical intervention is inevitable, the graves will be moved to a suitable place in accordance with legal procedures and religious customs, and archaeological monitoring will be conducted around the site during the construction activities.

Besides the sites identified during the field surveys, the sites, which were marked "Very High, High and Moderate Risk" as a result of the Archaeological Modeling Study have been considered to have high the probability of encountering with chance finds. Numerical distribution of these sites assigned with high probability is listed in Table 13.14 (see Table 13.12 for KM chainage of the sites). Cultural Heritage Management Plan and Chance Find Procedures will be followed especially at these sites during the construction activities.

Table 13.14. Sites for which High Probability of Encountering Chance Finds is Foreseen according to Archaeological Modeling

Section	Number of Sites with Corresponding Probability Level			Total Number of Sites	Mitigation Methods
	Moderate	High	Very High		
Section 1	6	0	0	6	Implementation of Cultural Heritage Management Plan Implementation of Chance Finds Procedure
Section 2	4	1	1	6	
Section 7	1	2	0	3	

13.5. Summary of Assessment and Residual Impacts

The studies conducted by cultural heritage experts have identified several new unregistered sites in addition to the known registered sites. With effective implementation of the mitigation measures for conservation of these sites in accordance with this ESIA, it would be possible to reduce the significance of impacts to generally low levels. Cooperation with the regional conservation boards, implementation of Cultural Heritage Management Plan and Chance Finds Procedure and archaeological monitoring to be done by experts to be hired by the Project during the land preparation and construction phase is crucial for management of cultural heritage corresponding to the Motorway route. The Project has already identified important sites. With the process to be conducted with the authorities, the Project is likely to contribute to cultural and archaeological inventory of Turkey with these new archaeological findings by shedding light on the still less known past of the region. Overall, the Project would be a benefit contributing to the cultural and archaeological inventory of the country with the implementation of ESIA measures.

The Project is likely to contribute to cultural and archaeological inventory of Turkey with possible new archaeological findings by shedding light on the still less known past of the region within the framework of interdisciplinary archaeological studies by implementing appropriate techniques and methods so that the Project will be a benefit contributing to the cultural and archaeological inventory of the country. Table 13.15 provides a summary of the assessments on archaeological and immovable cultural heritage.

Table 13.15. Summary of the Assessments on Archaeological and Immovable Cultural Heritage

Affected Ecosystem Component	Definition of Impact	Type	Archaeological/Historical Site Name	Registration Status				Motorway KM	Impact Magnitude						Sensitivity/ Value of the Resource/ Receptor	Impact Significance (Before Mitigation)	Measures to be Taken					Significance of Residual Impacts
				Registered	Unregistered				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude			Test or Salvage Excavation	The Decisions of the Conservation Board Should be Followed	Archaeological Monitoring	Physical Intervention Avoided	Removal to Another Place	
					Archaeological Site	Potential Archaeological Site	Historic/ Other Sites															
Archaeological and immovable cultural heritage	Damage to archaeological and immovable cultural heritage due to land preparation and construction activities	Adverse	Osmanbey Potential Archaeological Site			x		250+520-246+827	Restricted	Short	Low	Irreversible	One-off	Moderate	Low	Low (B1)			x			Low
			Çayırlar Archaeological Site		x			238+720-239+127			Low			Moderate	Low	Low (B1)			x			Low
			Budaklar Potential Arch. Site			x		236+747-236+850			Medium			Moderate	Low	Low (B1)			x			Low
			Çelebiler Potential Arch. Site			x		232+970-233+550			Medium			Moderate	Low	Low (B1)			x			Low
			Kömürlük Modern Cemetery				x	232+000; 1+500			Low			Moderate	Low	Low (B1)			x	x		Low
			Kömürlük Potential Archaeological Site			x		232+000; 0+250-1+150			Low			Moderate	Low	Low (B1)			x			Low
			Besihane Potential Arch. Site			x		229+000-239+450			Medium			Moderate	Low	Low (B1)			x			Low
			Azizbey Tepesi Arch. Site		x			226+550-226+670			Low			Moderate	Low	Low (B1)			x	x		Low
			Süloğlu Bridge				x	214+700			Low			Moderate	Low	Low (B1)			x	x		Low
			Deredağ Potential Arch.Site			x		213+750-213+950			Medium			Moderate	Low	Low (B1)			x			Low
			Adaparmak Sırtı Potential Archaeological Site			x		212+300-212+600			Low			Moderate	Low	Low (B1)			x			Low
			Kabaklı Mevkii Potential Archaeological Site			x		211+950-212+150			High			Major	Low	Medium (A1)			x			Medium
			Köprübaşı Tepesi Potential Archaeological Site			x		210+500-210+550			High			Major	Low	Medium (A1)			x			Medium
			Mancarcı Mevkii Potential Archaeological Site			x		199+560-199+780			High			Major	Low	Medium (A1)			x			Medium
			Gedikli 1 Archaeological Site		x			198+950-199+100			Medium			Moderate	Low	Low (B1)			x			Low
			Gedikli 2 Archaeological Site		x			198+600-198+810			High			Major	Low	Medium (A1)	x	x				Medium
			Biberoğlu Archaeological Site		x			197+970-198+060			High			Major	Low	Medium (A1)	x	x				Medium
			İğriköz Creek Arch. Site		x			197+560-197+640			Low			Moderate	Low	Low (B1)			x	x		Low
			Doruk Archaeological Site		x			195+700-196+000			Low			Moderate	Low	Low (B1)			x	x		Low
			Kesimahlar Arch. Site		x			195+000; 1+000			Low			Moderate	Low	Low (B1)			x	x		Low
			Solaklar Archaeological Site		x			193+460-194+000			Medium			Moderate	Low	Low (B1)	x	x				Low
			Çayırköy Arcchaeological Site		x			192+300-192+500			Low			Moderate	Low	Low (B1)			x	x		Low
			Kocaeli RPBCA Registered Archaeological Site 1	x			x	192+000 On Access Road			Low			Moderate	High	High (B3)			x	x		Low
			Toylar Archaeological Site		x			174+150-174+370			High			Major	Low	Medium (A1)			x			Medium
			Sipahiler 1 Archaeological Site		x			171+690-171+850			Medium			Moderate	Low	Low (B1)	x	x				Low
			Sipahiler 2 Archaeological Site		x			171+220-171+330			Medium			Moderate	Low	Low (B1)	x	x				Low
			Kocadere Archaeological Site		x			170+000-170+100			Low			Moderate	Low	Low (B1)			x	x		Low
			Martılar Archaeological Site		x			169+000; 41+750+42+800			Low			Moderate	Low	Low (B1)			x			Low
			Kocaeli RPBCA Yağcılar Ancient Road Remains	x			x	161+800			Low			Moderate	High	High (B3)		x	x			High
			Demirciler Archeaological Site		x			150+000; 1+200			Low			Moderate	Low	Low (B1)			x	x		Low
			Uluyan 1 Archaeological Site		x			149+950-150+000			Low			Moderate	Low	Low (B1)			x	x		Low
			Uluyan 2 Archaeological Site		x			149+700-149+850			Medium			Moderate	Low	Low (B1)			x			Low
			Karapınar (Molla Fenari) Archaeological Site		x			147+550- 147+900			High			Major	Low	Medium (A1)	x	x				Medium
			Cumaköy Cemetery				x	145+750			Low			Moderate	Low	Low (B1)			x	x		Low
			Kuzgunçay Tumulus		x			144+100			Low			Moderate	Low	Low (B1)			x	x		Low
			Akfırat 3 Archaeological Site		x			138+900-139+180			Low			Moderate	Low	Low (B1)		x	x	x		Low
			Akfırat 1 Archaeological Site		x			135+500-135+900			Low			Moderate	Low	Low (B1)			x	x		Low
			Akfırat 2 Archaeological Site		x			135+190-135+450			Medium			Moderate	Low	Low (B1)		x	x	x		Low
			Tepeoren Potential Archaeological Site			x		134+390-134+480			Medium			Moderate	Low	Low (B1)			x			Low

CHAPTER 14

SOCIO-ECONOMIC ENVIRONMENT

CHAPTER 14. SOCIO-ECONOMIC ENVIRONMENT

In this section, the potential impacts of the motorway project on socio-economic environment of the region are assessed. Within this scope, the construction and operation phases of the motorway are taken into consideration and impacts are evaluated separately. For the assessment of impacts on socio-economic environment, desktop and field studies were performed. This chapter includes the following:

- Assessment methodology and data sources;
- Baseline conditions of the socio-economic environment
- Potential social impacts of the proposed project
- Mitigation measures
- Summary of Assessment and Residual Impacts

14.1. Assessment Methodology and Data Sources

14.1.1. Significance Criteria

The significance criteria for the impacts on socio-economic environment will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 (“ESIA Methodology”) will be used for the determination of the magnitude of impact on the socio-economic environment, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 14.2.

Detailed explanation of the sensitivity components for each ecosystem component is provided in the following “Baseline Conditions” section.

Evaluation of magnitude of impacts was based on the baseline conditions of the affected area and expert judgment (see Table 14.1.).

Table 14.1. Impact Magnitude Criteria

Affected Ecosystem Component	Definition of Impact	Magnitude of Impact
Livelihood and Economic and Physical Displacement	Effects on livelihood from agricultural activities / Physical displacement	Low (Section 4; Section 5: (KM 151+100 – KM 166+600; KM 175+500 – KM 188+300); Section 6: (KM 200+600 – KM 211+200)
		Medium (Agricultural areas that will be affected by the Project)
		High (Physical displacement up to 5 households in a single settlement)
	Effects on livelihood from livestock activities	Low (affected area of the pasture parcel is less than 10% of the entire parcel area) Karakamis - Section 6
		Medium (distance of the construction zone to the settlements is ≤500m) Section 5 (Sevindikli, Karayakuplu, Sipahiler, Toylar, Sepetci Neighborhoods Section 6 (Cayirkoy, Durhasan, Eseler, Bayraktar, Karabdulbaki, Suleymaniye, Akmese Ataturk, Besevler, Celebiler, Kasimlar, Cerciler, Haciramazanlar, Budaklar, Kizilcikorman, Osmanbey, Vakif and Topagac Neighborhood)
		High (affected area of the pasture parcel is more than 25% of the entire parcel area) Celebiler Neighborhood – Section 6
Infrastructures and Distribution of Utility Services	Effects on traffic and mobility	Low
	Effects on infrastructures and utility services	Low
Demographic Structure of Settlements	Influence on local communities	Low
Employment Opportunities	Opportunities for local economy	Medium
Increase of Tensions in the Local Community	Increase of Tensions and Conflicts	Low

Table 14.2. Criteria for Sensitivity/Value of Resource/Receptor

Affected Ecosystem Component	Definition of Impact	Sensitivity Criteria	Sensitivity/Value Level		
			High (3)	Medium (2)	Low (1)
Livelihood and Economic and Physical Displacement	Effects on livelihood from agricultural activities	• Settlements where agriculture is one of the main source of income • Settlements where access to agricultural areas will be restricted due to the Project • 10% of the total agricultural lands of the settlements will be affected by the Project	3 Item	2 Item	0-1Item
	Effects on livelihood from livestock activities	• Settlements where livestock is one of the source of income • Settlements where beekeeping is one of the source of income • Settlements where access to pasture lands will be restricted due to the Project	3 Item	2 Item	0-1Item
Infrastructures and Distribution of Utility Services	Effects on traffic and mobility	• Settlement with a population ≥ 500 inhabitant • Settlements with single road access • Settlements benefiting from mobile schooling • Settlements with difficulties in access in winter	4 Item	2-3 Item	0-1 Item
	Effects on infrastructures and utility services	• Settlements with no municipal water supply • Settlements with electric cuts • Settlement with no sewage system	3 Item	2 Item	0-1Item
Demographic Structure of Settlements	Influence on local communities	• Settlements experiencing out-migration or in-migration • Women ratio is above 52% • Presence of tensions and conflicts in the settlement	3 Item	2 Item	0-1Item
Employment Opportunities	Opportunities for local economy	• Settlements with a population ≥ 500 inhabitant • Presence of industrial facilities within the 5 km buffer • Presence of organized industrial zones within the 5 km buffer • Settlements where unemployment is a major problem	4 Item	2-3 Item	0-1 Item
Increase of Tensions in the Local Community	Increase of Tensions and Conflicts	• Presence of tensions and conflicts in the settlement • Presence of minorities • Women ratio is above 52%	3 Item	2 Item	0-1Item

14.1.2. Data Sources

Objective of the socioeconomic field survey (conducted on 17-28 January, 2017); is to determine Project affected area depending on land acquisition; to identify current socioeconomic characteristics of the settlements. In this context it is also aimed to provide database of measures and management implementations in order to assess possible social and economic impacts, and to prevent adverse impacts on socioeconomic living conditions in the settlements

Socioeconomic investigations consisted of two main components, namely the desktop studies and field studies. In this extent, firstly, information on the impact area and the settlements (e.g. land use, population information etc.) was gathered from available information sources (e.g. information from TUIK) and later, to plan the field surveys, this information was used together with the information obtained from site visit conducted along the planned motorway route on 22-24 November 2016.

Two main tools used survey for quantitative and qualitative data collection during the socioeconomic survey is described in Table 14.3. Additional tools such as land and structure inventories were used as well.

Table 14.3. Data Collection Tools

Tools	Description
Key Informant Questionnaires	The key informant questionnaires were considered as supporting tools for information collection, aimed at making the information gathered during the entire research more comprehensive and rich. In this regard, key informant questionnaires provided a basis for checking the information obtained from other methods of data collection. This way, the reliability of information collected by other methods was ensured. In addition, key informant questionnaires were used to obtain preliminary information that is useful for application of other data collecting methods. Within the scope of the Project in total, the key informant questionnaires were applied in 18 neighborhoods (Kurnakoy, Tepeoren, Demirciler, Kutluca, Karayakuplu, Sipahiler, Cayirkoy, Eseler, Karaabdulbaki, Suleymaniye, Korucuk, Taskisigi, Camyolu, Celebiler, Budaklar, Kizilcikorman, Osmanbey and Topagac Neighborhoods) that are likely to get affected by the Project. Main topics of the key informant questionnaires are listed below: • Population and Demographic Profile • Socioeconomic Conditions • Agriculture and Livestock • Infrastructure Services • Health/Education • Issues Related with Settlements • Perceptions on the Project
Focus Group Meetings	Focus group meetings are detailed interviews conducted with selective groups in accordance with an objective. The main purpose of the focus group meeting is to identify priorities and necessities of PAPs and vulnerable groups and also to identify direct and indirect effects of the Project. Five focus group meetings were applied in four neighborhoods (Suleymaniye, Kutluca, Taskisigi, and Karayakuplu Neighborhoods) with men and women separately when possible. These meetings, which are important for taking stakeholders' thoughts, were applied by meeting moderator and an assistant.

Sample photographs from the survey are presented in between Photograph 14.1 and Photograph 14.6. Additionally, a map shows the locations where social field survey and public consultation meetings were held is given in Figure 14.1

Photograph 14.1. Key Informant Meeting with Budaklar Neighborhood Headmen

Photograph 14.2. Key Informant Meeting with Suleymaniye Neighborhood Headmen

Photograph 14.3. Key Informant Meeting with Eseler Neighborhood Headmen

Photograph 14.4. Key Informant Meeting with Demirciler Neighborhood Headmen

Photograph 14.5. Focus Group Meeting with Suleymaniye Neighborhood Residents

Photograph 14.6. Focus Group Meeting with Karayakuplu Neighborhood Residents

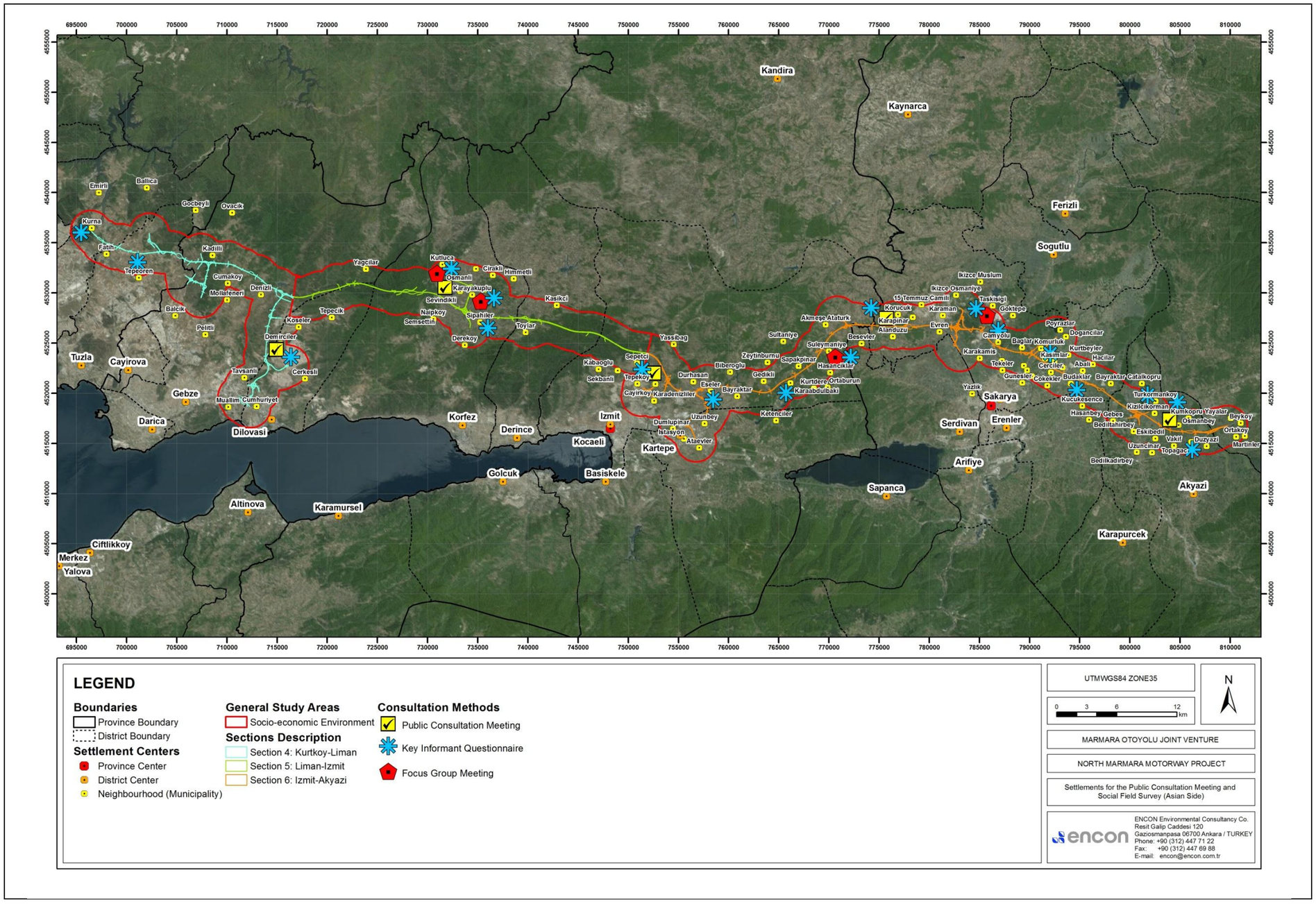


Figure 14.1. Map of Social Field Survey and Public Consultation Meetings Locations

14.2. Baseline Conditions

Economy

Istanbul Province

Istanbul is a city in Eurasia, comprising the Bosphorus (which separates Europe and Asia) between the Sea of Marmara and the Black Sea. Its commercial and historical center lies on the European side and about a third of its population lives on the Asian side. The city is the administrative center of the Istanbul Metropolitan Municipality, both hosting a population of around 14.8 million residents and is one of the most populous city in the world.

Specific indicators for the socioeconomic development level of Istanbul are presented in Table 14.4. As seen in the table, the number of automobiles per thousand people is the highest indicator of the socioeconomic development level in Istanbul. Istanbul ranks 7th in terms of the average number of automobiles per thousand people which is 152 and Istanbul is also significantly higher than the average number of Turkey which is 121 people (among 81 province) Other important indicator of Istanbul is the total electricity consumption per person which is 2,388 KWh. Istanbul ranks 31 with related indicator in Turkey.

Table 14.4. Indicators for Development Level of Istanbul *(TurkStat, 2013)*

Indicators of Development Level	Turkey	Istanbul	Ranking of the Province Among the Country
Total Electricity Consumption per Person , 2012 (KWh)	2,577	2,388	31
Net Schooling Rate in Secondary School, 2013-2014 (%)	75.7	81.6	39
Level of Happiness by Provinces*, 2013 (%)	59.0	58.4	50
Number of Automobiles per thousand People (2013)	121	152	7
Treated Water Consumption per Person, 2012 (Liter)	216	186	66
Number of Hospital Beds per Hundred Thousand People (2012)	265	233	48

**Note:* Level of Happiness by Provinces is the proportion of surveyed population who declared that they are happy

Trade has the biggest share within the annual revenue of Istanbul and the Bosphorus Bridge has a great contribution in terms of development of the trade sector as well as railways, international ports and airports located within the Province. Initial factories in Istanbul were established along with the Golden Horn during the time of industrialization together with the establishment of the Republic. However, due to the pollution and turmoil they created within city, they were moved to the Organized Industrial Zones situated outside of the Province. Ataturk Auto Industry Site and Ikitelli Organized Industrial Zone are the biggest industrial areas in Istanbul. However, due to the unavoidable expansions of the urban settlements, these facilities have remained among the settlements today. Apart from the industrial facilities, headquarters of all the private banks that serve in Turkey, national newspapers, television channels, transportation companies and publishing houses are located in Istanbul.

Despite the relative recession in Turkish industry since 1980s, Istanbul's contribution to finance, especially construction, commerce, housing and other service sectors, has always been between 20% and 25% share in Turkey's national income since 1960s (Istanbul Metropolitan Municipality website. http://www.ibb.gov.tr).

According to nomenclature of units for territorial statistics, Istanbul province is named as TR10 Level 2 territory. According to the "Selected Indicators for Istanbul 2013" which was published by TurkStat in 2013, the number of people who are working in industrial and service sector in Istanbul was comprised 23.7% of the total working population (in these sectors) of Turkey in 2013.

In Istanbul, the unemployment rate has shown a steady decrease after 2008, from 16.8% in 2009 down to 11.2% in 2013. Between 2007 and 2012, the province has secured 4 million jobs (ISTKA, 2013). However, youth unemployment is still high in the province, with 19.2% in 2012 (EUROSTAT, 2015). The distribution of employment by sector in Istanbul is as follows: agriculture (0.5%), industry (39.8%) and services (59.7%). According to the Turkish Statistical Institute 2012, 2.6 million people are working as white-collar workers and 1.9 million people as blue-collar workers.

Table 14.5. presents labor force and employment data by age group in Istanbul Province for the year 2013. The percentage of labor force and employment rates is high in the 25-34 age group, while unemployment rate is high in the 15-19 age group.

Table 14.5. Labor and Employment Data for Istanbul (TurkStat, 2013)

Age Group	Unemployed (%)	Labour Force (%)	Employment Rate (%)
15-19	20.5	25.2	20.0
20-24	18.6	59.5	48.5
25-34	9.9	70	63.1
35-54	9.2	60.9	55.3
55+	12.3	14.1	12.4

Kocaeli Province

Specific indicators for the socioeconomic development level of Kocaeli are presented in Table 14.6. As seen in the table, total electricity consumption per person is the highest indicator of the socioeconomic development level in Kocaeli where the town ranks second in this field. Additionally, the Province ranks 20th in terms of the net schooling rate in secondary school which is 86.2 and Kocaeli is also significantly higher than the average rate of Turkey which is 75.7.

Table 14.6. Indicators for Development Level of Kocaeli *(TurkStat, 2013)*

Indicators of Development Level	Turkey	Kocaeli	Ranking of the Province Among the Country
Total Electricity Consumption per Person , 2012 (KWh)	2,577	7,268	2
Net Schooling Rate in Secondary School, 2013-2014 (%)	75.7	86.2	20
Level of Happiness by Provinces*, 2013 (%)	59.0	57.2	57
Number of Automobiles per thousand People (2013)	121	99	44
Treated Water Consumption per Person, 2012 (Liter)	216	251	25
Number of Hospital Beds per Hundred Thousand People (2012)	265	238	44

**Note:* Level of Happiness by Provinces is the proportion of surveyed population who declared that they are happy

Industry has the biggest share within the annual revenue and Province's economy is built on its industry, as it contributes on its own to 13% of Turkey's manufacturing industry production.

Currently 2,200 important industrial companies, including 252 foreign-owned accounts, are based in Kocaeli. Additionally, 26 companies of the 100 biggest companies of Turkey are based in Kocaeli and 87 companies from Kocaeli are in the country's top 500 list. Another important aspect of the city is that 12.4 % of Turkey's tax revenues come from the industry in Kocaeli. The tax revenues generated in Kocaeli are equal to the resources provided by 73 other Turkish cities (http://www.gr-businessdays.com).

Furthermore, Kocaeli has a significant potential in terms of foreign trade. In 2013, the exportation amounted to 18.421 billion USD, whereas importations of 51.457 billion USD were realized. These values can be explained by the shipping facilities that available in Kocaeli. The companies located in Kocaeli can deliver their products all over the world through its ports, special piers, motorway and railway infrastructures.

According to nomenclature of units for territorial statistics, Kocaeli province is named as TR42 Level 2 territory. According to the "Selected Indicators for Kocaeli 2013" which was published by TurkStat in 2013, the number of people who are working in industrial and service sector TR42 Region (Kocaeli, Sakarya, Düzce, Bolu and Yalova) was comprised 5.4% of the total working population (in these sectors) of Turkey in 2013.

Sakarya Province

Specific indicators for the socioeconomic development level of Sakarya are presented in Table 14.7. As seen in the table, the rate treated water consumption per person is the highest indicator (285 liter) of the socioeconomic development level in Sakarya. Sakarya ranks 15th in terms of the level of happiness by Provinces which is 69.6 and Istanbul is also significantly higher than the average number of Turkey which is 59.0. Other important indicator of Sakarya is the total electricity consumption per person which is 2,597 KWh. Sakarya ranks 23 with related indicator in Turkey.

Table 14.7. Indicators for Development Level of Sakarya *(TurkStat, 2013)*

Indicators of Development Level	Turkey	Sakarya	Ranking of the Province Among the Country
Total Electricity Consumption per Person , 2012 (KWh)	2,577	2,597	23
Net Schooling Rate in Secondary School, 2013-2014 (%)	75.7	83.6	29
Level of Happiness by Provinces*, 2013 (%)	59.0	69.6	15
Number of Automobiles per thousand People (2013)	121	112	40
Treated Water Consumption per Person, 2012 (Liter)	216	285	12
Number of Hospital Beds per Hundred Thousand People (2012)	265	188	79

**Note:* Level of Happiness by Provinces is the proportion of surveyed population who declared that they are happy

Sakarya is a suitable Province for industrial, agricultural and touristic investments due to its geographical location. In fact, 50% of active population of Sakarya is busy with agriculture. Cattle breeding and poultry have also an important role in Province's economy.

There are seven Organized Industrial Zone located in Sakarya and various factories and workshops are contributing Province's industrial productivity. As part of an important transportation route, the Province delivers its productions whole around the world in an easy and beneficial way.

According to nomenclature of units for territorial statistics, Sakarya province is named as TR42 Level 2 territory. According to the "Selected Indicators for Sakarya 2013" which was published by TurkStat in 2013, the number of people who are working in industrial and service sector TR42 Region (Sakarya, Kocaeli, Düzce, Bolu and Yalova) was comprised 5.4% of the total working population (in these sectors) of Turkey in 2013.

Socio-economical Baseline of the Surveyed Neighborhoods

Information regarding the main economic activities in the surveyed settlements is given in this section. Within surveyed settlements, the main economic activity is agriculture and livestock. According to the headmen of the Neighborhoods, 39% of the neighborhoods declared that agriculture and salary is the primary sources of income. Furthermore, 44% of the neighborhoods declared that livestock activity is the secondary sources of income. Meanwhile, retirement pension, salary, greenhouse activities and forestry also declared as sources of income however, considering the importance of livestock and agricultural activities, the contribution of such sources of livelihood to the household economy is low (Social Field Survey, January 2017). Main sources of income in the surveyed settlements are given in Table 14.8.

Table 14.8. Main Sources of Income in the Surveyed Settlements (Social Field Survey, January 2017)

Neighborhood	Primary Income Source	Secondary Income Source	Tertiary Income Source
Kurnakoy	Retirement Pay	Livestock	
Tepeoren	Salary	Trade	Retirement Pay
Demirciler	Salary	Retirement Pay	Livestock
Kutluca (Kıyırlı q.)	Agricultural Activities	Livestock	Forestry
Karayakuplu	Agricultural Activities	Livestock	Greenhouse
Sipahiler	Agricultural Activities	Livestock	Retirement Pay
Cayirkoy	Salary	Agricultural Activities	Livestock
Eseler	Livestock	Agricultural Activities	Greenhouse
Karaabdulbaki	Salary	Retirement Pay	Livestock
Suleymaniye	Retirement Pay	Salary	Agricultural Activities
Korucuk	Salary		
Taskisigi	Salary	Agricultural Activities	Livestock
Camyolu	Salary	Trade	
Celebiler	Agricultural Activities	Livestock	Retirement Pay
Budaklar	Agricultural Activities	Livestock	Trade
Kızılcıkorman	Livestock	Agricultural Activities	Retirement Pay
Osmanbey	Agricultural Activities	Livestock	
Topagac/Ramasli	Agricultural Activities	Livestock	Salary

Sewerage and Waste Disposal

Municipal water is used almost in every settlement except Kutluca, Suleymaniye, Kizilcikorman, Osmanbey and Topagac Neighborhoods. However, the quality and the regularity of the water is satisfactory for the inhabitants in every neighborhood.

In terms of sewerage system in the Neighborhoods, general sewage system is available in 8 neighborhoods; while 10 of them use septic tanks and local municipality collects the waste regularly. Most of the Neighborhoods dumping their wastes to open area and according to the headmen, this is one of the important issue in the Neighborhoods. Sewerage and waste disposal methods in the surveyed neighborhoods are given in Table 14.9.

Table 14.9. Sewerage and Waste Disposal Methods in the Surveyed Neighborhoods (Social Field Survey, January 2017)

Neighborhood	Domestic Water	Quality of Domestic Water	Type of Sewerage	Waste Disposal
Kurnakoy	Municipal Water	Potable	Septic Tanks	Collects by Municipality
Tepeoren	Municipal Water	Potable	General Sewage System	Collects by Municipality
Demirciler	Municipal Water	Potable	Septic Tanks	Collects by Municipality
Kutluca (Kıyırlı q.)	Ground Water	Potable	General Sewage System	Dumping to Open Area
Karayakuplu	Municipal Water	Potable	Septic Tanks	Dumping to Open Area
Sipahiler	Municipal Water	Potable	General Sewage System	Collects by Municipality
Cayirkoy	Municipal Water	Potable	General Sewage System	Collects by Municipality
Eseler	Municipal Water	Potable	General Sewage System	Dumping to Open Area
Karaabdulbaki	Municipal Water	Potable	Septic Tanks	Collects by Municipality
Suleymaniye	Ground Water	Potable	General Sewage System	Dumping to Open Area
Korucuk	Municipal Water	Potable	General Sewage System	Collects by Municipality
Taskisigi	Municipal Water	Potable	Septic Tanks	Collects by Municipality
Camyolu	Municipal Water	Potable	General Sewage System	Collects by Municipality
Celebiler	Municipal Water	Potable	Septic Tanks	Dumping to Open Area
Budaklar	Municipal Water	Potable	Septic Tanks	Dumping to Open Area
Kızılcıkorman	Ground Water	Potable	Septic Tanks	Dumping to Open Area
Osmanbey	Ground Water	Potable	Septic Tanks	Dumping to Open Area
Topagac/Ramasli	Ground Water	Potable	Septic Tanks	Collects by Municipality

Vulnerable Groups

It is necessary to identify disadvantaged and vulnerable groups for major projects which cover expropriation and resettlement plans. The reason for this is to protect disadvantaged and vulnerable groups from the disproportionate impacts of the project and take measures and precautions to prevent them to be disadvantaged in terms of development programs and opportunities'. According to the International Finance Corporation (IFC) Performance Standards (2012), factors such as gender, ethnicity, culture, literacy, illness, physical or mental disabilities, poverty, economic disadvantages and dependence on unique resources should be considered while identifying disadvantaged and vulnerable groups.

Within surveyed neighborhoods, there are 513 vulnerable people has been identified during the Social Field Survey. Camyolu has the largest population with 100 individuals who are identified as vulnerable by neighborhood headmen. Moreover, women headed households within Demirciler neighborhood comprises the largest proportion with 40 individuals. Mentally and physically disabled people constitute a significant proportion with 84 individuals in the neighborhoods. In addition, person in need of nursing are the group with the highest rate (41%) among all vulnerable groups within surveyed neighborhoods. Vulnerable Groups within the surveyed neighborhoods are given in Table 14.10.

Table 14.10. Vulnerable Groups within the Surveyed Neighborhoods (Social Field Survey, January 2017)

Neighborhood	Person in need of Nursing	Women Headed Household	Shepherd	Person in need of Charity	Homeless	Disabled	Widow and without Encumbrance	Total
Kurnakoy	10	30	-	-	-	15	5	60
Tepeoren	5	-	-	-	-	2	-	7
Demirciler	-	40	-	3	-	-	1	44
Kutluca (Kıyırlı q.)	-	7	-	-	-	2	-	9
Karayakuplu	10	-	-	-	-	-	-	10
Sipahiler	2	-	1	-	-	1	-	4
Cayirkoy	-	6	-	-	-	4	1	11
Eseler	-	10	-	-	-	1	-	11
Karaabdulbaki	2	8	-	-	7	-	3	20
Suleymaniye	5	20	-	-	-	13	-	38
Korucuk	-	-	-	-	-	-	-	0
Taskisigi	3	30	-	-	-	8	4	45
Camyolu	80	10	-	-	-	10	-	100
Celebiler	3	1	1	-	-	-	-	5
Budaklar	10	8	-	-	-	2	1	21
Kızılcıkorman	-	10	1	-	-	4	-	15
Osmanbey	-	10	-	-	-	7	-	17
Topagac/Ramasli	80	-	1	-	-	15	-	96
Total	210	190	4	3	7	84	15	513

Population

Project area is located within Istanbul, Kocaeli and Sakarya Provinces and information regarding the demographic features of these Provinces, Districts and Neighborhoods are given under this section.

Istanbul Province

According to the data received from the Address-Based Population Registration System carried out in 2016, the population of Istanbul Province is 14,804,116. The population of the province was 13,120,596 in 2010. Accordingly it can be said that the population of the province presents an increasing trend through the past years. In this context, there has been an increase of 1,683,520 people from 2010 to 2016 and this number corresponds to an increase of 12.8% through the years. However, the migration trend of Istanbul is negative. Between the years 2015-2016, 369,582 people migrated to Istanbul and 440,889 people migrated from Istanbul (net migration -71,307). Based on these data net migration rate was calculated as -4.82 and largest group of newcomers were from Ankara, Kocaeli and Tokat respectively in 2016.

By considering the changes of the population in the province census, the highest population growth is seen between the years of 1950 and 1960. Until 1950, the population growth was increasing steadily but the population growth rate highly increased after 1950. Rapid urbanization and unpreventable migration flow caused rapid population growth and at the end of 20th Century, the population of Istanbul was reached 10 Million people. Population change graph between the years of 1927-2016 and population growth rates by decades are given in Figure 14.2.[1] and Figure 14.3.

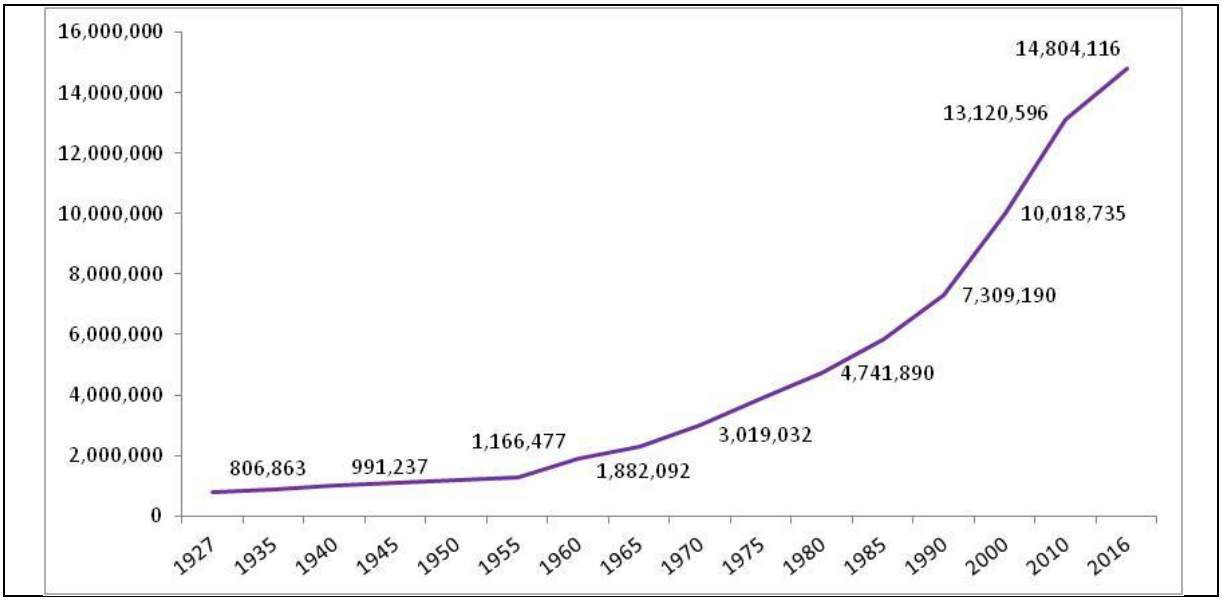


Figure 14.2. Population Change of Istanbul Province by Years (TurkStat, 2016)

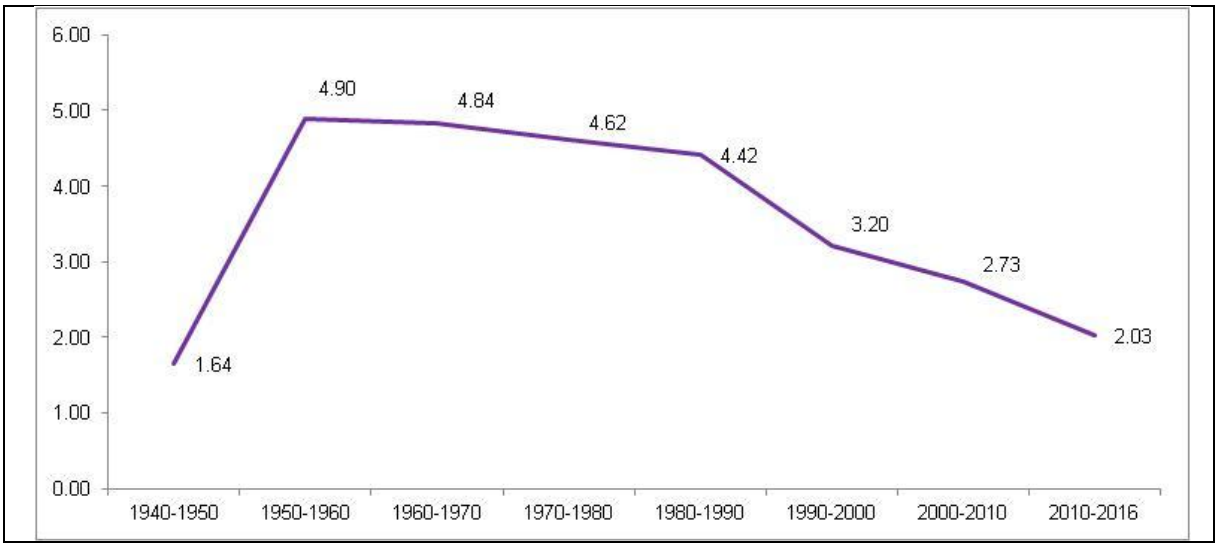


Figure 14.3. Population Growth Rates of Istanbul Province by Decades (TurkStat, 2016)

[1] Population data of the years 1927-1990 was obtained from "General Census: Social and Economic Qualities of the Population, Turkish Statistical Institute (TurkStat), 1990". Data regarding the remaining years was obtained from TurkStat's website.

Fertility rate of Istanbul province is 1.85 by the year of 2015. By considering that the fertility rate of the province was 1.73 in 2010, it is understood that the fertility rate has increased within the past 5 years.[2] In addition based on the results of Turkey Demographic and Health Survey (TDHS) in 2013 this rate is significantly lower than the fertility rate of Turkey which is 2.26.

When the age distribution of Istanbul examined separately, it seems that the age group of 35-39 (9.5%) has the highest ratio within the population. In addition, when the population structure examined, the ratios of women and men to the total population are 49.8% and 50.2% respectively. These ratios show similarity with the average ratio of Turkey (49.8% for men, 50.2%. for women). Age and gender distribution of Istanbul is given in Table 14.11.

Table 14.11. Age Groups and Male-Female Population Distribution of Istanbul Province (TurkStat, 2016)

Age	Total	Male	Female	Percentage (%)
0-4	1,157,280	594,015	563,265	7.8
5-9	1,102,953	566,728	536,225	7.5
10-14	1,041,490	536,398	505,092	7.0
15-19	1,113,396	574,597	538,799	7.5
20-24	1,158,213	578,959	579,254	7.8
25-29	1,304,105	654,062	650,043	8.8
30-34	1,376,698	694,708	681,990	9.3
35-39	1,408,692	712,537	696,155	9.5
40-44	1,190,696	601,481	589,215	8.0
45-49	949,652	485,294	464,358	6.4
50-54	882,253	443,985	438,268	6.0
55-59	646,560	324,432	322,128	4.4
60-64	531,810	257,676	274,134	3.6
65-69	358,780	166,430	192,350	2.4
70-74	236,521	105,311	131,210	1.6
75-79	158,216	63,647	94,569	1.1
80-84	107,387	41,076	66,311	0.7
85-89	56,389	17,347	39,042	0.4
90+	23,025	5,707	17,318	0.2
Total	**14,804,116**	**7,424,390**	**7,379,726**	**100.0**

Population pyramid of Istanbul province is presented in Figure 14.4. When the population pyramid examined, it can be said that Istanbul has a developing province profile. By considering these data, the dependency ratio[3] of Istanbul is 40.2% and this ratio is lower than the average ratio of Turkey (47.2%). By considering the ratio of the active population (individuals aged group 15-64) in Istanbul which is 71.4%, it is observed that the dependency ratio is not significantly high. Also the median age ratio of Istanbul[4] is an important data as the median age ratio of Istanbul (31.9) and Turkey (31.4) is almost same.

[2] Related values were calculated considering TurkStat's 2007-2011, 15-49 age group women's number of births based on age.
[3] Dependant Population Ratio: Ratio of population that is not in working age (0-14) and population that is not fit for working to the active population (15-64).
[4] Median Age: Age of the person that corresponds to the middle when people of the population are ranked from oldest to youngest (TurkStat).

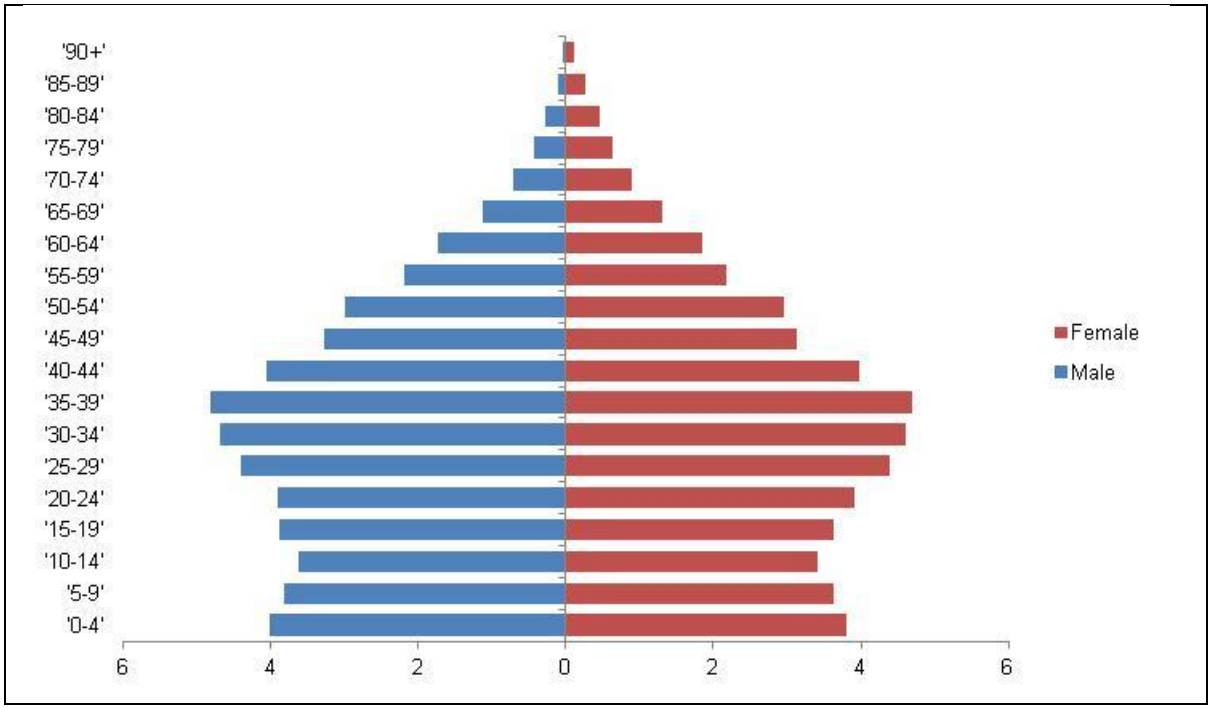


Figure 14.4. Population Pyramid of Istanbul (TurkStat, 2016)

Istanbul Districts' population is given In Table 14.12. According to the Table, it is seen that Esenyurt is the most populous district in Istanbul with 795,010 inhabitants and Kucukcekmece (766,609) and Bagcilar (751,510) following the Esenyurt district.

Table 14.12. District Populations of Istanbul (TurkStat, 2016)

District	Total	Male	Female	Male (%)	Female (%)
Adalar	14,478	7,420	7,058	51.3	48.7
Arnavutkoy	247,507	128,276	119,231	51.8	48.2
Atasehir	422,513	208,267	214,246	49.3	50.7
Avcilar	430,770	216,173	214,597	50.2	49.8
Bagcilar	751,510	382,698	368,812	50.9	49.1
Bahcelievler	598,097	300,705	297,392	50.3	49.7
Bakirkoy	222,437	104,439	117,998	47.0	53.0
Basaksehir	369,810	186,233	183,577	50.4	49.6
Bayrampasa	273,148	137,501	135,647	50.3	49.7
Besiktas	189,356	87,823	101,533	46.4	53.6
Beykoz	250,410	124,209	126,201	49.6	50.4
Beylikduzu	297,420	145,555	151,865	48.9	51.1
Beyoglu	238,762	122,559	116,203	51.3	48.7
Büyükcekmece	237,185	117,960	119,225	49.7	50.3
Catalca	68,935	35,510	33,425	51.5	48.5
Cekmekoy	239,611	120,826	118,785	50.4	49.6
Esenler	457,231	235,131	222,100	51.4	48.6
Esenyurt	795,010	408,516	386,494	51.4	48.6
Eyup	377,650	190,455	187,195	50.4	49.6
Fatih	417,285	207,477	209,808	49.7	50.3
Gaziosmanpasa	499,766	252,018	247,748	50.4	49.6
Gungoren	298,509	150,297	148,212	50.3	49.7
Kadikoy	452,302	204,382	247,920	45.2	54.8
Kagithane	439,685	222,981	216,704	50.7	49.3
Kartal	459,298	228,304	230,994	49.7	50.3
Kucukcekmece	766,609	385,070	381,539	50.2	49.8
Maltepe	490,151	241,411	248,740	49.3	50.7
Pendik	691,681	350,782	340,899	50.7	49.3
Sancaktepe	377,047	192,982	184,065	51.2	48.8
Sariyer	342,753	169,918	172,835	49.6	50.4
Silivri	34,241	17,595	16,646	51.4	48.6
Sultanbeyli	170,523	92,892	77,631	54.5	45.5
Sultangazi	272,803	133,080	139,723	48.8	51.2
Sile	324,709	167,194	157,515	51.5	48.5
Sisli	525,090	268,737	256,353	51.2	48.8
Tuzla	242,232	123,941	118,291	51.2	48.8
Umraniye	694,158	348,788	345,370	50.2	49.8
Uskudar	535,537	262,390	273,147	49.0	51.0
Zeytinburnu	287,897	143,895	144,002	50.0	50.0
Total	**14,804,116**	**7,424,390**	**7,379,726**	**50.2**	**49.8**

As Istanbul has 5,461 square kilometer surface area, the number of people per square kilometer is 2,711. This number is significantly higher than the average number of Turkey which is 101 (*General Command of Cartography website, www.hgk.msb.gov.tr*). In terms of surface area, Catalca is the largest district in Istanbul with 1,142 square kilometer. Silivri and Sile districts are following the Catalca district with 858 square kilometer and 800 square kilometer surface area respectively. However, considering the population densities of the districts in Istanbul, Silivri and Catalca districts have the lowest population density with 40 and 60 people per square kilometer respectively.

Kocaeli Province

According to the data received from the Address-Based Population Registration System carried out in 2016, the population of Kocaeli Province is 1,830,772. The population of the province was 1,560,138 in 2010. Accordingly it can be said that the population of the province presents an increasing trend through the past years. In this context, there has been an increase of 270,634 people from 2010 to 2016 and this number corresponds to an increase of 17.3% through the years. Additionally, the migration trend of Kocaeli is positive. Between the years 2015-2016, 85,602 people migrated to Kocaeli and 60,479 people migrated from Kocaeli (net migration 25,123). Based on these data net migration rate was calculated as 13.72 and largest group of newcomers were from Istanbul, Sakarya and Ankara respectively in 2016.

By considering the changes of the population in the province census, the highest population growth is seen between the years of 1980 and 1990. Until 1960, the population growth was increasing steadily (except year 1955 when Adapazari District separated from the Kocaeli Province) but the population growth rate highly increased after 1970. Rapid urbanization and unpreventable migration flow caused rapid population growth and at the end of 20th Century, the population of Kocaeli was reached 1.8 Million people. Population change graph between the years of 1927-2016 and population growth rates by decades are given in Figure 14.5.[5] and Figure 14.6.

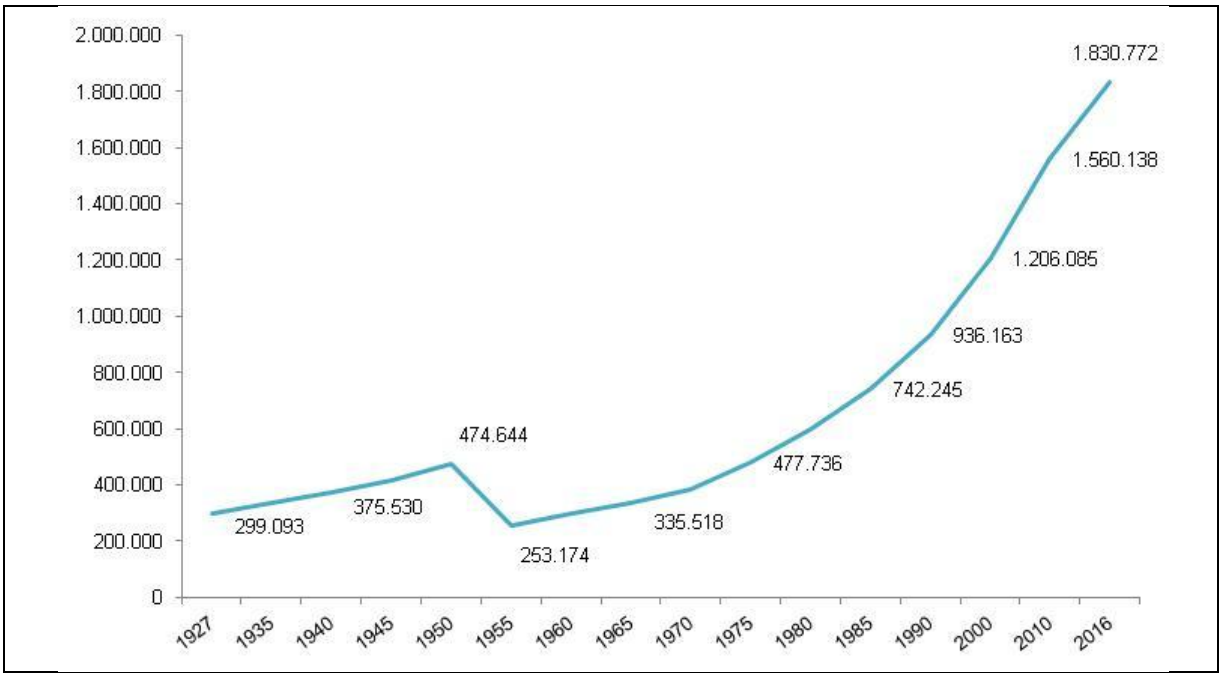


Figure 14.5. Population Change of Kocaeli Province by Years (TurkStat, 2016)

[5] Population data of the years 1927-1990 was obtained from "General Census: Social and Economic Qualities of the Population, Turkish Statistical Institute (TurkStat), 1990". Data regarding the remaining years was obtained from TurkStat's website.

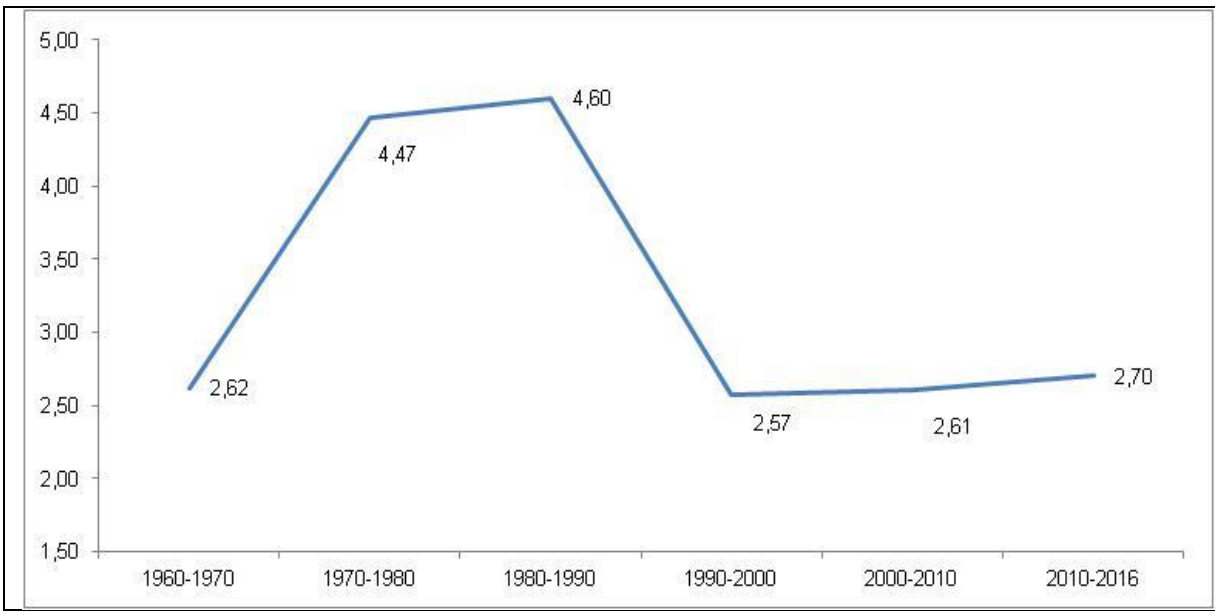


Figure 14.6. Population Growth Rates of Kocaeli Province by Decades (TurkStat, 2016)

Fertility rate of Kocaeli province is 2.03 by the year of 2015. By considering that the fertility rate of the province was 1.84 in 2010, it is understood that the fertility rate has increased within the past 5 years.[6] In addition based on the results of Turkey Demographic and Health Survey (TDHS) in 2013 this rate is significantly lower than the fertility rate of Turkey which is 2.26.

When the age distribution of Istanbul examined separately, it seems that the age group of 35-39 (9.2%) has the highest ratio within the population. In addition, when the population structure examined, the ratios of women and men to the total population are 49.4% and 50.6% respectively. These ratios show similarity with the average ratio of Turkey (49.8% for men, 50.2%. for women). Age and gender distribution of Kocaeli is given in Table 14.13.

[6] Related values were calculated considering TurkStat's 2007-2011, 15-49 age group women's number of births based on age.

Table 14.13. Age Groups and Male-Female Population Distribution of Kocaeli Province (TurkStat, 2016)

Age	Total	Male	Female	Percentage (%)
0-4	151.439	77.677	73.762	8,3
5-9	145.161	74.734	70.427	7,9
10-14	133.895	69.107	64.788	7,3
15-19	141.548	74.018	67.530	7,7
20-24	140.081	70.344	69.737	7,7
25-29	155.659	77.986	77.673	8,5
30-34	164.849	83.654	81.195	9,0
35-39	168.645	86.755	81.890	9,2
40-44	139.417	71.793	67.624	7,6
45-49	110.299	56.620	53.679	6,0
50-54	106.630	53.693	52.937	5,8
55-59	81.327	40.965	40.362	4,4
60-64	70.292	34.691	35.601	3,8
65-69	47.661	22.907	24.754	2,6
70-74	31.412	14.768	16.644	1,7
75-79	20.688	9.065	11.623	1,1
80-84	13.094	5.513	7.581	0,7
85-89	6.512	2.244	4.268	0,4
90+	2.163	623	1.540	0,1
Total	**1.830.772**	**927.157**	**903.615**	**100,0**

Population pyramid of Kocaeli province is presented in Figure 14.7. When the population pyramid examined, it can be said that Kocaeli has a developing province profile. By considering these data, the dependency ratio[7] of Kocaeli is 43.2% and this ratio is lower than the average ratio of Turkey (47.2%). By considering the ratio of the active population (individuals aged group 15-64) in Kocaeli which is 69.9%, it is observed that the dependency ratio is not significantly high. Also the median age ratio of Kocaeli[8] is an important data as the median age ratio of Kocaeli (31.4) and Turkey (31.4) is same.

[7] Dependant Population Ratio: Ratio of population that is not in working age (0-14) and population that is not fit for working to the active population (15-64).
[8] Median Age: Age of the person that corresponds to the middle when people of the population are ranked from oldest to youngest (TurkStat).

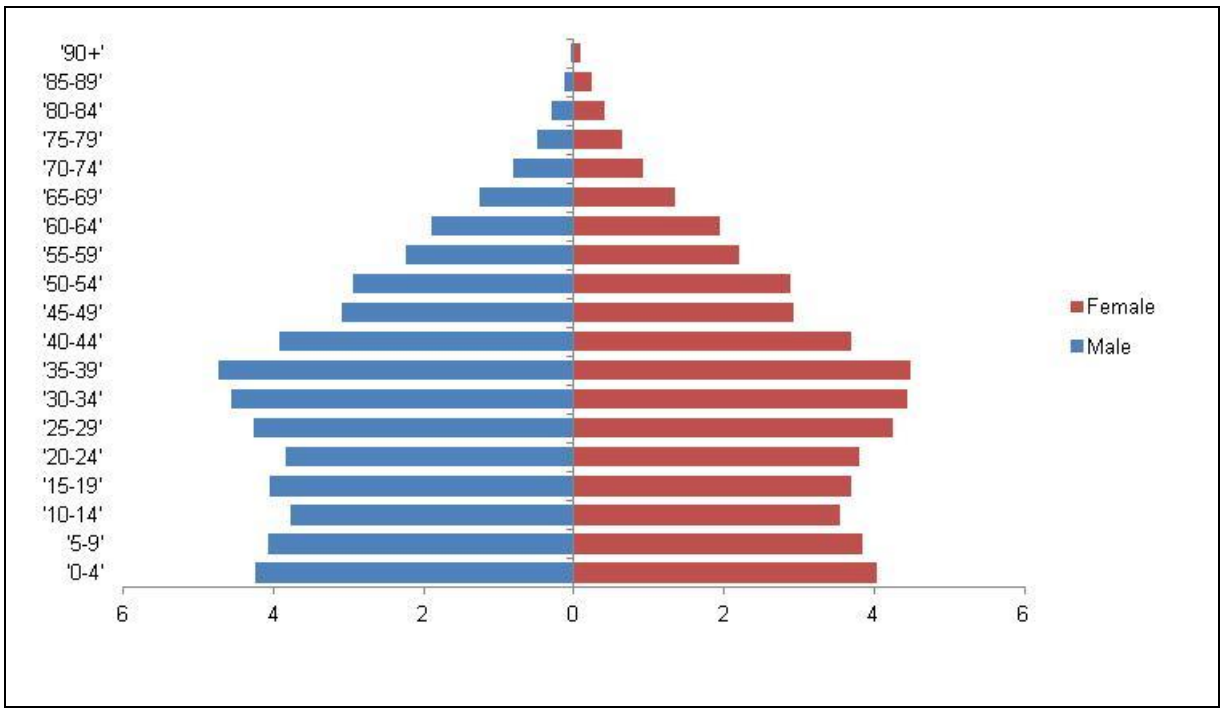


Figure 14.7. Population Pyramid of Kocaeli (TurkStat, 2016)

Kocaeli Districts' population is given In Table 14.14. According to the Table, it is seen that Gebze is the most populous district in Kocaeli with 357,743 inhabitants and Izmit (354,464) is following the Gebze district.

Table 14.14. District Populations of Kocaeli (TurkStat, 2016)

District	Total	Male	Female	Male (%)	Female (%)
Başiskele	88.910	44.904	44.006	50,5	49,5
Çayırova	122.460	62.712	59.748	51,2	48,8
Darıca	191.123	97.277	93.846	50,9	49,1
Derince	138.050	69.363	68.687	50,2	49,8
Dilovası	46.933	24.106	22.827	51,4	48,6
Gebze	357.743	182.189	175.554	50,9	49,1
Gölcük	156.901	79.802	77.099	50,9	49,1
İzmit	354.464	176.157	178.307	49,7	50,3
Kandıra	49.221	26.693	22.528	54,2	45,8
Karamürsel	55.895	27.879	28.016	49,9	50,1
Kartepe	111.790	56.854	54.936	50,9	49,1
Körfez	157.282	79.221	78.061	50,4	49,6
Total	**1.830.772**	**927.157**	**903.615**	**50,6**	**49,4**

Sakarya Province

According to the data received from the Address-Based Population Registration System carried out in 2016, the population of Sakarya Province is 976,948. The population of the province was 872,872 in 2010. Accordingly it can be said that the population of the province presents an increasing trend through the past years. In this context, there has been an increase of 104,076 people from 2010 to 2016 and this number corresponds to an increase of 11.9% through the years. Additionally, the migration trend of Sakarya is positive. Between the years 2015-2016, 35,228 people migrated to Sakarya and 28,965 people migrated from Sakarya (net migration 6,263). Based on these data net migration rate was calculated as 6.41 and largest group of newcomers were from Istanbul, Kocaeli and Ankara respectively in 2016.

By considering the changes of the population in the province census, the highest population growth is seen between the years of 1960 and 1970. Until 2000, the population growth was increasing unsteadily however the population growth rate increased steadily after 2000. The population of Sakarya is reached almost 1 Million people today. Population change graph between the years of 1955-2016 and population growth rates by decades are given in Figure 14.8.[9] and Figure 14.9.

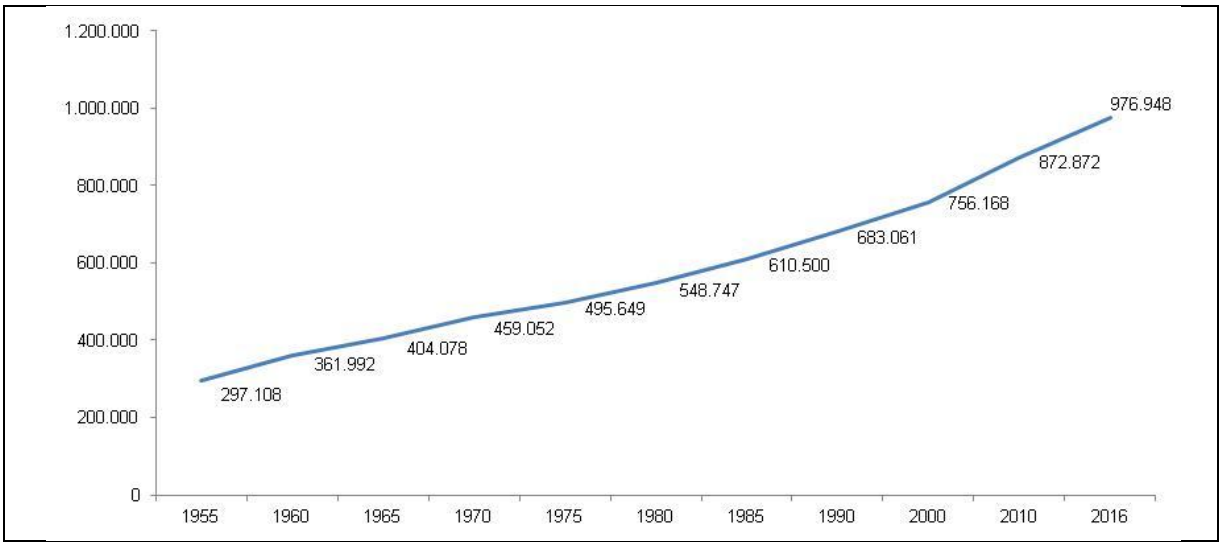


Figure 14.8. Population Change of Sakarya Province by Years (TurkStat, 2016)

[9] Population data of the years 1955-1990 was obtained from "General Census: Social and Economic Qualities of the Population, Turkish Statistical Institute (TurkStat), 1990". Data regarding the remaining years was obtained from TurkStat's website.

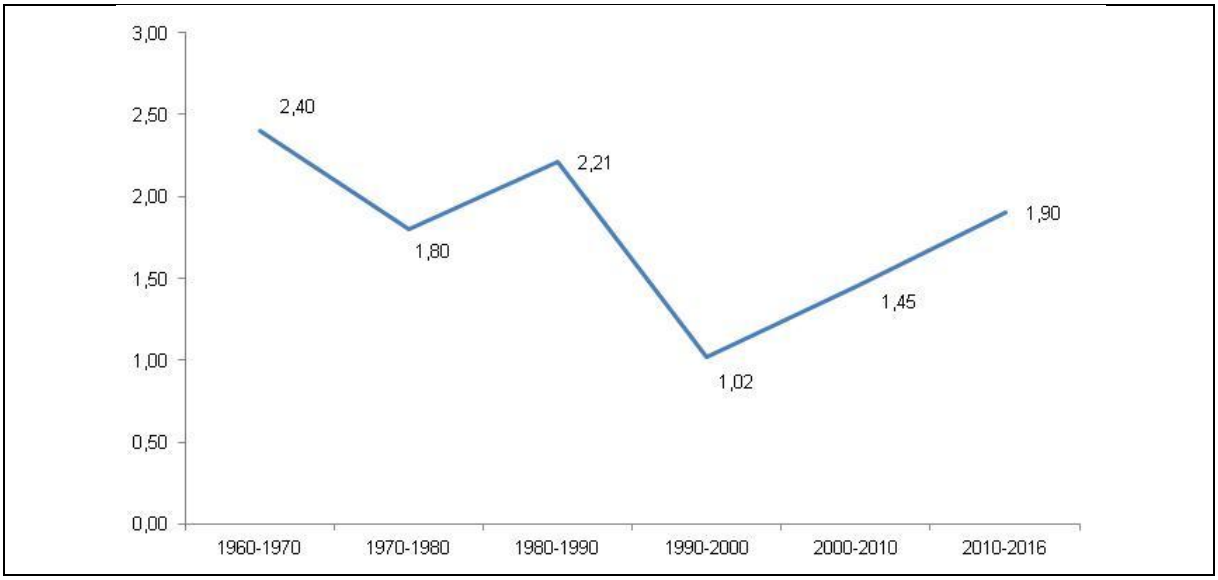


Figure 14.9. Population Growth Rates of Sakarya Province by Decades (TurkStat, 2016)

Fertility rate of Sakarya province is 1.91 by the year of 2015. By considering that the fertility rate of the province was 1.81 in 2010, it is understood that the fertility rate has increased within the past 5 years.[10] In addition based on the results of Turkey Demographic and Health Survey (TDHS) in 2013 this rate is significantly lower than the fertility rate of Turkey which is 2.26.

When the age distribution of Istanbul examined separately, it seems that the age group of 15-19 (8.3%) has the highest ratio within the population. In addition, when the population structure examined, the ratios of women and men to the total population are 49.7% and 50.3% respectively. These ratios show similarity with the average ratio of Turkey (49.8% for men, 50.2%. for women). Age and gender distribution of Sakarya is given in Table 14.15.

[10] Related values were calculated considering TurkStat's 2007-2011, 15-49 age group women's number of births based on age.

Table 14.15. Age Groups and Male-Female Population Distribution of Sakarya Province (TurkStat, 2016)

Age	Total	Male	Female	Percentage (%)
0-4	71.382	36.471	34.911	7,3
5-9	71.064	36.616	34.448	7,3
10-14	71.430	36.667	34.763	7,3
15-19	81.550	42.164	39.386	8,3
20-24	77.149	38.793	38.356	7,9
25-29	73.505	37.217	36.288	7,5
30-34	74.441	37.647	36.794	7,6
35-39	80.410	40.855	39.555	8,2
40-44	71.025	35.801	35.224	7,3
45-49	60.842	31.092	29.750	6,2
50-54	60.696	30.252	30.444	6,2
55-59	50.946	25.852	25.094	5,2
60-64	45.515	22.461	23.054	4,7
65-69	32.675	15.929	16.746	3,3
70-74	21.777	10.101	11.676	2,2
75-79	15.448	6.593	8.855	1,6
80-84	10.305	4.195	6.110	1,1
85-89	5.052	1.753	3.299	0,5
90+	1.736	476	1.260	0,2
Total	**976.948**	**490.935**	**486.013**	**100,0**

Population pyramid of Sakarya province is presented in Figure 14.10. When the population pyramid examined, it can be said that Sakarya has a developing province profile. By considering these data, the dependency ratio[11] of Sakarya is 44.5% and this ratio is lower than the average ratio of Turkey (47.2%). By considering the ratio of the active population (individuals aged group 15-64) in Sakarya which is 69.2%, it is observed that the dependency ratio is not high. Also the median age ratio of Sakarya[12] is an important data as the median age ratio of Sakarya (32.8) is significantly higher than Turkey (31.4).

[11] Dependant Population Ratio: Ratio of population that is not in working age (0-14) and population that is not fit for working to the active population (15-64).
[12] Median Age: Age of the person that corresponds to the middle when people of the population are ranked from oldest to youngest (TurkStat).

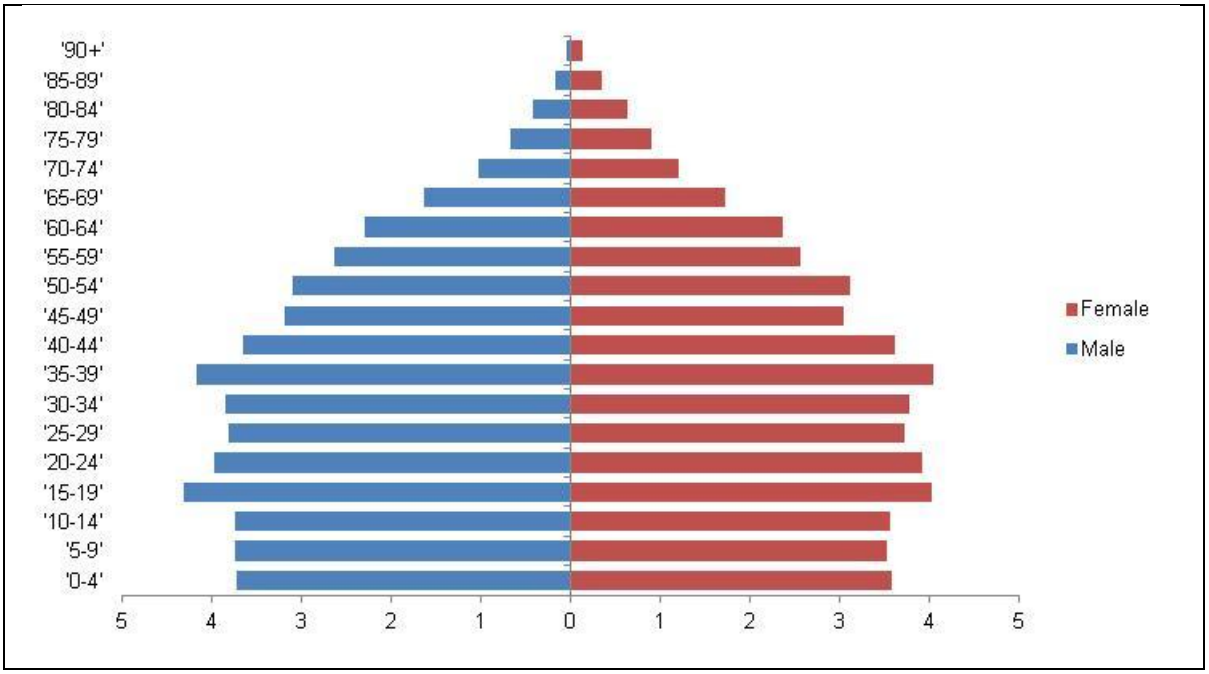


Figure 14.10. Population Pyramid of Sakarya (TurkStat, 2016)

Sakarya Districts' population is given In Table 14.16. According to the Table, it is seen that Adapazari is the most populous district in Sakarya with 274,898 inhabitants and Serdivan (128,121) is following the Adapazari district.

Table 14.16. District Populations of Sakarya (TurkStat, 2016)

District	Total	Male	Female	Male (%)	Female (%)
Adapazarı	274.898	137.123	137.775	49,9	50,1
Akyazı	86.704	43.386	43.318	50,0	50,0
Arifiye	40.568	20.598	19.970	50,8	49,2
Erenler	83.984	42.241	41.743	50,3	49,7
Ferizli	25.386	13.517	11.869	53,2	46,8
Geyve	48.496	24.309	24.187	50,1	49,9
Hendek	80.264	39.958	40.306	49,8	50,2
Karapürçek	12.578	6.398	6.180	50,9	49,1
Karasu	61.533	30.810	30.723	50,1	49,9
Kaynarca	23.626	12.065	11.561	51,1	48,9
Kocaali	20.878	10.504	10.374	50,3	49,7
Pamukova	28.955	14.515	14.440	50,1	49,9
Sapanca	40.045	20.072	19.973	50,1	49,9
Serdivan	128.121	64.901	63.220	50,7	49,3
Söğütlü	14.031	7.112	6.919	50,7	49,3
Taraklı	6.881	3.426	3.455	49,8	50,2
Total	**976.948**	**490.935**	**486.013**	**50,3**	**49,7**

Population Characteristics of the Affected Neighborhoods

Total populations of the affected settlements are given in Table 14.11. based on Address Based Population Registration System Results (ABPRS) 2015 and 2016 results which announced by Turkstat. According to the Turkstat 2016, total population of the affected neighborhoods is 103,505 and this number was 102,158 in 2015. Korucuk neighborhood has the highest population with 20,331 in 2016; while Biberoglu neighborhood has the lowest with 108 at the same year. Population of the affected settlements is given in Table 14.17.

Table 14.17. Total Population of the Affected Settlements

Districts	Neighborhoods	Population (Tukstat 2015)	Population (Tukstat 2016)
Istanbul			
Pendik	Kurnakoy	1.233	1.215
Tuzla	Tepeoren	6.252	6.594
Tuzla	Akfırat	2.386	2.420
Kocaeli			
Gebze	Kadilli	502	469
Gebze	Cumakoy	1.707	1.656
Gebze	Denizli	1.200	1.131
Dilovası	Koseler	554	544
Dilovası	Demirciler	497	507
Dilovası	Cerkesli	1.055	1.102
Gebze	Tavsanli	2.275	2.336
Gebze	Muallim	1.690	1.739
Section 5			
Izmit	Tepecik	1.281	1.277
Gebze	Yagcilar	174	165
Korfez	Kutluca (Kıyırlı q.)	299	292
Korfez	Semsettin	214	194
Korfez	Sevindikli	285	244
Korfez	Karayakuplu	226	218
Korfez	Sipahiler	306	302
Derince	Toylar	207	201
Derince	Kasikci	396	381
Izmit	Sepetci	681	662
Izmit	Yassibag	740	759
Izmit	Cayirkoy	1.426	1.486
Section 6			
Kocaeli			
Izmit	Durhasan	677	667
Izmit	Eseler	350	340
Izmit	Biberoglu	104	108
Izmit	Bayraktar	996	984
Izmit	Gedikli	405	400
Izmit	Karaabdulbaki	504	493
Izmit	Sapakpinar	339	339
Izmit	Suleymaniye	416	401
Izmit	Akmese Ataturk	783	760
Sakarya			
Serdivan	Besevler	608	630
Adapazari	Alanduzu	863	860
Adapazari	Korucuk	19.404	20.331
Adapazari	Karapinar	428	417
Adapazari	Camili	17.631	18.068
Adapazari	Evrenkoy	2.488	2.616
Adapazari	Karaman	13.085	13.282
Adapazari	Taskisigi	1.316	1.311
Adapazari	Camyolu	1.535	1.603
Adapazari	Dagdibi	1.519	1.553

Districts	Neighborhoods	Population	Population
Adapazari	Poyrazlar	341	320
Adapazari	Dogancilar	256	242
Adapazari	Komurluk	257	263
Adapazari	Celebiler	132	135
Adapazari	Kasimlar	323	312
Adapazari	Cerciler	210	204
Adapazari	Haciramazanlar	337	327
Adapazari	Budaklar	1.356	1.331
Adapazari	Abali	1.364	777
Erenler	Kucukesence	836	841
Akyazi	Gebes	129	127
Akyazi	Bediltahirbey	259	260
Akyazi	Catalkopru	1.154	1.144
Akyazi	Turkormankoy	435	424
Akyazi	Kizilcikorman	756	752
Akyazi	Eskibedil	608	588
Akyazi	Vakif	1.145	1.142
Akyazi	Osmanbey	985	985
Akyazi	Kumkopru	460	480
Akyazi	Topagac/Ramasli	1.253	1.261
Akyazi	Duzyazi	525	533
Total		**102.158**	**103.505**

The information regarding household/family size is obtained with key informant questionnaire and the data is analyzed based on settlements separately. According to the survey results, the common average number of household size in all 18 settlements is 3.0. The average household sizes of the seven settlements are presented in Table 14.18. Accordingly the average sizes of household in terms of all settlements are 3.12.

Table 14.18. Average Household Sizes in the Surveyed Neighborhoods (Social Field Survey, January 2017)

Neighborhood	(A) Population (Tukstat 2016)	Population (According to the Headmen)	(B) Number of Household (According to the Headmen)	(A/B) Average Number of Household
Kurnakoy	1.215	1.600	470	2,59
Tepeoren	6.594	7.200	2.200	3,00
Demirciler	507	550	170	2,98
Kutluca (Kıyırlı q.)	292	350	85	3,44
Karayakuplu	218	350	70	3,11
Sipahiler	302	350	100	3,02
Cayirkoy	1.486	1.500	800	1,86
Eseler	340	350	120	2,83
Karaabdulbaki	493	600	247	2,00
Suleymaniye	401	450	175	2,29
Korucuk	20.331	25.000	6.000	3,39
Taskisigi	1.311	1.423	450	2,91
Camyolu	1.603	2.000	400	4,01
Celebiler	135	200	40	3,38
Budaklar	1.331	1.500	400	3,33
Kızılcıkorman	752	1.000	200	3,76
Osmanbey	985	1.200	305	3,23
Topagac/Ramasli	1.261	3.000	450	2,80
Total	**39.557**	**48.623**	**12.682**	**3,12**

14.3. Potential Impacts

Motorway projects have both negative and positive impacts on from socio-economic standpoint. Loss of livelihoods (such as agricultural lands, structures etc.), impacts on social infrastructures, noise and dust emissions generated by construction activities can be characterized as negative impacts; while short and long term employment opportunities and transportation benefits can be described as positive impacts. Both positive and negative impacts are explained separately land preparation and construction and operation phase under this section.

Certain other issues relating to socio-economic impacts are dealt with elsewhere in this ESIA Report, for example, in relation to Land Use (Chapter 5) and Community Health and Safety (Chapter 15).

14.3.1. Land Preparation and Construction Phase

Various social impacts are expected to occur within the scope of the proposed Project's land preparation and construction phase. These impacts can be categorized as follows:

- Impacts on livelihoods due to the expropriation and land acquisition activities;
- Restriction of access to the agricultural and pasturelands due to the route design;
- Impacts on local business;
- Impacts of noise and dust emissions generated by construction activities on human health and livelihoods;
- Effects on infrastructures and distribution of utility services;
- Short and long term employment opportunities created by Project activities;
- Changes in the demographic structure of the settlements; and
- Increase of tensions and conflicts in the local community;

14.3.1.1. Livelihood and Economic and Physical Displacement

Project related land acquisition and/or restrictions on land use may results in physical or economic displacement of affected people. In the selection of the route, physical displacement has been avoided to the extent the highway design criteria allowed. In the current design, there is limited number of buildings, houses, structures located within the expropriation corridor in several settlements, thus physical displacement is anticipated at a limited extent if the current route design is maintained. Similarly, a prominent part of the Motorway crosses agricultural lands, especially in Section 6, thus economic displacement and the resulting impacts on the livelihood of the affected households has been identified as an issue for the Project, despite the efforts made to minimize the amount of agricultural lands to be acquired.

As mentioned above, main sources of income in the settlements located within the project area depends on agriculture and livestock activities. In fact, information obtained from headmen of the settlements where social field survey was conducted in January 2017, 1,939 households are dealing with agricultural activities; while approximately 1,600 households are dealing with livestock activities. During the same studies, land use characteristics of the settlements were obtained from the headmen and this information is as follows (see Table 14.19.):

Table 14.19. Land Use Characteristics in the Surveyed Settlements (Social Field Survey, January 2017)

Neighborhoods	Total Land	Treasury Land	Privately Owned Land	Forest Land	Pasture Land
Kurnakoy	3,000	1,000	1,400	600	-
Tepeoren	6,200	150	5,900	-	150
Demirciler	-	-	-	-	-
Kutluca (Kıyırlı q.)	508	-	300	200	8
Karayakuplu	700	35	565	100	-
Sipahiler	-	10	400	400	1
Cayirkoy	430	-	400	30	-
Eseler	300	-	200	100	-
Karaabdulbaki	130	-	75	30	25
Suleymaniye	-	-	-	-	-
Korucuk	-	-	-	-	-
Taskisigi	500	-	500	-	-
Camyolu	-	-	-	-	-
Celebiler	200	-	193	-	7
Budaklar	600	-	560	-	40
Kızılcıkorman	1,000	-	835	100	65
Osmanbey	500	-	400	-	100
Topagac/Ramasli	2,00	-	100	35	65
Total	**14,268**	**1,186**	**11,828**	**1,595**	**461**

According to the headmen, the total land in the neighborhoods is 14,268 hectares, while the size of the privately owned land within these areas is 11,828 hectares. This corresponds to 82.9% of the total area. Additionally, the size of the pastureland is 461 hectares.

The size of the lands subject to expropriation in the Asian Side of the Project is 3129.2 hectares. While 1498.1 hectares of the area covered by the expropriation works are privately owned lands, the size of the treasury lands is 276 hectares. In addition, the size of the pasture lands will be subjected to expropriation is approximately 14.9 hectares.

Physical displacement is considered a potential social impact issue as the process of selling and relocating property (particularly residential property) is considered a significant stressful activity for people (especially impacting health and wellbeing) from social impact perspective. According to the expropriation plans that were available during the ESIA studies, the number of buildings/structures that will be acquire is 130 (the information regarding how many households will be affected was not available during the ESIA studies).It should be noted that there will be impacts on property owners as well as on the tenants that occupy the property, during the expropriation process. In many cases these will be different parties and the impacts on each of them may be felt differently. People experience effects associated with displacement, loss of emotional attachment to places, feelings of uncertainty and anxiety from the acquisition and removal of these facilities. There will also be economic uncertainty; for property owners this may be in relation to compensation or finding new tenants, and for tenants, this may relate to a disruption in income or uncertainty around finding similarly priced accommodation in the same area.

During the construction activities, relevant measures will be taken into account in order to avoid any damages to the crops or agricultural lands. However, damages or losses of local people that may occur as a result of Project related activities, if occur, will be fully compensated by the Project Sponsor in line with the Turkish Law. Moreover, during the Project, specific attention will be given to vulnerable groups such as women, elderly people, disabled people and children.

Land owners will be financially compensated for their expropriated lands. A mutual agreement was reached between the KGM and the landowners in approximately 70% of the landowners who received expropriation decision.

14.3.1.2. Restriction of Access to the Agricultural Lands and Pasturelands

The Motorway sections that pass through the pasturelands will result in fragmentation of land and restriction of access between separated parts of the land. In this case, significance of impacts will depend on either the availability of passage structures such as culverts, etc. to ensure access of local people and animals between the severed lands; or the area that will remain to be available for public users. In Celebiler, more than half of the pasture parcel corresponding to the expropriation corridor will be lost. Examples of these cases are presented between Figure 14.11. and Figure 14.14.

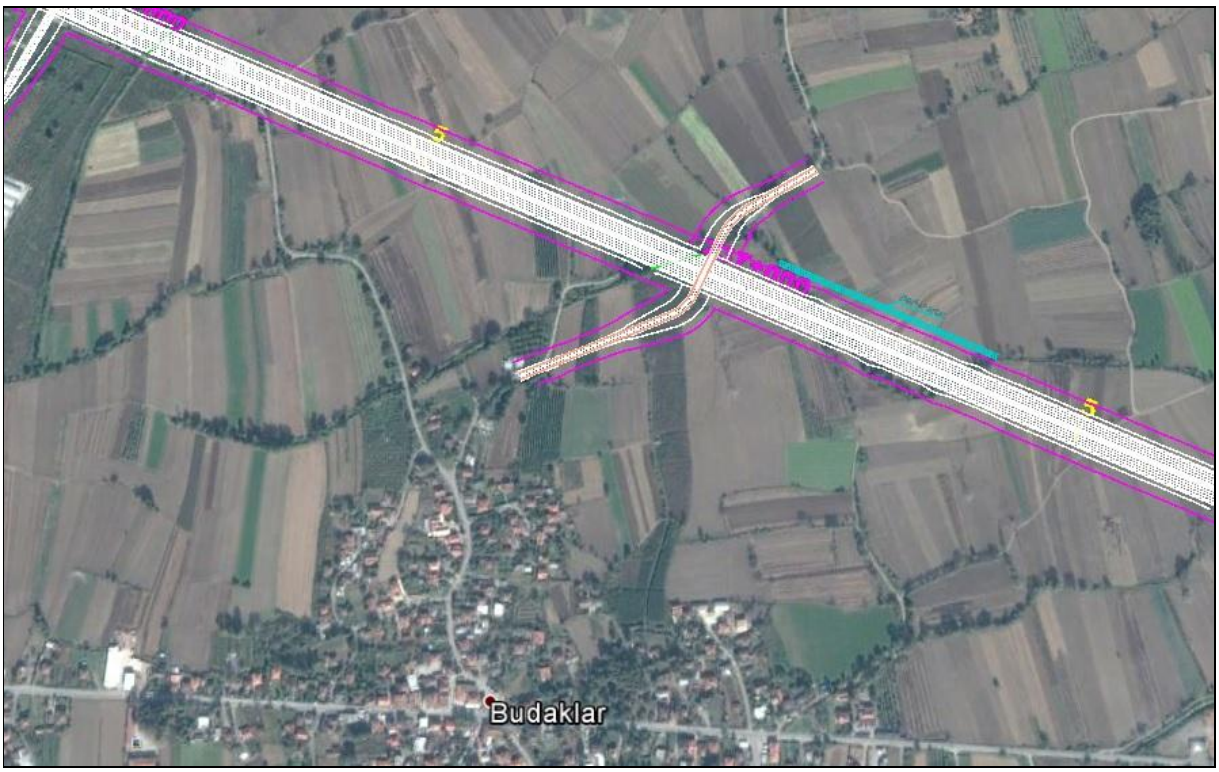


Figure 14.11. Agricultural Lands in Budaklar Neighborhood Crossed by the Motorway (Section6; KM 237+000)

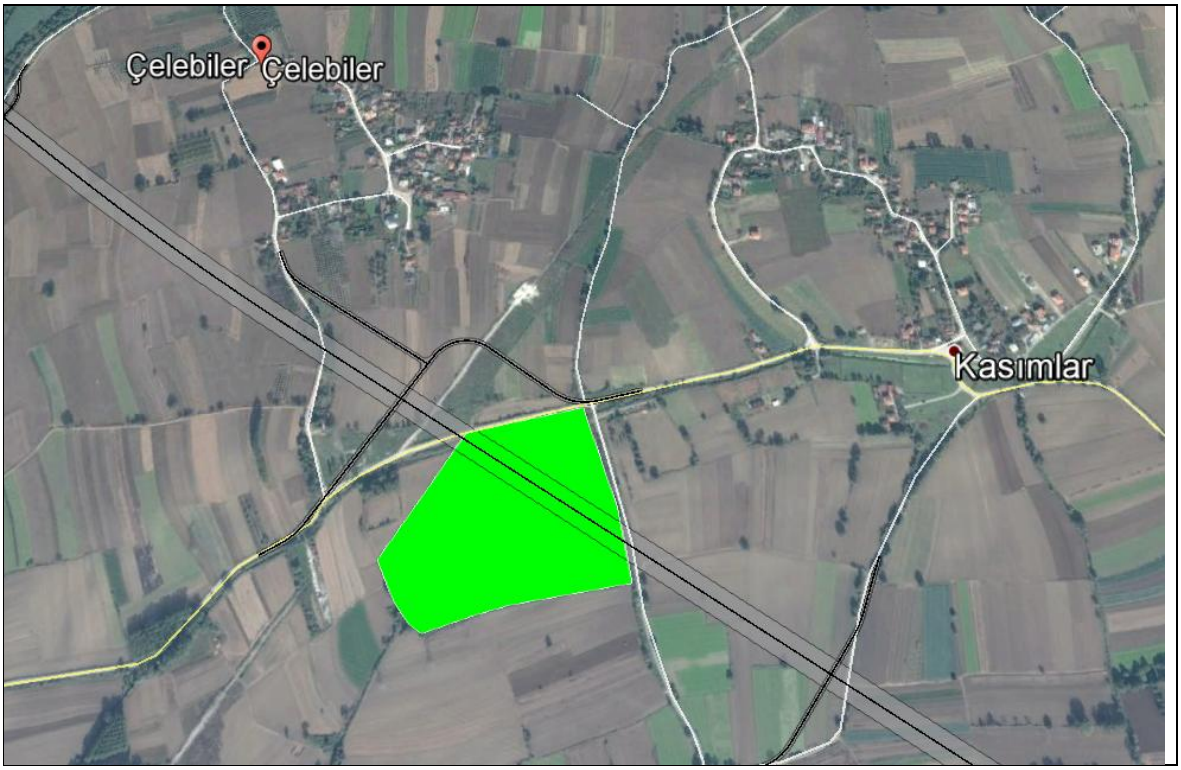


Figure 14.12. Pastureland in Celebiler Neighborhood Crossed by the Motorway (Section 6; KM 234+000)

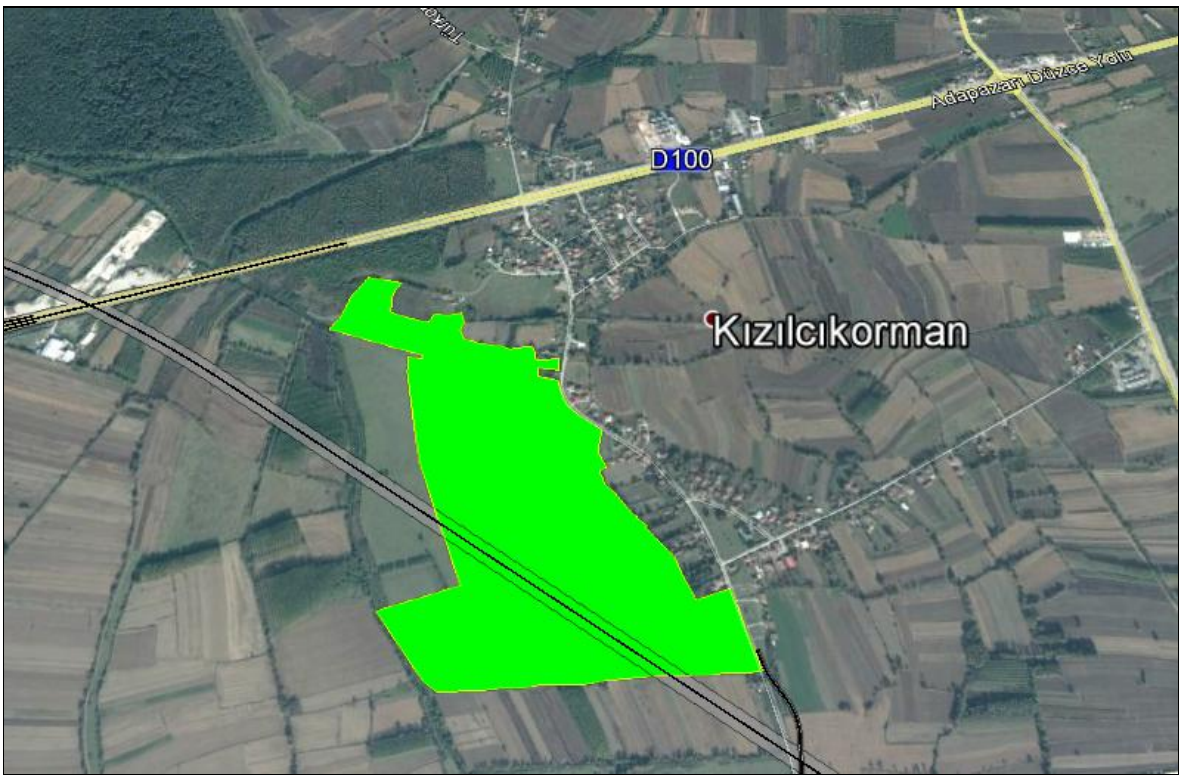


Figure 14.13. Pasturelands in Kizilcikorman Neighborhood Crossed by the Motorway (Section 6; KM 246+000)

In cases, when the Motorway does not directly cross the pastureland, but some part (e.g. one corner) of the pastureland corresponds to the expropriation corridor, the area that will be available to public will be restricted. In this case, significance of impacts will depend on the area that will remain to be available for public users.

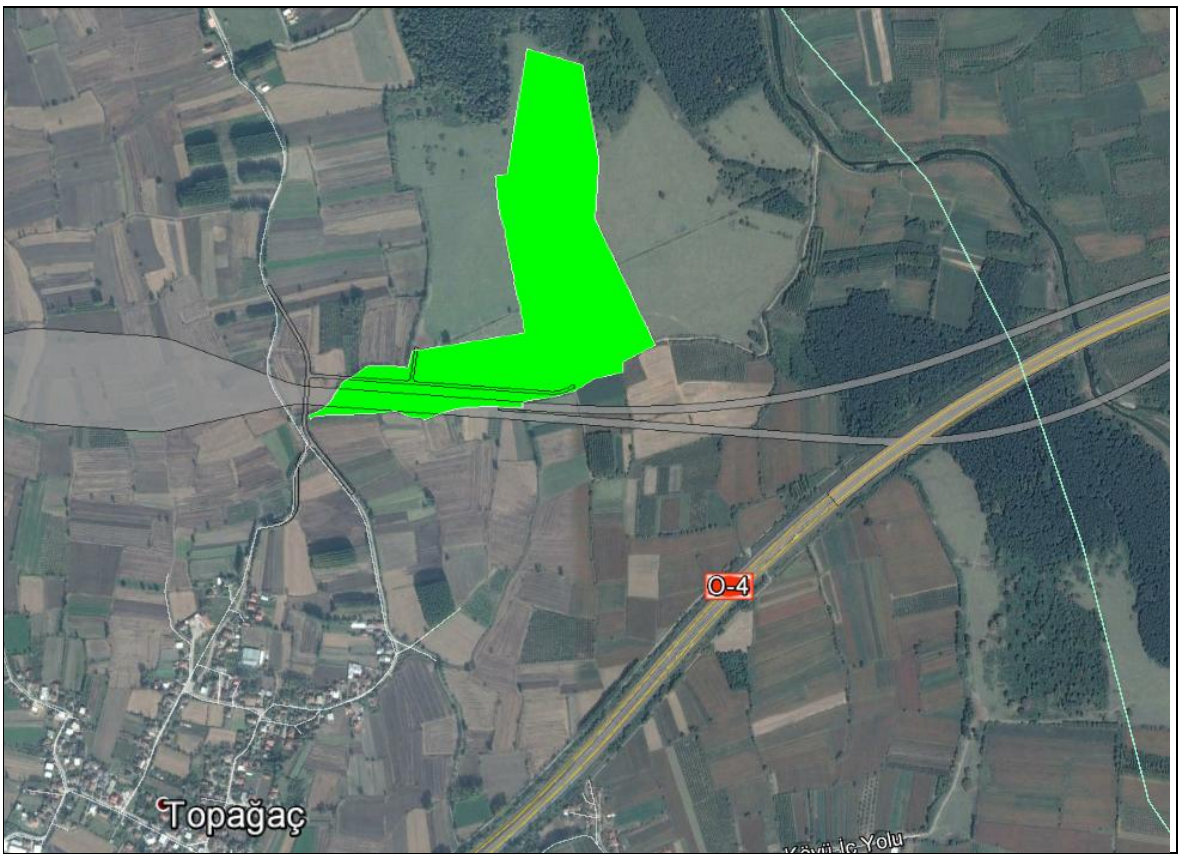


Figure 14.14. Pastureland in Topagac/Ramasli Neighborhood Crossed by and Adjacent to the Motorway (Section1; KM 21+300)

14.3.1.3. Impacts on Local Business

Apart from abovementioned land acquisition and resettlement issues, temporarily economic displacement is expected as a result of the Project construction activities. Especially the business and commercial facilities will be affected where traffic diversion and road closure is needed and considering the distance between construction sites and the commercial facilities, nuisance impacts such as dust and noise emissions are also expected cause by construction activities.

Business facilities may also be adversely affected as a result of the Project construction activities, as congested roads led to reduced number of customers. All these aspects can lead to the reduction in customer's number, which adversely affect the economic conductions of the business places. Example of business facilities that will be displaced within the scope of the Project is given in Figure 14.15.

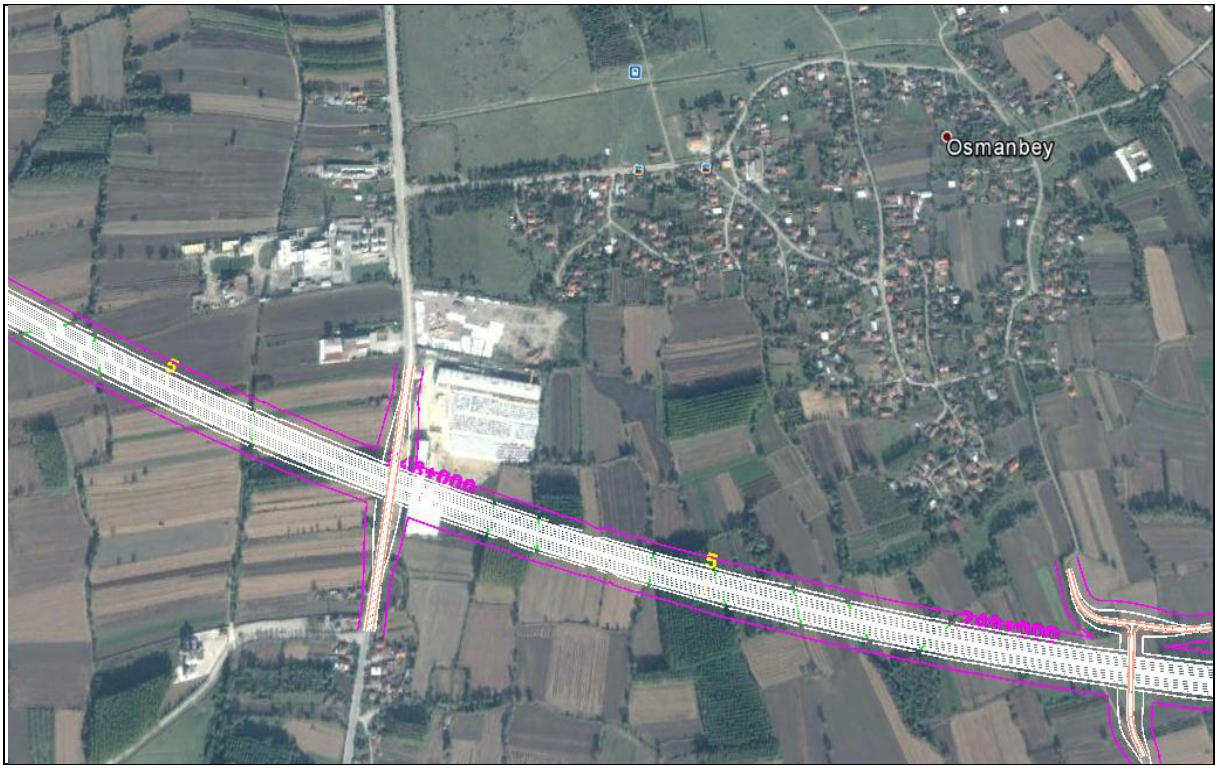


Figure 14.15. Business Facilities that will be affected within the scope of the Project (Section 6; 48+000)

14.3.1.4. Effects on Infrastructures and Distribution of Utility Services

As a result of Project construction activities, the need to transport material, products and staff will lead to increased traffic, mainly of heavy vehicles, on the existing road network. It is expected that traffic will be more intense around certain project components like campsites and quarries. The additional traffic can lead to delays in travel times and increased congestion, particularly in critical locations that are already subject to intense traffic. Construction traffic, in particular of heavy vehicles, can also contribute to the deterioration of existing roads, especially unpaved roads and roads that are already in bad conditions.

Additionally, construction activities will affect infrastructure and utility services mainly due to possible disruptions and interruptions that may occur where construction activities intersect underground utility networks (sewage systems, potable water networks etc.).

14.3.1.5. Noise and Dust Emissions Generated by Construction Activities

The significant effects from noise will occur during the construction phase of the project (indicated to be 2-3 years in duration), in those areas where surface works are occurring, and particularly from night construction activities. These effects though temporary are potentially disruptive and adverse, but they will cease after construction and once the motorway is operational. Additionally, there will be potential adverse effects on air quality as a result of the construction of the motorway, resulting from surface construction works. The main adverse construction effects to manage are dust from excavations and odor/hazardous air pollutants arising from the disturbance of contaminated soil.

Key sensitive noise and dust emission receivers identified at each of the surface construction works areas include:

- Three villa complex located at KM 133+000;
- Residential buildings located at 189+100 km in Section 5;
- Eseler Neighborhood;
- Suleymaniye Neighborhood;
- Camyolu Neighborhood;

However, as explained above, these impacts will be limited to 2-3 years in duration of construction works.

14.3.1.6. Changes in the Demographic Structure of the Settlements

During the construction phase of the Project main impacts on local population are due to in-migration and out-migration events due to direct and indirect temporary employment opportunities brought by the Project. Currently, it is not possible to estimate how many direct and indirect jobs will be created and where staff is expected to be sourced from (local, provincial or national level), therefore it is difficult to draft with precision what demographic changes will occur. Directly employed workers will be accommodated in campsites, thus leading to increase in population in the areas where they are planned to be built. However campsites are planned to be built self-sufficient to the extent possible, therefore contacts and exchanges with local communities will be limited. In addition campsite will be temporary, therefore changes in the population are expected to be limited in time and will be reversed once construction activities are over.

14.3.1.7. Short and Long Term Employment Opportunities Created by the Project

The workforce needed during the construction phase of the Project will be sourced locally, regionally and nationally (from other parts of Turkey). Due to the technical nature of the Project and the low skill set in local communities, it is likely that skilled labor will be sourced nationally. Typically, in Turkey, most of the construction companies employ unskilled labor from the local communities, primarily to reduce costs associated with travel and accommodation.

Employment of locals will provide significant benefits on those who are employed however this will be a minor portion of the entire population. The employment of individuals from local communities will however be beneficial as it is expected to lead to improved relationships between the Project and local communities.

Another benefit of the Project will be indirect employment opportunities and these will be associated with the Project supply chain (goods and services) and spending of Project employees in local communities.

Employment of non-locals, as well as the increase of incomes of local employees, may also bring in some minor benefits for local communities, associated with increased spending in the project area. Due to the fact that, nearest vicinities to Project area is large scale residential areas, this positive impact is anticipated to be minor.

14.3.1.8. Increase of Tensions and Conflicts in the Local Community

During the construction phase an increase of tensions and conflicts may occur both within communities or between communities; this can be due to a series of factors directly and indirectly linked to the Project activities.

Temporary and permanent changes to land use may create in tensions in owners or people making a livelihood from the affected areas. The perception that the expropriation activities are not performed in an equitable and transparent manner might lead to tensions among land owners.

Additionally, the perception that economic benefits are not distributed equitably or that certain groups are excluded from employment opportunities can create situations of frustration and resentment in local communities.

In addition the arrival of workers directly or indirectly employed in the Project can have consequences in settlements where contacts among workers and local communities are more common. Increased tensions would be due to general nuisances brought by workers, increased pressure on infrastructures or services or localize cultural aspects. This is more likely to occur in settlements closer to campsites, where the influx of workers is stronger.

14.3.2. Operation Phase

The proposed project will increase the economic activities around the region and it will improve the commercial activity in the project area resulting in economic uplift of the local communities. There would be a wider economic impact in terms of generating opportunities for other business like transportation, marketing, repair and maintenance tasks, etc. It will also increase in value of land along the carriage way resulting due to gentrification effect Property value especially near interchanges may increase in future. It is planned by the Government to develop Industrial Zones near each interchange, which will enhance the commerce and trade activities. It gives safe and fast way for traveling and trade (as there are minimum chances of accidents due to controlled speed). Decreasing the vehicle operating cost and travel time costs due to better/ improved road facility, reduced traffic congestion, uninterrupted and smooth traffic flow.

Relevant impacts cause by noise emissions are given in Chapter 11 - Noise and Vibration; while dust emissions are given in Chapter 10 - Air Quality. Additionally, potential impacts and mitigation measures regarding to the local communities' health and safety issues are explained in Chapter 15 - Community Health and Safety.

14.4. Mitigation Measures

Mitigation measures are proposed in accordance with Turkish legislation and international standards (e.g. IFC PS 5). Relevant mitigation measures will be taken against potential social impacts during the Project's all phases are described under this section.

14.4.1. Land Preparation and Construction

Mitigation measures will be taken to potential social impacts during the land preparation and construction phase of the project are explained below sections.

14.4.1.1. Livelihood and Economic and Physical Displacement

International Finance Corporation (IFC) Performance Standards 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. In order to minimize this impact PS 5 defines basic mitigations. These are as follows:

PS5. Land Acquisition and Involuntary Resettlement	To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs; To avoid forced eviction; To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement costs and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; To improve, or restore, the livelihoods and standards of living of displaced persons; and To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

In spite of IFC PS5's recognitions, all related expropriation and land acquisition activities will be performed in line with national laws and regulations.

When displacement cannot be avoided, displaced communities and persons will be provided with appropriate compensation for loss of assets through Project-specific measures to be developed. It should be here noted that according to the related terms of the BOT Contracts, the Project Sponsors are liable to provide up to 500 million TL for the expropriation costs in each section. The costs exceeding this amount will be provided by the KGM. Implementation of the expropriation works are under the responsibility of KGM as the administrative authority. The costs related with the procurement of services for the valuation works and others will be separately covered by the Project Owner.

Additional compensation method will be available for the affected communities through “Government Assisted Resettlement”. Article 12 of Resettlement Law refers to the resettlement of persons whose immovable properties are expropriated and specifies eligibility criteria for government assisted resettlement as follows:

(1) Due to the construction of a dam, an area adjacent to the dam, an area under protection, airport, highway, railway, plant and other facilities related to national economy and defense will be erected by public institutions and organizations; and due to the implementation of special laws and in order to protect historical and natural valuables;

a) The families who have to leave their locations/places as a result of partial or full expropriation of their immobile properties,

b) The families who do not own any immovable property, but who reside in the expropriation area at least for three years before the beginning of the calendar year, in which the resettlement planning studies were commenced, will be resettled to the locations/places indicated by the MoEU according to the provisions of this Law, provided that they request.

(2) However, the families who own immovable properties to be expropriated but left their places before the commencement date of resettlement planning studies shall not be resettled. Within the last three years as of this date, the families who sold their immobile properties without any compulsory situation and did not purchase immovable property with the equal or higher value shall not be resettled even if they did not leave their places. The compulsory situations mentioned above shall be determined by the regulations.

(3) Among the families residing in the expropriation area, those who are affected from the expropriation implemented by the public institutions and organizations, can be resettled by the Ministry to a location indicated within their village boundaries upon their written application if they do not want to be resettled by the government in any other place, provided that the suggestion of relevant Governorate and the approval of the Ministry of Interior are obtained.

(4) Among the families included in the scope of the this article, and requested to be resettled by the Government; the families who do not apply within the ninety day following the ending date of the announcement of resettlement, and the families who do not commit to deposit the amount determined by the MoEU from their expropriation compensation they received or will receive, or their full expropriation compensation and additional increase awarded by court in the case that the amount of expropriation compensation is lower than the amount (determined by the Ministry) into the account of the Central Account Unit of the Ministry, shall not be resettled.

Article 9 of Resettlement Law explains the resettlement assistance (which is similar to World Bank Standards) as follows:

(1) The immigrants, nomads, the persons whose places/grounds are expropriated and persons who are decided to be relocated by the reason of the national security shall be resettled in cities, towns and villages by means of providing the following through

debiting/repayment according to the provisions of this Law, and pursuant to the plan and the project (specific) prepared by the MoEU;

a) At first, house and its' house- plot (for building),
b) For craftsmen, artisans and tradesmen: work place and its' building plot and operation credit to enable them providing for their livelihood,
c) For farmers, land, necessary agricultural inputs, agricultural structures or plot of structure, and in kind and in cash operation and equipment credits as envisaged in agricultural resettlement project (specific),
d) In case of the request of the right holder families (entitled to resettlement), resettlement credits can be given to the families collectively or individually, if the house, work place and agricultural land are found by themselves and their suggestions are approved by MoEU.

(2) Annual operation and equipment credits provisioned in agricultural resettlement projects (specific) shall not be paid to the families who did not request the mentioned credits within two years following the transfer of their agricultural lands.

(3) For immigrants accepted to enter the country according to this Law, as of the date they pass (enter) the border gates with their used goods which are exempt of customs; and for the people whose grounds(immovable properties) are expropriated and for those who are resettled due to national security and for the nomads, as of time when they are transferred to their resettlement areas; they shall be provided the support of medical help, accommodation, food, fuel and the support of clothing (for once only) for persons in need, and gratuitous assistances for temporary re-settlement for those whose immovable properties are expropriated; these supports shall be provided according to the time, amount and the conditions specified in the regulations of the Law.

(4) Transportation (moving) of those (families) mentioned above to the resettlement areas (sites) shall be provided free of charge by the government according to the "Transportation (moving) Project" to be prepared (specifically) by the Ministry.

From the international standards point of view, another important point is the allocation of expenditure regarding land acquisition and resettlement under a single/same budget item. Article 33 of the Resettlement Law no 5543, states that the resettlement allowance will be allocated in the budget of the institution responsible for expropriation (in this case KGM).

14.4.1.2. Restriction of Access to the Agricultural Lands and Pasturelands

Expropriation of privately-owned agricultural lands will be done by KGM in accordance with the relevant provisions of the Expropriation Law. In the accordance with Turkish Expropriation Law, if the land portion remaining from expropriation would not be viable anymore, eligible persons have the right to request the expropriation of the entire parcel (application has to be in line with the requirements of the Law) including the remaining portion, even if this portion is out of the expropriation corridor.

- Several underpasses and culverts have been included in the design to ensure access of local people to agricultural lands. These underpasses and culverts will ensure sufficient dimensions for the passage of harvesters, vehicles, etc. where required. Detailed lists of underpasses and culverts planned in the Asian sections of the Project are provided in Chapter 3 (“Project Description”)
- Access roads will be constructed in parallel to the Motorway near agricultural areas/zones to provide access to agricultural lands, where necessary.
- Legitimate requests of local people regarding the avoidance and/or minimization of the restriction of access between their settlement areas and agricultural lands will be considered by the Project Sponsors’ design team and feasible solutions will be developed and implemented, where possible.

For the pasturelands that will be separated by the Motorway (fragmentation of land), impacts on the public users of the pasturelands will be mitigated by ensuring access between severed lands. In this scope, culverts, underpasses and over bridges have already been included in the design. However, additional passage ways that will be requested by local communities will be added in the design. These type of requested already been stated during the Public Consultation Meeting by local people and proposed locations of the underpasses, culverts and over bridges is recorded by the Project Sponsor.

14.4.1.3. Impacts on Local Business

Although business owner will be compensated by the government, Project activities may cause economic displacement for those business premises located nearby the Motorway route. Within the scope of SEP, Project Sponsor/Contractors will inform the local business owners prior to commence construction activities, 15 days notice.

14.4.1.4. Effects on Infrastructures and Distribution of Utility Services

The mitigation of impacts on infrastructures and utility distribution are partially addressed in the Waste Management Plan. The following mitigation measures will be applied throughout the construction phase:

- Mobile schooling times will be taken into account during the transportation of construction materials. Neighborhood headmen will be informed about the upcoming construction activities' date and times.

- All utility distribution networks intersected by Project Components will be identified and appropriate construction techniques will be used to reduce disruptions to the extent possible.

- Any planned disruption of utility distribution services will be communicated to local authorities and local communities with at least 72 hours notice; where planned disruptions are expected to last more than 12 hours, a specific risk analysis will be performed to assess impacts expected on local communities and to identify additional mitigation measures

- Any damage to utility distribution networks will be repaired promptly in accordance with the network owner or operator. Any unplanned disruption of utility distribution services will be managed through communication to local communities, written information to explain event occurred and repair measures needed. Grievance mechanism will be used to record and solve the relevant incidents results.

- Access to properties will be guaranteed or appropriate alternative access solutions that are agreed with users will be implemented. The existing irrigation networks affected by Project activities will be mapped and appropriate technical solutions will be implemented to reduce possible interferences; if interferences are unavoidable, appropriate alternative solutions will be agreed with irrigation water users

During the course of construction phase, grievance mechanism will be in effect in order to receive local community's nuisance and disturbance.

14.4.1.5. Noise and Dust Emissions Generated by Construction Activities

Relevant mitigation measures regarding the noise emissions are given in Chapter 11 - Noise and Vibration; while dust emissions are given in Chapter 10 - Air Quality. Additionally, potential impacts and mitigation measures regarding to the local communities' health and safety issues are explained in Chapter 15 - Community Health and Safety.

During the course of construction phase, grievance mechanism will be in effect in order to receive local community's nuisance and disturbance.

14.4.1.6. Changes in the Demographic Structure of the Settlements

In order to avoid population influx to the nearby settlements, all the workers will be accommodated in the campsites. Assessment of the potential problems between workers and local communities is highly important to avoid growing conflicts. SEP and grievance mechanism will be in effect at all stages of the construction phase.

14.4.1.7. Short and Long Term Employment Opportunities Created by the Project

The project owner shall take all necessary actions and measures for labor and employment in order to be in compliance with Turkish legislation and international standards. A “Human Resources Management Procedure” will be developed by the project sponsor.

Project Sponsor aims at employing local workers to the extent possible, in order to increase the Project’s local benefits. The recruitment processes will be transparent, public and non-discriminatory, providing equal opportunities with respect to ethnicity, religion, language, gender and sexuality.

Employment opportunities should be provided for those vulnerable groups living in the settlements. The following quote provide opinions collected during field studies on the issue of employment opportunities:

“I am a widow so how can I find a proper job for my son? Just think about this: I am not equal with a man who has a son. He can easily find a job for him but I don’t know anyone who can provide a job to my son. We are always alone. (A Widow living in Taskisigi Neighborhood, Social Field Survey, January 2017)”

The Contractors will provide clear information on the recruitment process, with particular emphasis on informing local communities of employment opportunities through different channels such as settlement headmen and local associations. Communication material such as posters and brochures will be distributed locally. Job descriptions will be clearly communicated in advance and will contain complete information on working conditions.

Contracts will comply with Turkish legal requirements and will contain complete information on working conditions; a copy will be signed by both parties and will be provided to the worker.

14.4.1.8. Increase of Tensions and Conflicts in the Local Community

Project Sponsor and Contractors will provide clear information on the recruitment process, with particular emphasis on informing local communities of employment opportunities through different channels such as settlement heads and local associations. Communication material such as posters and brochures will be distributed locally. The recruitment processes will be transparent, public and non-discriminatory, providing equal opportunities with respect to ethnicity, religion, language, gender and sexuality.

In order to increase the project's local benefits, goods, services and materials will be procured from local businesses to the extent possible.

Training on community relations will be provided to workers during induction and regularly throughout their employment; workers will be informed on the code of conduct to keep according to local customs and on approach to be used when interacting with local communities and individuals.

Project Sponsor and contractors will conduct medical check-up of the labor force before hiring them; this will minimize risk of increase in diseases due to the entry of the labor force into the project construction area. In addition communicable diseases that could be transmitted by the workforce should be identified.

Local authorities and local communities will be informed and consulted on impacts due to project activities and planned mitigation measures. An effective Stakeholder Engagement Plan (SEP) will be in effect. As part of the Stakeholder Engagement Activities, a Grievance Mechanism already been set up for communities and individuals to formally communicate their concerns, complaints and grievances and facilitate resolutions that are mutually acceptable by the parties

Accidental damages caused by project activities will be compensated by Project Sponsor.

14.5. Summary of Assessment and Residual Impacts

Table 14.20. provides a summary on the social impact assessment. Significance of the identified impacts before and after the implementation of mitigation measures are summarized in this table. As can be seen from the Table, in general, potential impacts on the livelihoods, infrastructures and utility services and demographic characteristics etc. are anticipated to be reduced to low levels in the long-run with effective implementation of mitigation measures, with the exception of impacts on livestock activities within the affected settlements. However, residual impacts related to the livestock owners which the residual impacts have been evaluated as medium due to their importance.

Table 14.20. Summary of Social Impact Assessment

Affected Socio-economic Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Livelihood and Economic Displacement	Land preparation and construction / Operation	Effects on livelihood from agricultural activities / Physical Displacement	Adverse	Restricted	Long	Low (Section 4; Section 5: (KM 151+100 – KM 166+600; KM 175+500 – KM 188+300); Section 6: (KM 200+600 – KM 211+200)	Irreversible	One-off	Moderate (B)	Medium (2)	Medium (B2)	• When displacement cannot be avoided, displaced communities and persons will be provided with appropriate compensation for loss of assets through Project-specific measures to be developed Additional compensation method will be available for the affected communities through “Government Assisted Resettlement”. • Several underpasses and culverts have been included in the design to ensure access of local people to agricultural lands. These underpasses and culverts will ensure sufficient dimensions for the passage of harvesters, vehicles, etc. where required. • Access roads will be constructed in parallel to the Motorway near agricultural areas/zones to provide access to agricultural lands. Legitimate requests of local people regarding the avoidance and/or minimization of the restriction of access between their settlement areas and agricultural lands will be considered by the Project Sponsors’ design team and feasible solutions will be developed and implemented, where possible.	Low
			Adverse	Restricted	Long	Medium (Agricultural areas that will be affected by the Project)	Irreversible	One-off	Moderate (B)	Medium (2)	Medium (B2)	• When displacement cannot be avoided, displaced communities and persons will be provided with appropriate compensation for loss of assets through Project-specific measures to be developed Additional compensation method will be available for the affected communities through “Government Assisted Resettlement”. • Several underpasses and culverts have been included in the design to ensure access of local people to agricultural lands. These underpasses and culverts will ensure sufficient dimensions for the passage of harvesters, vehicles, etc. where required. • Access roads will be constructed in parallel to the Motorway near agricultural areas/zones to provide access to agricultural lands. Legitimate requests of local people regarding the avoidance and/or minimization of the restriction of access between their settlement areas and agricultural lands will be considered by the Project Sponsors’ design team and feasible solutions will be developed and implemented, where possible.	Low
			Adverse	Restricted	Long	High	Irreversible	One-off	Major (A)	High (3)	High (A3)	• When displacement cannot be avoided, displaced communities and persons will be provided with appropriate compensation for loss of assets through Project-specific measures to be developed Additional compensation method will be available for the affected communities through “Government Assisted Resettlement”.	Medium
	Land preparation and construction / Operation	Effects on livelihood from livestock activities	Adverse	Restricted	Long	Low (affected area of the pasture parcel is less than 10% of the entire parcel area) Karakamis - Section 6	Short term reversible	One-off	Minor (C)	High (3)	High (C3)	• For the pasturelands that will be separated by the Motorway (fragmentation of land), impacts on the public users of the pasturelands will be mitigated by ensuring access between severed lands. In this scope, culverts, underpasses and over bridges have already been included in the design. However, additional passage ways that will be requested by local communities will be added in the design.	Low
			Adverse	Local	Long	Medium (distance of the construction zone to the settlements is ≤500m) Section 5 (Sevindikli, Karayakuplu, Sipahiler, Toylar, Sepetci Neighborhoods Section 6 (Cayirkoy, Durhasan, Eseler, Bayraktar, Karabdulbaki, Suleymaniye, Akmese Ataturk, Besevler, Celebiler, Kasimlar, Cerciler, Haciramazanlar, Budaklar, Kizilcikorman, Osmanbey, Vakif and Topagac Neighborhood)	Short term reversible	One-off	Moderate (B)	High (3)	High (B3)	• For the pasturelands that will be separated by the Motorway (fragmentation of land), impacts on the public users of the pasturelands will be mitigated by ensuring access between severed lands. In this scope, culverts, underpasses and over bridges have already been included in the design. However, additional passage ways that will be requested by local communities will be added in the design.	Medium
			Adverse	Restricted	Long	High	Short term	One-off	Major (A)	High (3)	High (A3)	• For the pasturelands that will be separated by the Motorway	Medium

Affected Socio-economic Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
						(affected area of the pasture parcel is more than 25% of the entire parcel area) Celebiler Neighborhood – Section 6	reversible					(fragmentation of land), impacts on the public users of the pasturelands will be mitigated by ensuring access between severed lands. In this scope, culverts, underpasses and over bridges have already been included in the design. However, additional passage ways that will be requested by local communities will be added in the design.	
Infrastructures and Distribution of Utility Services	Land preparation and construction / Operation	Effects on traffic and mobility	Adverse	Local	Medium	Low	Short term reversible	Intermittent	Moderate (B)	Medium (2)	Medium (B2)	• All utility distribution networks intersected by Project Components will be identified and appropriate construction techniques will be used to reduce disruptions to the extent possible. • Any planned disruption of utility distribution services will be communicated to local authorities and local communities with at least 72 hours notice; where planned disruptions are expected to last more than 12 hours, a specific risk analysis will be performed to assess impacts expected on local communities and to identify additional mitigation measures • Any damage to utility distribution networks will be repaired promptly in accordance with the network owner or operator. Any unplanned disruption of utility distribution services will be managed through communication to local communities, written information to explain event occurred and repair measures needed. Grievance mechanism will be used to record and solve the relevant incidents results. • During the course of construction phase, grievance mechanism will be in effect in order to receive local community's nuisance and disturbance. • Mobile schooling times will be taken into account during the transportation of construction materials. Neighborhood headmen will be informed about the upcoming construction activities' date and times.	Low
		Effects on infrastructures and utility services	Adverse	Local	Medium	Low	Short term reversible	Intermittent	Moderate (B)	Medium (2)	Medium (B2)	• Any damage to utility distribution networks will be repaired promptly in accordance with the network owner or operator. Any unplanned disruption of utility distribution services will be managed through communication to local communities, written information to explain event occurred and repair measures needed. Grievance mechanism will be used to record and solve the relevant incidents results. • During the course of construction phase, grievance mechanism will be in effect in order to receive local community's nuisance and disturbance.	Low
Demographic Structure of Settlements	Land preparation and construction	Influence on local communities	Adverse	Wide	Medium	Low	Short term reversible	Intermittent	Moderate (B)	Medium (2)	Medium (B2)	• In order to avoid population influx to the nearby settlements, all the workers will be accommodated in the campsites. Assessment of the potential problems between workers and local communities is highly important to avoid growing conflicts. SEP and grievance mechanism will be in effect at all stages of the construction phase.	Low
Employment Opportunities	Land preparation and construction	Opportunities for local economy	Beneficial	Wide	Medium	Medium	Short term reversible	Intermittent	Moderate (B)	Medium (2)	Medium (B2)	• A "Human Resources Management Procedure" will be developed by the project sponsor. • Project Sponsor aims at employing local workers to the extent possible, in order to increase the Project's local benefits. The recruitment processes will be transparent, public and non-discriminatory, providing equal opportunities with respect to ethnicity, religion, language, gender and sexuality. • Contracts will comply with Turkish legal requirements and will contain complete information on working conditions; a copy will be signed by both parties and will be provided to the worker. • The Contractors will provide clear information on the recruitment process, with particular emphasis on informing local communities of employment opportunities through different channels such as settlement headmen and local associations	Low
Increase of Tensions in the Local Community	Land preparation and construction	Increase of Tensions and Conflicts	Adverse	Wide	Medium	Low	Short term reversible	Intermittent	Moderate (B)	Medium (2)	Medium (B2)	• Training on community relations will be provided to workers during induction and regularly throughout their employment; workers will be informed on the code of conduct to keep according to local customs and on approach to be used when interacting with local communities and individuals. • Local authorities and local communities will be informed and consulted on impacts due to project activities and planned mitigation measures. An effective Stakeholder Engagement Plan (SEP) will be	Low

Affected Socio-economic Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource /Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
												in effect. As part of the Stakeholder Engagement Activities, a Grievance Mechanism already been set up for communities and individuals to formally communicate their concerns, complaints and grievances and facilitate resolutions that are mutually acceptable by the parties • In order to increase the project's local benefits, goods, services and materials will be procured from local businesses to the extent possible.	

CHAPTER 15

COMMUNITY HEALTH AND SAFETY

CHAPTER 15. COMMUNITY HEALTH AND SAFETY

The North Marmara Motorway Project will involve typical community health and safety impacts and/or risks that are applicable in most of the large scale infrastructure projects. Especially, construction phase will include significant earth moving activities and involvement of a large number of workforce. However, due to temporary nature of the construction activities, associated impacts on the health and safety of the community will be short-term and temporary. During the operation phase, pedestrian safety, traffic safety and emergency preparedness and response would be among the most important community health and safety issues that are to be properly managed throughout the long-term operational activities. It should be noted that, with the improved road standards, accidents rates for the associated routes are anticipated to reduce providing an overall benefit to the community safety and public welfare. Socio-economic impacts and benefits of the Project that would also be related with public welfare have been discussed in Chapter 14 ("Socio-economic Environment"). Main community health and safety issues to be covered in the following sections are summarized below:

- Traffic safety during construction and operation;
- Impacts of blasting operations during construction;
- Impacts on water quality and availability during construction;
- Airborne/communicable diseases due to construction workforce inflow;
- Pedestrian safety during operation;
- Emergency preparedness and response during the construction and operation;
- Disturbance of public health and welfare due to air emissions, noise generation, water-borne, water-based and water-related during the construction and operation;
- Security personnel arrangements during construction;
- Structural safety during operation.

15.1. Assessment Methodology and Data Sources

Impacts of the Project on the community health and safety have been assessed based on qualitative approaches. As some of the potential impacts on the community health and safety are primarily associated with other direct environmental impacts such as air emissions, noise generation, wastewater and waste production, etc., outcome of the assessments done for those impacts in the previous chapters of this ESIA have been taken into consideration as well.

- Social Field Survey conducted in January 2017;
- Turkstat's transportation statistics (accidents, fatalities, etc.);
- Turkstat's population statistics;
- Istanbul, Kocaeli and Sakarya Metropolitan Municipality's databases.

Study area for the community health and safety impacts have been determined as 2 km corridor (1.000 m from each side of the Motorway axis), as the settlements located within this area would be more likely to be subject to associated risks and impacts when compared to the settlements located at farther distances (>1.000 m).

Significance Criteria

The significance criteria for the impacts on community health and safety will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on the land use components, while sensitivity/value criteria to be used in the scope of impact assessment is summarized in Table 15.1. Detailed explanation of the sensitivity components for each ecosystem component is provided in the following "Baseline Conditions" section.

Table 15.1. Criteria for Sensitivity/Value of Resource/Receptor

Ecosystem Component	Sensitivity/Value Level		
	High (3)	**Moderate (2)**	**Low (1)**
Local Communities (Risk of Construction Accidents)	Settlements within the expropriation corridor having affected population>500 habitants or Settlements within the study corridor having affected population>1.000	Settlements within the study corridor (inc. exp. corridor) having affected population of 500-1.000 habitants	Settlements within the expropriation corridor having affected population<500 habitants
Local Communities (Blasting Effects)	Settlements where number of residential buildings within the expropriation corridor	Settlements where number of residential buildings within the expropriation corridor between10-20	Settlements where number of residential buildings within the expropriation corridor<10
Local Communities (Water Supply)	Settlements with limited water availability		Settlements with sufficient water availibility
Local Communities (Airborne/ communicable diseases)	Settlements with existing health issues		Settlements with no existing health issue
Local Communities (Disturbance due to acts of security personnel)	Settlements with particular sensitivity/past issues related with improper acts of security		Settlements with no particular sensitivity/past issues related with improper acts of security
Local Communities (Traffic accidents)	All locations		

15.2. Baseline Conditions

Settlements located within a 2 km study corridor (1.000 m from each side of the Motorway axis), together with their distance to Motorway components and populations, are listed in Table 15.2.

Table 15.2. Settlements Located in the Vicinity (within 2 km corridor) of the Motorway Components

Districts	Neighborhoods	Population (Turkstat 2015)	Percent of Residential Area within the Expropriation Corridor/Study Area		
			Within the Expropriation Area (<200 m)	Between Expropriation Area and the Study Area Borders (200 m-1.000 m)	Beyond Study Area (>1.000 m)
Section 4					
Istanbul					
Pendik	Kurnakoy	1.233	25	75	0
Tuzla	Tepeoren	6.252	25	75	0
Tuzla	Akfırat	2.386	25	75	0
Kocaeli					
Gebze	Kadilli	502	0	100	0
Gebze	Cumakoy	1.707	0	25	75
Gebze	Denizli	1.200	0	25	75
Gebze	Tavsanli	2.275	25	75	0
Gebze	Muallim	1.690	0	0	100
Dilovası	Koseler	554	0	0	100
Dilovası	Demirciler	497	0	0	100
Dilovası	Cerkesli	1.055	0	0	100
Section 5					
Izmit	Tepecik	1.281	0	0	100
Gebze	Yagcilar	174	0	0	100
Korfez	Kutluca (Kiyirlar)	299	0	75	25
Korfez	Semsettin	214	0	0	100
Korfez	Sevindikli	285	0	100	0
Korfez	Karayakuplu	226	0	100	0
Korfez	Sipahiler (Kadikoy)	306	100	0	0
Derince	Toylar	207	0	100	0
Derince	Kasikci	396	0	0	100
Izmit	Sepetci	681	0	50	50
Section 6					
Kocaeli					
Izmit	Yassibag	740	0	0	100
Izmit	Cayirkoy	1.426	0	100	0
Izmit	Durhasan	677	25	75	0
Izmit	Eseler	350	0	100	0
Izmit	Biberoglu	104	0	0	100
Izmit	Bayraktar	996	0	75	25
Izmit	Gedikli	405	0	50	50
Izmit	Karaabdulbaki	504	0	100	0
Izmit	Sapakpinar	339	0	100	0
Izmit	Suleymaniye	416	25	75	0
Izmit	Akmese Ataturk	783	0	50	50
Sakarya					
Serdivan	Besevler	608	0	0	100
Adapazari	Alanduzu	863	0	75	25
Adapazari	Korucuk	19.404	0	25	75
Adapazari	Karapinar	428	0	100	0
Adapazari	Camili	17.631	0	0	100
Adapazari	Evrenkoy	2488	0	75	25
Adapazari	Karaman	13.085	0	50	50
Adapazari	Taskisigi	1.316	25	75	0
Adapazari	Camyolu	1.535	25	75	0
Adapazari	Dagdibi	1.519	0	0	100
Adapazari	Poyrazlar	341	0	100	0
Adapazari	Dogancilar	256	0	75	25
Adapazari	Komurluk	257	100	0	0
Adapazari	Celebiler	132	25	75	0
Adapazari	Kasimlar	323	0	100	0
Adapazari	Cerciler	210	0	100	0
Adapazari	Haciramazanlar	337	25	75	0

Districts	Neighborhoods	Population (Turkstat 2015)	Percent of Residential Area within the Expropriation Corridor/Study Area		
			Within the Expropriation Area (<200 m)	Between Expropriation Area and the Study Area Borders (200 m-1.000 m)	Beyond Study Area (>1.000 m)
Adapazari	Budaklar	1.356	0	100	0
Adapazari	Abali	1.364	0	100	0
Erenler	Kucukesence	836	0	0	100
Akyazi	Gebes	129	0	0	100
Akyazi	Bediltahirbey	259	0	50	50
Akyazi	Catalkopru	1.154	0	0	100
Akyazi	Turkormankoy	435	0	25	75
Akyazi	Kizilcikorman	756	0	100	0
Akyazi	Eskibedil	608	0	25	75
Akyazi	Vakif	1.145	0	25	75
Akyazi	Osmanbey	985	0	100	0
Akyazi	Kumkopru	460	0	25	75
Akyazi	Topagac/Ramasli	1.253	0	75	25
Akyazi	Duzyazi	525	0	25	75

**<200 m represent the units located within the widest expropriation corridor; >1.000 m represents the units located beyond the study area of 2 km.*

Existing Transportation Infrastructure

Motorway network of Turkey is currently under development. As of 2015, total length of the Motorways was recorded as 2.159 km, which is less than %1 of the total length of the road network in the country. The 2035 target of KGM is to complete construction of 7.800 km of motorway. Increase in the length of the roads in Turkey between 1984 and 2015 is summarized in Table 15.3.

Table 15.3. Road Length in Turkey

Year	General Total (km)	State Highways (km)		Provincial Roads (km)		Motorways (km)	Village Roads (km)
		Divided Road	Other	Divided Road	Other		
1984	310 398	1 291	29 691	69	28 061	77	251 209
1985	316 887	1 499	29 498	99	28 206	77	257 508
1986	320 774	1 541	29 445	87	28 066	77	261 558
1987	328 170	1 484	29 578	72	27 781	101	269 154
1988	330 513	1 599	29 400	74	27 778	151	271 511
1989	356 282	1 708	29 340	86	27 418	151	297 579
1990	367 956	1 798	29 351	111	27 868	241	308 587
1991	368 165	1 836	29 426	136	27 824	342	308 602
1992	387 079	1 890	29 454	153	28 346	716	326 521
1993	388 035	2 018	29 407	167	28 179	1 012	327 253
1994	381 012	2 149	29 240	202	28 241	1 151	320 029
1995	381 297	2 185	29 237	231	28 346	1 243	320 055
1996	381 637	2 301	29 111	253	28 560	1 411	320 001
1997	381 759	2 450	28 870	302	29 219	1 470	319 448
1998	380 293	2 821	28 524	349	29 191	1 628	317 780
1999	384 382	3 027	28 361	369	29 166	1 639	321 820
2000	417 406	3 424	27 973	439	29 254	1 674	354 642
2001	426 249	3 673	27 703	451	29 478	1 696	363 248
2002	427 411	3 859	27 459	467	29 583	1 714	364 329
2003	428 415	4 926	26 432	521	29 612	1 753	365 171
2004	349 215	6 735	24 711	575	29 793	1 662	285 739
2005	349 238	7 917	23 454	594	29 974	1 667	285 632
2006	349 304	9 135	22 200	642	29 787	1 908	285 632
2007	350 708	10 387	20 946	678	29 901	1 908	286 888
2008	351 958	11 747	19 564	789	29 923	1 922	288 013

Year	General Total (km)	State Highways (km)		Provincial Roads (km)		Motorways (km)	Village Roads (km)
		Divided Road	Other	Divided Road	Other		
2009	362 660	13 606	17 665	852	30 096	2 036	298 405
2010	367 263	15 788	15 607	996	30 394	2 080	302 398
2011	370 276	17 033	14 339	1 122	30 436	2 119	305 227
2012	385 748	17 886	13 489	1 181	30 699	2 127	320 366
2013	388 666	18 524	12 817	1 311	30 844	2 127	323 043
2014	236 671	18 944	12 336	1 361	31 113	2 155	170 762
2015	238 776	19 357	11 856	1 467	31 598	2 159	172 339

Source: Turkstat, 2016.Transportation Statistics.

Number of vehicle ownership and vehicle movement density and usage rate of the roads (vehicle-kilometers) has increased rapidly (in parallel to population growth) since the beginning of 2000s. An evaluation of the risk of losing one's live in a road traffic accident is best expressed as a ratio of the number of fatalities per billion/million vehicle-kilometers (*http://ec.europa.eu/eurostat/*). When the data published by Turkstat is analyzed, it is seen that together with the increase of vehicle-kilometers and total number of traffic accidents, number of fatalities (killed persons) have decreased more than %50 between 2002-2015, which is a consequence attributed by KGM to the increased length of divide roads and motorways. KGM aims to decrease the rate of fatalities in 100 million vehicle-km to less than 1 fatality (which was recorded as 3,4 in 2015) as of 2023. Number of Fatalities in 100 million Vehicle-kilometers in Turkey is presented in Table 15.4.

Table 15.4. Number of Fatalities in 100 million Vehicle-kilometers* in Turkey

Year	Total ($x10^6$)	Vehicle-km ($x10^6$)			Number of Fatalities in Traffic Accidents (at the accident scene)	Number of Killed Persons in 100 million Vehicle-km
		State Road	Provincial Road	Motorway		
2002	51 664	40 504	5 130	6 030	4 093	7,9
2003	52 349	40 505	5 131	6 713	3 946	7,5
2004	57 767	44 328	5 675	7 764	4 427	7,7
2005	61 129	45 818	5 845	9 466	4 505	7,4
2006	64 577	47 055	5 994	11 528	4 633	7,2
2007	69 609	50 459	6 423	12 727	5 007	7,2
2008	69 771	50 255	6 385	13 131	4 236	6,1
2009	72 432	51 932	6 592	13 908	4 324	6,0
2010	80 124	58 159	7 016	14 949	4 045	5,0
2011	85 495	**62 276**	7 512	15 707	3 835	4,5
2012	93 989	64 661	12 949	16 379	3 750	4,0
2013	99 431	67 915	13 551	17 965	3 685	3,7
2014	102 988	70 246	13 983	18 759	3 524	3,4
2015	113 274	77 273	15 420	20 581	3 831**	3,4

Source: Turkstat, 2016.Transportation Statistics.

**Vehicle kilometers refer to the unit measure of traffic corresponding to the movement of one motor vehicle over a distance of one kilometer. For example, daily vehicle-kilometers for a road section of 10 km, through which 200 motor vehicle passes on a daily basis, is calculated as 2.000 vehicle-km. Consequently, vehicle-km value of a road is an indicator of the vehicle movement density and usage rate of the roads.*

***Turkstat data for 2015 is given as total number of killed persons (7.530) including persons lost following the accident (3.699) not at the accident scene in addition to persons lost at accident scene (3.831). However, since the data for the previous years was given considering only the persons lost at the accident scene, the data this value was taken into consideration in the above table.*

The North Marmara Motorway Project is located within the authority and responsibility area of KGM's Istanbul (1st) Regional Directorate. Relevant network and traffic volume maps of 2015 within this area are presented in Figure 15.1, Figure 15.2 and Figure 15.3.

Figure 15.1. Map of the Road Network within KGM's Istanbul (1st) Regional Directorate Authority Area

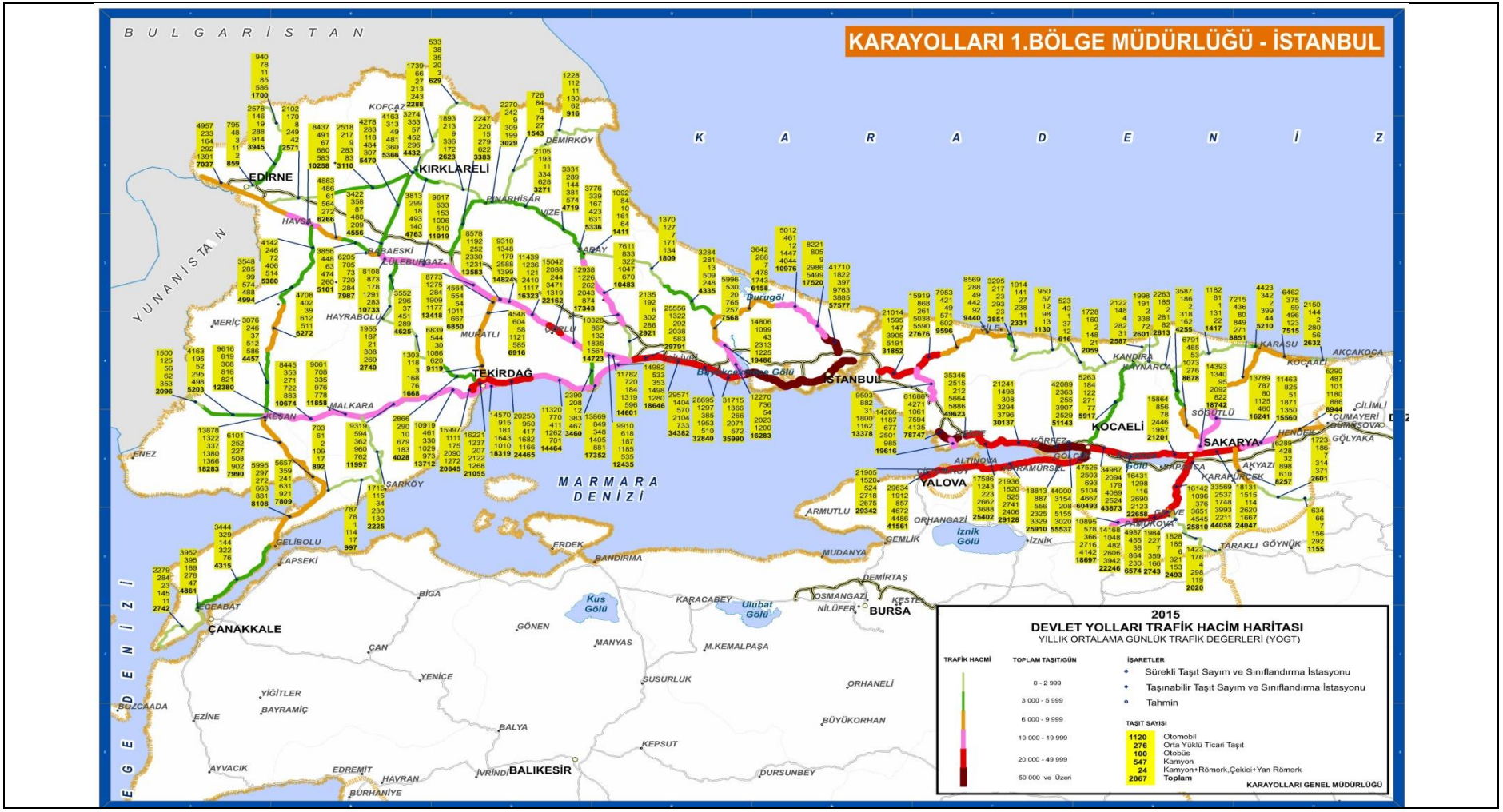


Figure 15.2. Map of the Existing Daily Traffic Volumes (Annual Average for 2015) on State Roads within KGM's Istanbul (1st) Regional Directorate Authority Area

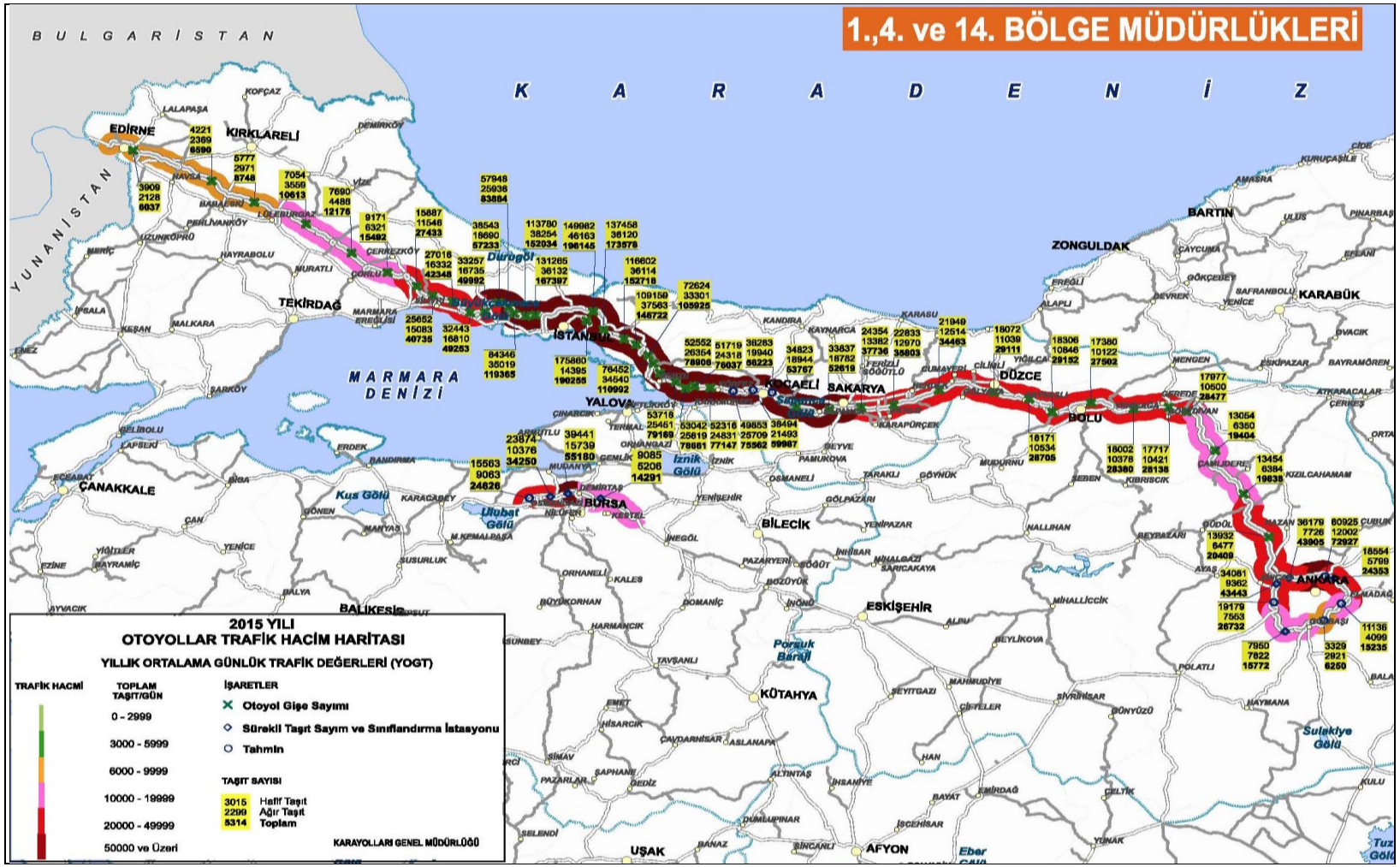


Figure 15.3. Map of the Existing Daily Traffic Volumes (Annual Average for 2015) on Motorways within KGM's Relevant Regional Directorates' Authority Areas

Existing Local Fire Prevention and Response Capacity

Map of existing local fire stations for the Asian side of Istanbul is presented in Figure 15.4 (Locations of the fires stations in Kocaeli and Sakarya provinces are not readily available). Closest stations to the Motorway route and their capacities are listed in Table 15.5. As can be seen, there are a few stations in the vicinity of Section 4's main road (which falls under the authority of Istanbul Metropolitan Municipality).

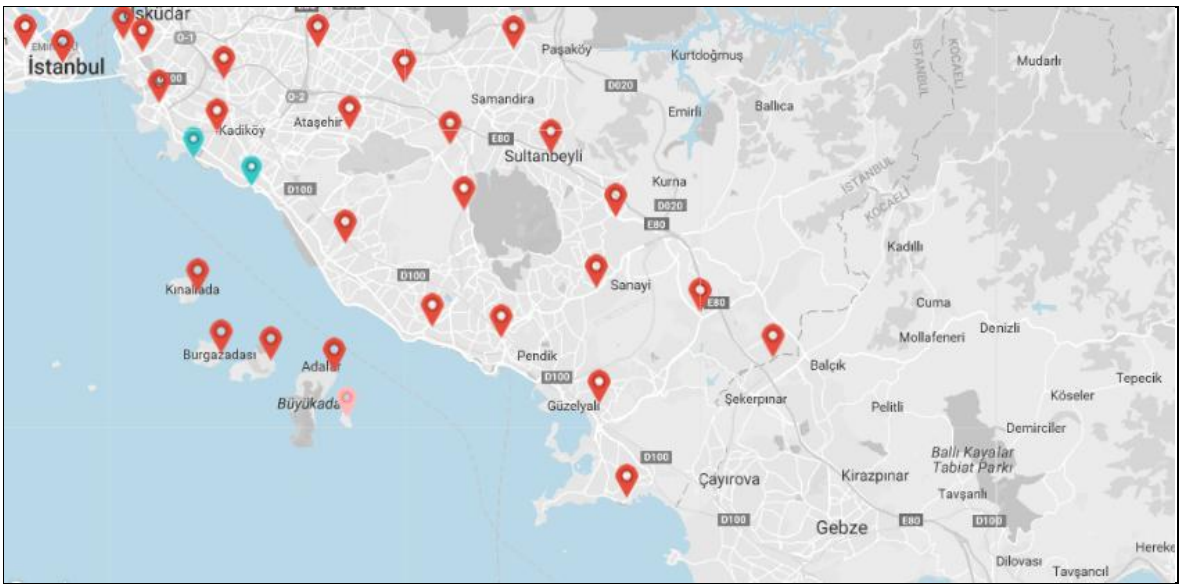


Figure 15.4. Map of Local Fire Stations in the Region
(Source: http://itfaiye.ibb.gov.tr/tr/istasyonlarimiz.html)

Table 15.5. Closest Fire Stations to the Motorway Route

Section	Province/District	Name of the Fire Station	Capacity		
			Fire Truck	Personnel	Hydrant
Section 4	Istanbul/Pendik	Yenisehir Fire Station	5	30	-
	Istanbul/Tuzla	Orhanli Fire Station	6	30	-
	Istanbul/Tuzla	Tuzla OSB Fire Station	4	30	-

Source: http://itfaiye.ibb.gov.tr/tr/istasyonlarimiz.html

15.3. Potential Impacts

Similar to most large construction sites, community health and safety issues during the construction of the Project will include the dust, noise and vibration from construction vehicle transit and issues related that may be associated with the influx of temporary construction labor (*IFC, April 2007*).

Mobile vehicle traffic during the construction and operation phases of the Project is also likely to result in the risk of accidents and potential impacts due to air and noise emissions that need management to minimize community and personnel health and safety issues. On the other hand, overall number of accidents may reduce as a result of the improved driving conditions to be provided by the high motorway standards.

Fire incidents would be another aspect that needs management to avoid risks on health and safety of the local people living nearby the construction sites and the Motorway components as well as the users of the Motorway during the operation phase. Further assessments on the potential impacts on community health and safety during the land preparation and construction and operation phase are provided below. Health and safety risks for the construction and operation personnel will be discussed in Chapter 16 (“Labor and Working Conditions”).

15.3.1. Land Preparation and Construction Phase

Land preparation and construction phase impacts of the North Marmara Motorway Project, would include emissions of dust and noise, and vibration from earthmoving activities, construction vehicle transit, increased traffic load, water supply, material extraction, blasting, and communicable/airborne diseases (respiratory or allergic) associated with the influx of temporary construction labor. Workers’ influx in the vicinity of a community may also strain existing infrastructure, in particular the water and sanitation, electricity and transport systems (*IFC/EBRD, 2009*). These impacts can be managed through good management practices and significance of impacts would then be reduced to acceptable levels. Assessment of specific community health and safety issues associated with the land preparation and construction phase is provided below. Detailed assessments of the impacts caused by air emissions and noise generation have been discussed in Chapter 10 (“Air Quality and Climate Change”) and Chapter 11 (“Noise and Vibration”), respectively.

Construction Traffic Safety

Significant numbers of trucks and other construction machinery will be involved in the land preparation and construction activities increasing the risk of accidents. Since the heavy machinery will work within the construction corridor, the risks posed on the users of public roads would be insignificant. On the other hand, delivery of the construction materials extracted at the quarries and material borrow sites to the construction site and transportation of the unused excavated materials from the work sites to the storage sites by means of trucks, delivery of construction materials (steel, beams, concrete, etc.) by means of trailers and trucks, transportation of personnel accommodating at Camp Sites to the work sites will be the main activities associated with increased traffic.

Some of the public roads may need to be diverted or closed for a certain period of time during the construction and if these activities are conducted in the lack of proper measures (i.e. putting road signs, providing adequate lightning at night), risk of accidents may increase.

Especially, routes passing through settlements may pose significant risks and disturbances on the health and safety of the local communities including those who are the most vulnerable to road traffic accidents (e.g. pedestrians, pedal cyclist, motorcyclists, children, older people). Thus, minimizing the passage of trucks and other construction machinery through the settlements where alternative roads are present would be an effective measure to reduce the risk of traffic accidents. No service road is planned to be constructed to provide access to Camp Sites in the Asian sections, no interaction is foreseen with the nearby settlements.

Behaviors of the drivers and construction machinery operators are among the most important factors related with the risk of traffic accidents, thus requirements for the training and licensing of drivers and operators would reduce the associated risks.

Blasting Operations

If not properly planned and mitigated, blasting operations to be conducted at the quarry sites or necessary road/tunnel construction areas may disturb the communities living or conducting agricultural activities in the close distance or users of the nearby roads due to vibration, air shock, fly rock impacts.

For the construction of tunnels planned in Section 5 and Section 6, blasting operations may be required. At Kutluca and Taskisigi quarries, blasting would also be conducted. Kutluca neighborhood (Kiyirlar quarter) and Taskisigi neighborhoods are the closest settlements but since the settlement centers, where the population density is higher, are located more than 1.000 m from the quarries and the existing topography and vegetation may act as a barrier these settlements are not considered to be sensitive. It should be noted that blasting will be an intermittent operation and potential impacts on the health and safety of the community would be short term and reversible in nature.

Water Quality and Availability

Potential impacts of the land preparation and construction activities involving water extraction, wastewater discharges, diversion or impoundment on the groundwater and surface water resources may pose impacts on the community if these resources are used by local people for drinking or irrigation purposes. Water resources of the local people residing in the settlements along the Motorway and near the construction sites were identified in the scope of social field surveys conducted as a part of the ESIA studies (see Chapter 14 “Socio-economic Environment” for further details and findings of the social field surveys). Table 15.6 summarizes the water resources and wastewater removal methods of the settlements surveyed in the scope of the studies as indicated by the neighborhood headmen. As can be seen from the table, all the neighborhoods around the Motorway route, except Kadikoy, use municipal distribution system as the source of domestic water.

Table 15.6. Water Resources and Wastewater Management in the Settlements Surveyed

Name of the Settlement Surveyed	Source of Water Used for Domestic Purposes	Perceived Quality of Domestic Water Source	Wastewater Management Method
Kurnakoy	Municipal water	Good	Septic tank
Tepeoren	Municipal water	Good	Sewerage network
Demirciler	Municipal water	Good	Septic tank
Kutluca (Kıyırlı q.)	Groundwater	Good	Sewerage network
Karayakuplu	Municipal water	Good	Septic tank
Sipahiler	Municipal water	Good	Sewerage network
Cayirkoy	Municipal water	Good	Sewerage network
Eseler	Municipal water	Good	Sewerage network
Karaabdulbaki	Municipal water	Good	Septic tank
Suleymaniye	Groundwater	Good	Sewerage network
Korucuk	Municipal water	Good	Sewerage network
Taskisigi	Municipal water	Good	Septic tank
Camyolu	Municipal water	Good	Sewerage network
Celebiler	Municipal water	Good	Septic tank
Budaklar	Municipal water	Good	Septic tank
Kızılcıkorman	Groundwater	Good	Septic tank
Osmanbey	Groundwater	Good	Septic tank
Topagac/Ramasli	Groundwater	Good	Septic tank

Source: Social Field Survey, January 2017.

Sources of water supply for the Camp Site is given in Table 15.7. Since the settlements in the vicinity of Camp Sites other than Kutluca use municipal water, no impact on the water availability is anticipated at the settlements. Significance of potential impact will be a factor of amount of water to be extracted and availability of groundwater resources in Kutluca.

Table 15.7. Daily Water Demand at Neighborhoods and Camp Sites

Location	Population	Daily Water Demand (m^3/day)	Source of Water Supply
Demirciler Neighborhood (Section 4)	497	74,6	Municipal water
Kutluca Neighborhood (Section 5)	299	44,9	Groundwater
Taskisigi Neighborhood (Section 6)	1.316	197,4	Municipal water
Cumakoy and Demirciler Camp Sites (Section 4)	2.500	375,0	Groundwater
Kutluca Camp Site (Section 5)	900	135,0	Groundwater
Cayirkoy Hacioglu and Taskisigi Camp Sites (Section 6)	1.100	165,0	Groundwater

Domestic wastewaters produced at the Camp Sites will be treated at the package domestic wastewater treatment plants and discharged into the nearest receiving water bodies in line with the discharge permits to be obtained from the Ministry of Environment and Urbanization. As these water bodies are not the drinking water sources of the communities, no significant impact is anticipated.

Airborne/Communicable Diseases

Involving large numbers of workforce, large development projects are seen as a factor for health hazards among local communities due communicable diseases, especially if sanitation standards and living conditions at the Camp Sites remain insufficient. Since the Project will give priority to employment of local people and proper accommodation facilities (water supply, waste management, food safety, etc.) will be provided at the Camp Sites, no significant risk of introduction of diseases by the incoming construction workers is anticipated in the scope of the Project.

Security Personnel Arrangements

Involvement of security personnel to control unauthorized access to work sites and safeguard the Project personnel and property would be another issue related with the community safety and welfare. Risks that may be posed by security arrangements may be due to use of disproportionate use of force and where applicable firearms, inappropriate conduct toward workers and local people. In the scope of the North Marmara Motorway Project, security personnel will be employed mainly at the Camp Sites through services to be taken from competent contracting companies. The working area of these personnel will be limited with the Project borders (e.g. Camp Sites).

Straight forward measures such as proper inquiries to be done at the hiring stage both for the contracting company and the personnel to be employed, good management of the related personnel, trainings to be provided to security personnel in relevant subjects, monitoring of legal compliance of the acts of the personnel, applying contractual sanctions, etc. would be effective in avoiding and/or minimizing associated risks so that no significant impact is anticipated due to security personnel arrangements of the Project.

Emergency Preparedness and Response

An emergency is an unplanned event when a project activity/operation loses control, or could lose control, of a situation that may result in risks to human health, property, or the environment, either within the facility or in the local community. Emergencies do not normally include safe work practices for frequent upsets or events that are covered by occupational health and safety (*IFC, April 2007*).

Emergency situations that may be encountered during the land preparation and construction phase of the Project may include accidents, fires, spills and leakages, geotechnical stability issues for the large engineering structures, earthquakes, etc. If the consequences of these situations cannot be controlled within the borders of the work sites (e.g. construction corridor, Camp Sites, quarries, etc.), risks may be posed to the health, safety and security of the local communities. Nevertheless, with effective implementation of the measures/actions defined in the Project's Emergency Preparedness and Response Plan presented in Annex-3, emergency situations can be controlled without causing significant risks and/or impacts on the health and safety of the local communities.

Risk of forest fires and spills/leakages have been covered in Chapter 5 ("Land Use and Property") and Chapter 6 ("Topograpghy, Soils and Geology")

Public Health and Welfare

Air emissions and noise generation during land preparation and construction activities, especially at dry periods, may cause disturbance and discomfort for some of the local people, especially in settlements living in close distance to the construction/working sites. Impacts caused by construction phase emissions will be removed upon the completion of construction activities, nevertheless gaseous emissions and traffic noise will remain to be a concern of the subsequent operation phase. Impacts on public health and welfare due to air emissions and noise have been covered in Chapter 10 ("Air Quality and Climate Change") and Chapter 11 ("Noise and Vibration").

15.3.2. Operation Phase

Once the North Marmara Motorway is taken into operation, it is anticipated to host significant numbers of motor vehicles, including passenger cars and heavy vehicles. The feasibility study for the Project assumes that the number of motor vehicles that will use the Motorway would increase from year to year. As the traffic density on the Motorway increases, risks on the safety of the traffic may also increase. Information of the minimum traffic guaranteed for the duration of operation as defined under the relevant terms of BOT contract have been provided in Section 3.8 ("Traffic Projections"). Based on the guaranteed traffic values, maximum number of motor vehicles estimated to use each section of the Motorway throughout the operation period under the BOT contract is provided in Table 15.8.

Table 15.8. Number of Vehicles Estimated for Each Section of the Motorway

Motorway Section	Number of Vehicles					Percent (%)	
	Passenger Car	Bus	Truck	Trailer	Total	Light Vehicle	Heavy Vehicle
Section 4	50.000	4.688	27.632	5.952	88.271	56,6	43,4
Section 5	31.500	3.656	21.553	4.643	61.352	51,3	48,7
Section 6	18.000	2.625	15.474	3.333	39.432	45,6	54,4

Together with traffic safety, structural safety will be the most important community health and safety issues during the operation phase. Pedestrian safety and emergency preparedness and response are other issues that need proper management to avoid/minimize risks on North Marmara Motorway Project. Additionally, air emissions and noise and vibration may cause disruption of the populations along the Motorway route. Further assessment of impacts during the operation phase is provided below.

Structural Safety

The Project involves several large and small engineering structures. Safety failure of these structures (i.e. tunnels, viaducts, bridges, etc.) may pose significant risks on the health and safety of the community. Asian sections of the Project are located in first degree earthquake zone according to Earthquake Zoning Map of Turkey, thus failures that may be triggered by earthquake events are among the most important design considerations for the Project. Similarly, landslides and floods would be other factors that may affect structural safety as especially Section 6 is prone to the risk of landslides. On the other hand, since the Project will be designed in accordance with KGM's technical specifications and international standards (including seismic), structural failure risks have already been minimized by design. Seismic and other geotechnical risks have been covered in Chapter 6 ("Topograpghy, Soils and Geology").

Traffic Safety

Traffic accidents, which have become one of the most significant causes of injuries and fatalities among members of the public, may be mainly related with the behavior of the drivers, quality of the vehicles used and/or design, construction and maintenance conditions of the road itself. Accordingly, improved driving conditions to be provided by the new Motorway are likely to prompt some of the drivers to a speedy traffic increasing the risk for accidents. On the other hand, this risk may be contra balanced by overall reduction of traffic accidents related to improved driving conditions for a more fluent and safe traffic on motorways having high physical and geometrical standards (*JASPERS, 2010*). Bridges, viaducts and tunnels are special Project structures where risk of accidents may be higher. Especially, fire and explosion risks in the tunnels entail particular management. Also, snow and ice, if not properly and timely removed, may reduce or eliminate the friction ability and road holding capacity of the vehicles resulting in risks on traffic safety. Thus, snow and ice removal is an important operation phase activity (*IFC, April 2007*).

As mentioned under baseline conditions (Section 15.2), number of fatalities caused as a result of traffic accidents per 100 million vehicle-km has decreased considerably since the beginning of 2000s. Thus, the new North Marmara Motorway, together with other motorways and divided roads in the country, is anticipated to contribute the improvements on the fatality rate reductions targeted to be achieved in the next decades despite the expected increase in the number of vehicle ownership and vehicle kilometers. Since there is no statistical information or analyses published by Turkish authorities about the effect of Motorway on the number of accidents and fatality rates that would support this assessment, the study "Road Safety Statistics at Regional Level" published by Eurostat (the Directorate General of the European Commission responsible to provide statistical information to the institutions of the European Union-EU, road safety statistics in the EU, as well as the European Free Trade Association (EFTA) and candidate countries) have been reviewed *(http://ec.europa.eu/eurostat/).* Motorway density and risk based on the total number of fatalities in road traffic accidents has been a special topic under this study.

According to the findings of the analysis, statistically, the numbers of road accident fatalities are particularly low for many regions with high traffic volumes. This is true especially in many regions in western Germany and England, in particular around major cities, and in most parts of the Netherlands. Around major cities and transport hubs, high traffic volumes cause congestion, which reduces average speeds and, therefore, also the likelihood of fatalities when accidents do occur. A closer look at this phenomenon also reveals that many of these regions tend to have high motorway density (expressed as length of motorways in relation to the region's total territory). In general, motorways are far safer than secondary roads. Furthermore, transit traffic mainly uses the motorway network, further reducing the number of road accidents, despite high total traffic volumes (*http://ec.europa.eu/eurostat/*).

In contrast, fatality rates are high in regions with a low motorway density, such as most regions in Romania, Hungary and the Czech Republic, except their capital regions, all Bulgarian and Polish regions, the Baltic Member States, and many rural areas in France and Spain. These data suggest that the high proportion of road traffic using motorways is an important factor behind the low number of road fatalities in many regions.

In addition to the share of the total road network accounted for by motorways, the significant reductions in the number of road deaths are also due to a combination of high in-vehicle and out-of-vehicle safety standards, better enforced speed limits and a general 'safety culture', including the quality of the emergency and healthcare systems.

Pedestrian Safety

Pedestrians and bicyclists are at greatest risk of serious injury from collisions with moving vehicles. Children are generally the most vulnerable due to lack of experience and knowledge of traffic related hazards, their behavior while at play, and their small size making them less visible to motorists. In addition, collisions and accidents can involve a single or multiple vehicles, pedestrians or bicyclists, and animals. Many factors contribute to traffic accidents. Some are associated with the behavior of the driver or the quality of the vehicle, while others are linked to the road design, or construction and maintenance issues. For example, risks that emerge during rainy weather conditions because of the wet road surface may be properly managed by drivers strictly obeying the traffic rules (*IFC, April 2007*).

Public Health and Welfare

The new Motorway route will be a source of dust and gaseous emissions and traffic noise that may cause disturbance of the local people living, conducting agricultural, grazing or other economic activities, etc. along the route. On the other hand, with the operation of the North Marmara Motorway together with the Third Bosphorus Bridge, certain portions of the existing traffic loads of light and heavy vehicles are anticipated to shift towards the new Motorway route, resulting in reduced traffic volumes and improved traffic flow conditions on the ring roads of Istanbul and correspondingly reduced air emissions and noise along these existing routes. The shifting ratios anticipated for existing ring roads of Istanbul are provided in Table 15.9.

Table 15.9. Traffic Shifting Ratios for the Existing Ring Roads in Istanbul

Section	Section Description	Traffic Shifting Ratio			
		State Road and 1st Ring Road		2nd Ring Road	
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Section 4	Pasakoy-Gebze (Mollafenari)*	25%	30%	30%	35%
Section 5	Gebze (Mollafenari)-Izmit (Durhasan)	30%	35%	35%	40%
Section 6	Izmit (Durhasan)-Akyazi	20%	25%	25%	30%

Source: KGM, August 2010.

**Starting point of Section 4 was planned as Pasakoy, which is located around 14 kilometers northwest of Kurtkoy, in the Revised Feasibility Report. It is assumed that Kurtkoy-Liman section will experience the same level of traffic shifting ratio with the previously planned Pasakoy-Gebze section.*

Existing traffic loads on the bridge sections of the 1st and 2nd ring roads are provided in Table 15.10. The North Marmara Motorway Project is anticipated to contribute to the alleviation of the future traffic loads on these arteries.

Table 15.10. Existing Traffic Loads on Ring Roads and Anticipated Traffic Loads on the Planned Motorway Sections

Section	Section Description	Light Vehicle	Heavy Vehicle	Total
Existing Traffic Load (2015)				
Bogazici Bridge	Connection with 1st Ring Road	175.860	14.395	190.255
FSM Bridge	Connection with 2nd Ring Road	149.982	46.163	196.145
Guaranteed Traffic Load during the Operation Period under BOT Contract				
Section 4	Kurtkoy-Liman	50.000	26.790	49.290
Section 5	Liman-Izmit	31.500	35.720	65.720
Section 6	Izmit-Akyazi	18.000	6.123	114.123
Maximum Anticipated Traffic Load at 23th Year of Operation Period (End of Feasibility Study Period)				
Section 4	Kurtkoy-Liman	135.651	33.319	168.970
Section 5	Liman-Izmit	103.354	36.421	13.774
Section 6	Izmit-Akyazi	55.076	18.515	73.591

Source: KGM, August 2010. Sections are as indicated in the Revised Feasibility Report.

Camp Sites will provide adequate sanitary, medical and social facilities to workers so that the impact of the Project on local services and facilities will be minimized.

Emergency Preparedness and Response

Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and/or the release of oil or hazardous materials. Thus, an Emergency Preparedness and Response Plan, covering the emergency situations (involving vehicles and pedestrians) that may occur during the Motorway's operation, has to be prepared and implemented by trained personnel (*IFC, April 2007*).

15.4. Mitigation Measures

The design, construction and operation of the Motorway will be done in accordance with most recent project standards and technical specifications of KGM as well as robust engineering design criteria. KGM will control the works to be conducted by the contractors during the BOT Contract.

An Emergency Preparedness and Response Plan, describing the targets and framework regarding the means for dealing with possible emergency situation during the construction and operation phases, has been prepared for the Project (see Annex-3). With effective implementation of this Plan, Project Sponsors will aim to prevent emergencies and respond to unavoidable incidents that could not be prevented by taking relevant measures properly so that no significant risk is posed to health and/or safety of the public. Specific measures to be taken during the land preparation and construction as well as operation phases of the Project are described in the following sub-sections.

15.4.1. Land Preparation and Construction Phase

During the land preparation and construction phase, primarily, access to construction/work sites will be restricted by means of proper measures such as fencing, signage, etc. Other specific measures to be taken for particular risk subjects to ensure community health and safety and public welfare during the land preparation and construction phases of the Project are described below.

Construction Traffic Safety

In Section 4 (except the Liman Access Road) and Section 6, the route passes mainly through rural settlements dominated by agricultural lands. Thus interaction of the construction traffic with local communities may be a concern in these sections of the Project and measures have to be taken to minimize risk of accidents involving both the pedestrian and vehicles/trucks.. Since the Camp Sites are located mainly on forestry lands and interaction with local communities is not foreseen, construction of service roads are not planned for the Asian sections of the Project. Accordingly, construction traffic is not anticipated to pass directly through the settlement.

In this regard, following measures will be taken in accordance with the KGM's Technical Specifications for Motorways and relevant international standards to ensure traffic safety at the construction sites and minimize the risk of accidents:

- Construction works on existing roads will not be started until relevant traffic safety measures (including traffic signing and placement of equipments) are taken on roads serving pedestrian and vehicle traffic. These measures will be designed to ensure the safety of life and property of the local people and the users of the roads.
- In the scope of better working organization, construction traffic routes will be strictly defined and road construction machinery will use only these routes.
- Passage of the routes through the settlements (i.e. neighborhoods) will be avoided where alternative routes are available. Dangerous routes that are to be avoided, if there is any, will be specified and informed. In this scope, construction contractors will construct service roads in order not the affect (such as increasing the heavy traffic load) the natural flow on the existing roads and for avoiding the passage of heavy vehicles through residential areas to the extent possible. In addition service roads will be constructed where the traffic will be temporarily diverted. Furthermore, service roads will be used for transportation of the construction machinery, equipments and materials used for Project.
- Pedestrian interaction with construction vehicles will be minimized by taking appropriate measures in and around the construction corridor.
- Valid licenses will be required for the drivers and operators.
- Drivers and operators will be provided with relevant trainings that emphasize the safety aspects.
- Working hours of the day for the drivers/operators will be specified and informed to relevant personnel.
- Limits will be defined for the working/trip duration for the drivers and operators to avoid overtiredness.
- Speed control devices will be used on trucks.
- All the construction machinery and equipments will be operated in alignment with the direction of the traffic flow.
- Rigid objects will not be used for the purpose of traffic diversion.
- Unused construction materials, equipments or machinery will not be left on the road in an uncontrolled way. They will be put in designated places.
- Construction-related traffic delays will be minimized. Flow of traffic will be allowed in every 30 minutes.
- Road signing for night traffic will be provided with reflectors and flashing signals of sufficient number.
- Relevant dust control measures will be taken at the road construction sites so that safe sight distances could be maintained on the existing roads under service.
- Upon the completion of works, signing equipments will be immediately removed and standard signing will be provided.
- To reduce transportation distances, services and materials required for construction works will be aimed to be primarily supplied from the local sources, wherever possible.

Disturbance due to Blasting Operations

- Relevant permits will be obtained from the security authorities for the delivery, transportation and use of explosives in the scope of the blasting operations to be conducted on the Motorway route and the quarries.
- Blasting operations including their transportation, storage, preparation, utilization, discharge of surplus explosives or unblasted materials, etc. and use will be carried out by competent trained experts under the control of technical supervisor.
- Explosives will be kept within permitted storage areas having isolated divisions for capsules.
- Blasting operations will be performed only after necessary announcements are made to local people. Blasting schedule will be prepared and activities will comply with this schedule.
- Warning signs explaining the blasting schedule will be posted at proper locations within the construction sites and at the nearby roads and passageways.
- Flagged signal men will be located at designated locations prior to each blasting activity.
- Blasting operations will be conducted daytime between 08:00-18:00. No blasting operation will be conducted on Sundays and holidays.
- Blasting calculations will be done and maximum number of holes to be blasted at one shot and total charge amounts per shot that would not cause significant environmental impacts (i.e. vibration, air shock, flyrock, etc.) will be determined prior to execution of operations in consideration of the manufacturers' suggestions. Prior to blasting operations, calculations done in consideration of the type of explosive and blasting method will be rechecked.
- Safety distances ensuring no hazard to Project personnel and local people will be determined and maintained during blasting operations. Where required, structures preventing scattering of materials will be used.
- Locations of holes will be measured and marked before the execution of blasting operations to ensure that blasting energy would be effectively distributed.
- Blasting operations will not be performed during stormy weather conditions.
- Access by unauthorized persons to blasting sites will be prevented.
- If required, cooperation will be made with local authorities to ensure safety of nearby roads by controlling traffic during the time of blasting.

Airborne/Communicable Diseases

Involving large numbers of workforce, large development projects are seen as a factor for health hazards among local communities due communicable and vector-borne diseases, especially if sanitation standards and living conditions at the Camp Sites remain insufficient.

In the North Marmara Motorway Project, Camp Sites have been established at sufficiently large areas and most of the construction workforce (except the ones from local) and the sanitation and living conditions at the Camp Sites are assumed to be sufficient. Drinking water to be provided to Project workforce will meet the requirements of the Regulation Concerning Water Intended for Human Consumption so that diseases related with low quality drinking water are not anticipated to emerge. Additionally, domestic wastewaters and solid wastes will be managed in accordance with waste management procedures meeting the requirements of the national waste management regulations and international standards so that hygienic problems related with insufficient management of wastewaters and solid wastes are not anticipated.

- General health and safety trainings and education materials to be provided to Project personnel will include hygienic rules.
- Surveillance and active screening and treatment of workers will be provided.
- Immunization programs will be conducted for workers in local communities to improve health and guard against infection.
- Medical rooms with competent personnel will be available at Camp Sites.
- Measures will be taken against insect bites whenever required.

Security Personnel Arrangements

Security personnel to be employed at the Camp Sites will be hired through contracting companies. Reputable and legitimate enterprises/companies will be selected and cooperated for this purpose. In the hiring of security services, Turkish Regulation on the Implementation of the Law Concerning Private Security Services will be complied with. Additionally, good international practices will be taken into consideration.

In this respect, the contracting company will be required to provide documents (e.g. identity cards issued in accordance with the relevant Regulation following legal security clearance/archive review processes) ensuring that security personnel to be hired have not implicated past abuses. In consideration of good international practice, trainings will be provided to these personnel covering the following subjects:

- Legal requirements regarding their acts under the applicable Turkish legislation,
- Principles of proportionality,
- Rules of conduct,
- Use of force and where applicable firearms,
- Legitimate preventive and defensive purposes for the use of force (in proportion to the nature and extent of the threat),
- Conduct towards Project workers and local people.

Security personnel will be required to act in accordance with the requirements of the applicable Turkish legislation through the contractual agreements to be done with the contracting companies.

The Grievance Mechanism established by the Project Sponsors (see Chapter 19 "Public Consultation and Stakeholder Engagement") will provide a mechanism for the local communities to express their concerns about the security arrangements and acts of security personnel, if there is any. This mechanism will be kept operational throughout the entire BOT Contract Duration. In case of any grievance or allegations of unlawful or abusive acts of security personnel, Project Sponsors will take all the necessary measures to prevent recurrence and take action (and require the Contracting Company to take action) in accordance with legal requirements.

Emergency Preparedness and Response

Against emergency situations arising at the construction/work sites and Camp Sites, relevant emergency preparedness and response measures will be taken in accordance with the plan given in Annex-3. Details of the nature of the emergency and protection options (evacuation, quarantine, etc.) will be communicated to the directly affected settlements/communities, if there is any.

Public Health and Welfare

Following measures will be taken to minimize impacts of air emissions and noise generation on public health and welfare:

- To minimize the impacts on community health and safety and local disturbances due to air emissions and noise and vibration, new, highly efficient and reliable road construction machinery and equipments and high quality fuels will be used in the scope of construction works.
- Only construction machinery and equipments having proper emission controls and certificates in the scope of relevant Turkish regulations will be used.
- Well-balanced measures will be developed to limit worker movements to minimize disruption of local people while providing the workers with the right of movement freedom.
- Vehicle/wheel wash basins will be constructed at suitable locations to minimize transportation of sediments/mud and pollution/dustiness of public roads.

15.4.2. Operation Phase

Traffic and pedestrian safety risks that may emerge during the operation of the Motorway can be reduced by proper Motorway design including safe crossing, fencing, installation of warning signs, etc. (*IFC, April 2007*). In the scope of the North Marmara Motorway Project, such measures will be taken in accordance with KGM's technical specifications and international standards, as detailed below.

In accordance with the related terms of the BOT Contract, Project Sponsors will be responsible from taking necessary traffic safety measures under the related national legislation. In this respect, Project Sponsors will cooperate with the related government agencies and institutions where necessary. In case of situations that may emerge to violate traffic and environmental safety during the operation period, Project Sponsors will be liable for taking immediate actions to reassure the safety of relevant aspects. Project Sponsors will also take all the necessary measures to avoid damage on life and/or any private or legal property, structure, infrastructure, existing traffic or environmental resources.

Structural Safety

Structural safety of the Project components will be ensured by design, engineering and construction in accordance with most recent project standards and international codes as well as technical specifications of KGM. In accordance with KGM's specifications, safety and durability have been the main considerations in the design and engineering of the structures. Static and dynamic stability analyses and cross-section calculations of the engineering structures have been done by using internationally accepted computer programs approved by the KGM. In the design of the engineering structures, the Standard Specifications for Highway Bridges published by the American Association of State Highway and Transportation Officials (AASHTO) has been used. In the seismic calculations, the Standard Specifications used for the seismic design of the highway bridges has been taken as basis. Where required, Project-specific revisions have been/would be done with the approval of KGM to adequately adapt these specifications to the Project. In accordance with the KGM's technical specifications, design of the traffic safety measures including guardrails, wire fences, horizontal and vertical traffic signs and markings and signalization implementations will also meet KGM standards. Guardrails will fulfill the internationally accepted standards. KGM will control the operation works during the BOT Contract.

In case of natural disasters that may risk the structural safety of the Project structures, the operation personnel will conduct visual inspections, take immediate actions (e.g. communication with local people, restricting access to risky areas, etc.) and collaborate with local emergency response authorities to prevent any adverse impact on the health and safety of the local people or users of the Motorway.

Additional measures to be taken to ensure community health and safety during the operation phase of the Motorway are described below.

Traffic Safety

Traffic accidents directly related with the behavior of the drivers and quality of the vehicles will not be under the control of the Motorway's operators. Additionally, legal speed limits different types of vehicles driving on Motorways are defined in relevant Turkish laws and regulations. Thus, all the drivers using the Motorway will be obliged to comply with the legal speed limitations.

On the other hand, design, construction and maintenance measures can contribute to the minimization of traffic safety risks to a certain extent. Especially, maintenance of the Motorway and the planning of traffic safety signings may be effective in preventing, minimizing and controlling risks to the community from traffic accidents and ensure safety of the traffic. Measures to be taken by the Project Sponsors in this context are provided below:

- Horizontal (i.e. shoulder lines, traffic lines, parking lines, etc.) and vertical signing (i.e. traffic signs, plates, etc.) of the Motorway will be in accordance with KGM's technical specifications.
- Rescue vehicles and tow trucks will be kept ready in adequate numbers to promptly respond to probable accidents and slippery vehicles that may cause the closure of the road.
- Pavement structure of the Motorway will be subject to routine maintenance works in order to remove any impairment on the road surface that may risk traffic safety, reduce driving comfort and decrease the structural strength. Large-scale repair and reconstruction works will also be conducted as required to maintain the functionality of the road.
- Wire fences will be installed along the expropriation border of the Motorway to minimize the risk of collisions between animals and vehicles and direct the animals towards crossing structures (i.e. culverts) to be built.
- Wire fences, welded wires, walls to be used to enclose the area to be allocated to the Motorway will be continuously checked to prevent any uncontrolled intrusion of wild animals to the Motorway corridor that may pose risk to traffic safety and damage the landscape components. Any damaged enclosure component will be immediately repaired/maintained.
- Intelligent Traffic System (ITS) will be installed in the scope of the Project. By means of the ITS, real-time warning systems with signage to warn drivers of congestion, accidents, adverse weather road conditions, and other potential hazards ahead will be used.
- Snow and ice removal works will be conducted within the Motorway corridor when the temperature is between 0^0C and -12^0C to ensure safe and secure driving conditions for the vehicles and users of the road (including interchanges, access roads, service areas) during severe winter conditions.
- If necessary, precautionary salt application will be done before the start of snowfall.
- Where required, road deicing will be done by application of a suitable agent in solid or solution forms such as salt (NaCl), calcium chloride ($CaCl_2$), magnesium chloride ($MgCl_2$), etc. directly or blended in proper ratios depending on road and weather temperature.
- In case of continuous snowfall periods, effectiveness of the chemicals applied may become insufficient in removing snow and ice. In such situations, mechanical snow and ice removal works will be conducted by using suitable and adequate vehicles and/or equipments.
- In case of oil spill or spill of other hazardous liquids, road surface will be washed with plenty of water.
- Measures will be taken to prevent parking vehicles at the entrance and exit roads of the services areas.

- Specific precautionary and response measures will be taken to ensure safety in the tunnels (see Annex-3 “Emergency Preparedness and Response Plan).

Service areas that will serve as roadside rest areas for the drivers have been planned in accordance with KGM’s technical specifications and international standards. In this regard, to minimize driver fatigue and provide resting facilities to the users of the Motorway, Type D service areas will be constructed in about every 20 km and Type B services areas will be constructed in about every 50 km (for further explanations on the features of different types of service areas, please see Section 3.2.5 “Service Areas”).

Pedestrian Safety

To ensure safe passage/crossing of the Motorway by the pedestrians and avoid population disruption, culverts and underpass/overpasses have been included in the design and will be constructed. Culverts and underpasses planned in each section and the settlements and roads connected by overpasses have been provided in Chapter 3 (“Project Description”).

In this regard, to prevent crossing of the Motorway by pedestrian and wild life animals in an uncontrolled and unsafe way, wire fences will be installed along the expropriation border of the Motorway, except the designated crossing points, in accordance with the technical specifications of the KGM.

Public Health and Welfare

Air emissions and noise to be sourced by the Motorway traffic will be monitored at selected/sensitive locations along the route (see Chapter 20 for the “Environmental and Social Management System”). Additionally, complaints related with air quality or noise impacts would be delivered to Project Sponsors by means of the Project-specific grievance mechanisms established (see Chapter 19 for “Public Consultation and Stakeholder Engagement”) If the measurement results or the grievance mechanism indicate impacts on public’s health and welfare at certain locations, effective and feasible corrective measures will be planned and implemented by the Project Sponsors.

Emergency Preparedness and Response Plan

The Emergency Preparedness and Response Plan prepared for the Project is presented in Annex-3. The main objective of this Plan is to establish strategies and procedures for managing all aspects of emergency situations associated with Project components. In this regard the Emergency Preparedness and Response Plan consists of targets and procedures regarding the following aspects of emergency management:

- Prevention and preparation measures (actions to be taken before emergency);
- Response measures (actions to be taken during emergency);
- Damage assessment and recovery measures (actions to be taken after emergency).

The Emergency Preparedness and Response Plan cover the actions to be implemented by the Project to ensure emergency preparedness. These actions are mainly associated with proper planning and design of the project units, construction in accordance with specifications and operation and maintenance in line with project safety requirements as well as the actions to be taken for preparing to an emergency such as installation of monitoring and warning systems, communication systems, and carrying out impact studies, training of staff for awareness, procedures for warning, communication, mobilization of emergency forces and equipment, responsibilities, and evacuation practices.

The general emergency response procedures defined in the Emergency Preparedness and Response Plan cover the whole highway including bridges and viaducts for the major hazards such as accidents, fires, earthquakes and spills/leakages. Specific procedures are additionally described for the tunnels.

Finally, the actions to be taken following emergency response and further actions to be taken for recovery management purposes are also included in the Plan.

15.5. Summary of Assessment and Residual Impacts

Project-related risk would be minimized by taking relevant planning and design measures and implementation of an Emergency Preparedness and Response Plan, which meet the international requirements. On the other hand, some of the traffic and pedestrian safety risks will be mostly related with the users of the road on which the Project Sponsors will only have limited control. Summary of the community health and safety assessments are provided in Table 15.11.

Table 15.11. Summary of the Community Health and Safety Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Local communities	Land preparation and construction phase	Increased risk of accidents due to operation of heavy construction machinery or disturbance on the health, safety and welfare of local communities due to road closure, traffic passing through settlement centers, etc.	Adverse	Restricted	Medium	Moderate (machinery will not be localized but distributed along the linear route) •Number of Consturction Machinery for Section 4: 250 •Number of Consturction Machinery for Section 5: 123 •Number of Construction Machinery for Section 6: 292	Short term reversible	Continous	Moderate (B)	High (3) Settlements within the expropriation corridor having affected population>500 habitants; •Section 4: Tepeoren, Akfirat, Tavsanli Settlements within the study corridor having affected population>1.000; •Section 4: Kurnakoy •Section 6: Cayirkoy, Korucuk, Evrenkoy, Karaman, Taskisigi, Camyolu, Dagdibi, Budaklar, Abali	High (B3)	•Construction works on existing roads will not be started until relevant traffic safety measures (including traffic signing and placement of equipments) are taken on roads serving pedestrian and vehicle traffic. These measures will be designed to ensure the safety of life and property of the local people and the users of the roads. •In the scope of better working organization, construction traffic routes will be strictly defined and road construction machinery will use only these routes. •Passage of the routes through the settlements (i.e. neighborhoods) will be avoided where alternative routes are available. Dangerous routes that are to be avoided, if there is any, will be specified and informed. In this scope, construction contractors will construct service roads in order not the affect (such as increasing the heavy traffic load) the natural flow on the existing roads and for avoiding the passage of heavy vehicles through residential areas to the extent possible. In addition service roads will be constructed where the traffic will be temporarily diverted. Furthermore, service roads will be used for transportation of the construction machinery, equipments and materials used for Project. •A service road will be constructed to provide access to the Kadikoy Camp Site without causing any impact on local roads. •Pedestrian interaction with construction vehicles will be minimized by taking appropriate measures in and around the construction corridor. •Valid licenses will be required for the drivers and operators. •Drivers and operators will be provided with relevant trainings that emphasize the safety aspects. •Working hours of the day for the drivers/operators will be specified and informed to relevant personnel. •Limits will be defined for the working/trip duration for the drivers and operators to avoid overtiredness. •Speed control devices will be used on trucks. •All the construction machinery and equipments will be operated in alignment with the direction of the traffic flow. •Rigid objects will not be used for the purpose of traffic diversion. •Unused construction materials, equipments or machinery will not be left on the road in an uncontrolled way. They will be put in designated places. •Construction-related traffic delays will be minimized. Flow of traffic will be allowed in every 30 minutes. •Road signing for night traffic will be provided with reflectors and flashing signals of sufficient number. •Relevant dust control measures will be taken at the road construction sites so that safe sight distances could be maintained on the existing roads under service. •Upon the completion of works, signing equipments will be immediately removed and standard signing will be provided. •To reduce transportation distances, services and materials required for construction works will be aimed to be primarily supplied from the local sources, wherever possible.	Low
										Medium (2) Settlements within the study corridor (inc. exp. corridor) having affected population 500-1.000; •Section 4: Kadilli •Section6: Durhasan, Bayraktar, Karaabdulbaki, Alanduzu, Kizilcikorman, Osmanbey, Topagac	Medium (B2)		Low
										Low (1) Settlements within the expropriation corridor having affected population<500 habitants •Section 4: Cumakoy, Denizli • Section5: Kutluca, Sevindikli, Karayakuplu, Sipahiler, Toylar, Sepetci, •Section 6: Eseler, Gedikli, Sapakpinar, Suleymaniye, Akmese Ataturk, Karapinar, Poyrazlar, Dogancilar, Komurluk, Celebiler, Kasimlar, Cerciler,Haciramazanlar, Bediltahirbey, Turkormankoy, Eskibedil, Vakif, Kumkopru, Duzyazi	Low (B1)		Low
	Land preparation and construction phase	Blasting operations to be conducted at road/tunnel construction sites, etc.	Adverse	Restricted	Medium	Medium	Short term reversible	Intermittent	Moderate (B)	High (3) (Number of residential buildings within the expropriation corridor>20) •Section 4: Tepeoren, Akfirat, Tavsanli	High (B3)	• Relevant permits will be obtained from the security authorities for the delivery, transportation and use of explosives in the scope of the blasting operations to be conducted on the Motorway route and the quarries. •Blasting operations including their transportation, storage, preparation, utilization, discharge of surplus explosives or unblasted materials, etc. and use will be carried out by competent trained experts under the control of technical supervisor. •Explosives will be kept within permitted storage areas having isolated divisions for capsules •Blasting operations will be performed only after necessary announcements are made to local people. Blasting schedule will be prepared and activities will comply with this schedule.	Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance	Measures to be Taken	Significance of Residual Impacts
										Medium (2) (Number of residential buildings within the expropriation corridor between10-20) •Section 4: Kurnakoy, Cumakoy •Section 5: Sipahiler •Section 6: Cayirkoy, Durhasan, Eseler, Suleymaniye, Korucuk, Karaman,Vakif	High (A2)	•Warning signs explaining the blasting schedule will be posted at proper locations within the construction sites and at the nearby roads and passageways. •Flagged signal men will be located at designated locations prior to each blasting activity. •Blasting operations will be conducted daytime between 08:00-18:00. No blasting operation will be conducted on Sundays and holidays. •Blasting calculations will be done and maximum number of holes to be blasted at one shot and total charge amounts per shot that would not cause significant environmental impacts (i.e. vibration, air shock, flyrock, etc.) will be determined prior to execution of operations in consideration of the manufacturers' suggestions. Prior to blasting operations, calculations done in consideration of the type of explosive and blasting method will be rechecked. •Safety distances ensuring no hazard to Project personnel and local people will be determined and maintained during blasting operations. Where required, structures preventing scattering of materials will be used. •Locations of holes will be measured and marked before the execution of blasting operations to ensure that blasting energy would be effectively distributed. •Blasting operations will not be performed during stormy weather conditions. •Access by unauthorized persons to blasting sites will be prevented. •If required, cooperation will be made with local authorities to ensure safety of nearby roads by controlling traffic during the time of blasting.	Low
										Low (1) (Number of residential buildings within the expropriation corridor<10) •Section 4: Mollafenari, Muallim •Section 5: Sevindikli, Karayakuplu, Tepecik, Tepekoy, Sepetci •Section 6: Bayraktar, Gedikli, Karaabdülbaki, Evrenköy, Karakamis, Celebiler, Haciramazanlar, Kizilcikorman, Osmanbey, Topagac, Budaklar	Medium (A1)		Low
		Blasting operations to be conducted at quarries	Adverse	Restricted	Medium	High	Short term reversible	Intermittent	Major (A)	Low (1) (Number of residential buildings within the AoI<10) •Section 5: Kutluca (Kiyirlar) •Section 6: Taskisigi	Medium (A1)		Low
		Water supply	Adverse	Local	Medium	High (135 m^3/day of water is estimated to be required at Kutluca Camp Sites)	Long term reversible	Continous	Major (A)	Low (1) •Section 5: Kutluca neighborhood	Medium (A1)	•Permit will be obtained from DSI for groundwater supply.	Medium
	Land preparation and construction phase	Health risks (spreading of airborne/ communicable diseases) due to population influx	Adverse	Wide	Medium	Low (Project will give priority to employment of local people, number of incoming workers is anticipated to be low)	Short term reversible	One-off	Minor (C)	Low (1) No existing health issues have been identified in the area.	Low (C1)	•Drinking water to be provided to Project workforce will meet the requirements of the Regulation Concerning Water Intended for Human Consumption so that diseases related with low quality drinking water are not anticipated to emerge. Additionally, domestic wastewaters and solid wastes will be managed in accordance with waste management procedures meeting the requirements of the national waste management regulations and international standards so that hygienic problems related with insufficient management of wastewaters and solid wastes are not anticipated. •General health and safety trainings and education materials to be provided to Project personnel will include hygienic rules. •Surveillance and active screening and treatment of workers will be provided. •Immunization programs will be conducted for workers in local communities to improve health and guard against infection. •Medical rooms with competent personnel will be available at Camp Sites. •Measures will be taken against insect bites whenever required. •Well-balanced measures will be developed to limit worker movements to minimize disruption of local people while providing the workers with the right of movement freedom. •Vehicle/wheel wash basins will be constructed at suitable locations to minimize transportation of sediments/mud and pollution/dustiness of public roads.	Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/Value of Resource/Receptor	Impact Significance	Measures to be Taken	Significance of Residual Impacts
	Land preparation and construction phase	Disturbance of local communities due to improper acts of security personnel	Adverse	Local	Medium	Low	Short term reversible	One-off	Minor (C)	Low (1) No particular sensitivity/past issues have been identified in the area	Low (C1)	•Reputable and legitimate enterprises/companies will be selected and cooperated for the hiring of security personnel through contracting companies. •Contracting company will be required to provide documents (e.g. identity cards issued in accordance with the relevant Regulation following legal security clearance/archive review processes) ensuring that security personnel to be hired have not implicated past abuses. •Trainings to be provided to thesecurity personnel will cover legal requirements regarding their acts under the applicable Turkish legislation; principles of proportionality; rules of conduct; use of force and where applicable firearms; legitimate preventive and defensive purposes for the use of force (in proportion to the nature and extent of the threat); conduct towards Project workers and local people. •Security personnel will be required to act in accordance with the requirements of the applicable Turkish legislation through the contractual agreements to be done with the contracting companies. •In case of any grievance or allegations of unlawful or abusive acts of security personnel, Project Sponsors will inquiry, take all the necessary measures to prevent recurrence and take action (and require the Contracting Company to take action) in accordance with legal requirements.	Low
	Operation	Accident risks (involving vehicles or pedestrians) due to speedy traffic by some of the drivers on the new Motorway route	Adverse	Restricted	Long	High	Irreversible	One-off	Major (A)	High (3)	High (A3)	•To minimize driver fatigue and provide resting facilities to the users of the Motorway, Type D service areas will be constructed in about every 20 km and Type B services areas will be constructed in about every 50 km (for further explanations on the features of different types of service areas, please see •Horizontal (i.e. shoulder lines, traffic lines, parking lines, etc.) and vertical signing (i.e. traffic signs, plates, etc.) of the Motorway will be in accordance with KGM's technical specifications. •Rescue vehicles and tow trucks will be kept ready in adequate numbers to promptly respond to probable accidents and slippery vehicles that may cause the closure of the road. •Pavement structure of the Motorway will be subject to routine maintenance works in order to remove any impairment on the road surface that may risk traffic safety, reduce driving comfort and decrease the structural strength. Large-scale repair and reconstruction works will also be conducted as required to maintain the functionality of the road. •Wire fences will be installed along the expropriation border of the Motorway to minimize the risk of collisions between animals and vehicles and direct the animals towards crossing structures (i.e. culverts) to be built. •Wire fences, welded wires, walls to be used to enclose the area to be allocated to the Motorway will be continuously checked to prevent any uncontrolled intrusion of wild animals to the Motorway corridor that may pose risk to traffic safety and damage the landscape components. Any damaged enclosure component will be immediately repaired/maintained. •Intelligent Traffic System (ITS) will be installed in the scope of the Project. By means of the ITS, real-time warning systems with signage to warn drivers of congestion, accidents, adverse weather road conditions, and other potential hazards ahead will be used. •Snow and ice removal works will be conducted within the Motorway corridor when the temperature is between 00C and -120C to ensure safe and secure driving conditions for the vehicles and users of the road (including interchanges, access roads, service areas) during severe winter conditions. •If necessary, precautionary salt application will be done before the start of snowfall. •Where required, road deicing will be done by application of a suitable agent in solid or solution forms such as salt (NaCl), calcium chloride (CaCl2), magnesium chloride (MgCl2), etc. directly or blended in proper ratios depending on road and weather temperature. •In case of continuous snowfall periods, effectiveness of the chemicals applied may become insufficient in removing snow and ice. In such situations, mechanical snow and ice removal works will be conducted by using suitable and adequate vehicles and/or equipments. •In case of oil spill or spill of other hazardous liquids, road surface will be washed with plenty of water. •Measures will be taken to prevent parking vehicles at the entrance and exit roads of the services areas. •Specific precautionary and response measures will be taken to ensure safety in the tunnels (see Annex-3 "Emergency Preparedness and Response Plan). •To ensure safe passage/crossing of the Motorway by the pedestrians and avoid population disruption, culverts and underpass/overpasses included in the design will be constructed. •To prevent crossing of the Motorway by pedestrian and wild life animals in an uncontrolled and unsafe way, wire fences will be installed along the expropriation border of the Motorway, except the designated crossing points, in accordance with the technical specifications of the KGM.	Medium

CHAPTER 16

LABOR AND WORKING CONDITIONS

CHAPTER 16. LABOR AND WORKING CONDITIONS

In this section, labor and working conditions including the occupational health and safety aspects of the North Marmara Motorway Project will be discussed. Since a large number of direct and contracted personnel will be involved in and significant earthworks will be conducted in the land preparation and construction activities, labor and working conditions and occupational health and safety management will be an important aspect of the Project in this phase. On the other hand, maintenance activities to be conducted during the operation phase would also be subject to occupational health and safety issues that needs proper management. The occupational health and safety risks for the construction and operation phase would mainly include physical and chemical hazards. Biological and radiological hazards are not anticipated to be applicable to the North Marmara Motorway Project. Accordingly, following aspects will be assessed in the following sections of this Chapter:

- Labor and working conditions
- General occupational health and safety risks (e.g. hygiene, access, air supply, etc.) especially during the construction phase
- Physical hazards during the construction and operation phases
- Chemical hazards during the construction and operation phases
- Emergency preparedness and response

16.1. Assessment Methodology and Data Sources

Labor and occupational health and safety aspects of the Project have been assessed based on qualitative approaches in consideration of the typical risks in large-infrastructure projects. Key national legislation and international standards/guidance documents considered in the scope of the assessments are listed below:

- Turkish Labor Law
- Turkish Law and Occupational Health and Safety and related regulations
- IFC's Performance Standard 2: on Labor and Working Conditions (2012)
- Guidance Note by IFC/EBRD on Worker's Accommodation (2009)
- Turkstat. Statistics on Child Labor (2006 and 2012) and Work Accidents (2015)
- Health Facilities Database of Istanbul Provincial Directorate of Health

Significance Criteria

The significance criteria for the impacts on labor will be determined, as high, medium or low, based on the evaluation of magnitude of impact and sensitivity/value of the receptors/resources. The criteria previously presented in Chapter 4 ("ESIA Methodology") will be used for the determination of the magnitude of impact on the land use components, while sensitivity/value criteria to be used in the scope of impact assessment will be assumed as high for all types of impacts, except retrenchment, as the concern is the health and safety of the personnel. Detailed explanation of the sensitivity components for each ecosystem component is provided in the following "Baseline Conditions" section.

16.2. Baseline Conditions

The International Labor Organization (ILO) is a specialized agency of the United Nations for the world of work. It sets international labor standards, promotes rights at work, encourages decent employment opportunities, the enhancement of social protection and the strengthening of dialogue on work-related issues. Turkey became a member state of the ILO in 1932 and ratified 59 ILO Conventions (4 of them have been denounced) including the ones related with occupational health and safety, minimum age, forced labor, weekly rest, equality treatment, etc. (*http://www.ilo.org*)

In 1992 Turkey was one of the initial six countries to undertake direct action to combat child labor. On the other hand, the problem of child labor is one that Turkey, as every country in transition, needs to address. The problem needs to be viewed in terms of demography, educational levels, economics and social development. Similar to global statistics for child labor, agriculture is by the most important sector where child laborers can be found (*http://www.ilo.org*).

Turkey has ratified relevant ILO Conventions on improvement of gender equality and women employment. On the other hand low women's labor force participation and employment rates are among the most important issues in the field of employment in Turkey. Compared to EU, Turkey's female employment rates are extremely lower (*http://www.ilo.org*).

Accordingly, Turkish labor law and related regulations covers the basic principles of international labor standards and the IFC PS 2 in the issues of equal treatment of employees, restrictions on the working age and employment of children, avoidance of forced labor and ensuring occupational health and safety at the workplaces. On the other hand, monitoring of the implementation is essential to ensure full compliance of the activities with the relevant legislation. Figure 16.1 presents a comparison of child labor in different sector in year 2006 and 2012. Number of children working in agricultural sector increased between 2006 and 2012. In 2012, around 45% of the working children are engaged in agricultural sector. On the other hand, ratio of children engaged in industrial and services sectors have decreased between 2006 and 2012. Statistics of the child labor in Turkey in years 2006 and 2012 are summarized in Table 16.1.

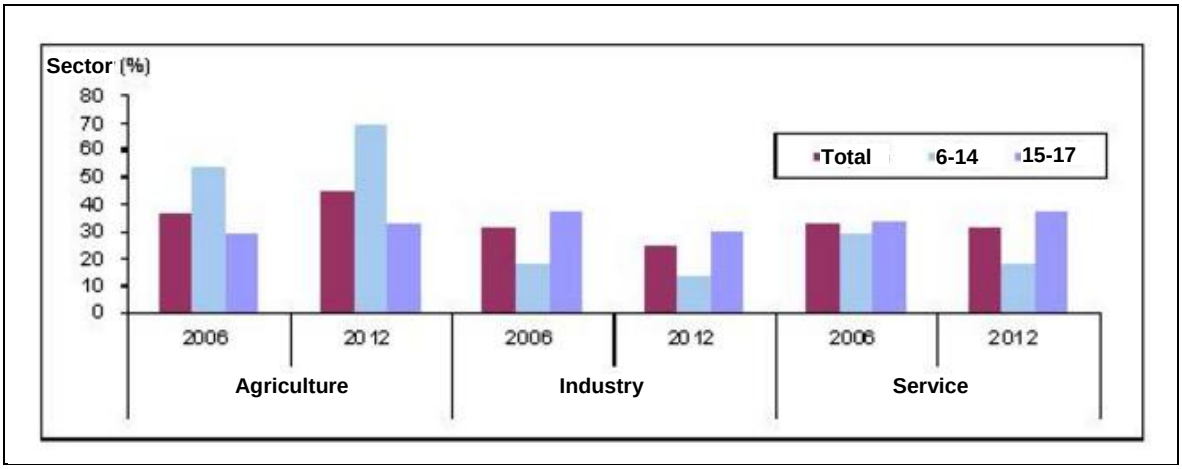


Figure 16.1. Comparison of the Ratio of Children Working in Different Economic Sectors in Years 2006 and 2012

Table 16.1. Child Labor Statistics for Turkey (years 2006 and 2012)

Indicator	2006 (October-November-December)		2012 (October-November-December)	
	x 1.000 Persons	Percent (%)	X 1.000 Persons	Percent (%)
Population of 6-17 age group	**15.025**	-	**15.247**	-
Employment (6-17 age group)	**890**	**100,0**	**893**	**100,0**
Age Group				
6-14	285	32,0	292	32,7
15-17	605	68,0	601	67,3
Gender				
Male	601	67,5	614	68,8
Female	289	32,5	279	31,2
Settlement				
Urban	490	55,1	400	44,8
Rural	400	44,9	493	55,2
Sector				
Agriculture	326	36,6	399	44,7
Industry	275	30,9	217	24,3
Service	289	32,5	277	31,0
Labor Status				
Wage or Per Diem Employee	505	56,7	470	52,6
For own account	24	2,7	10	1,1
Unpaid family worker	362	40,7	413	46,2

Source: http://www.tuik.gov.tr/

In 2015, Turkey made a moderate advancement in efforts to eliminate the worst forms of child labor. The Government implemented a project in cooperation with the ILO that provided services to more than 1,000 children working in commercial hazelnut production and amended the Labor Law to provide protections for children working in the arts and commercial advertising. However, children in Turkey are engaged in child labor in street work and mobile seasonal work in agriculture. The Government does not have laws that protect children working in agricultural enterprises employing fewer than 50 workers. Although the Government took important steps to increase Syrian refugee children's access to education and other services nationwide, many Syrian refugee children in urban areas of Turkey had low or no access to education and other social services, leaving significant numbers at increased risk of exploitation in the worst forms of child labor. Children in Turkey are mainly engaged in child labor, including in street work and mobile seasonal work in agriculture. Table 16.2 provides an overview of children's work by sector and activity. The growing number of Syrian refugees in the country is likely to adversely affect the child labor rates in the recent years (*US Department of Labor, 2016*).

Table 16.2. Overview of Children's Work by Sector and Activity

Sector/Industry	Activity
Agriculture	Production of cotton, hazelnuts, citrus fruits, sugar beets, cumin, peanuts, pulses, apricots, melons, and cherries
Industry	Production of furniture, bricks, shoes, leather goods, and textiles; auto repair; mining
Services	Street work, including vending small items, carrying bundles in market areas, cleaning car windshields, collecting recyclable materials, and begging ; working in restaurants and small shops

Source: US Department of Labor, 2016.

Statistics on work accidents for the insured personnel working in different industries are published by Turkstat. Statistics kept for the insured personnel (under Article 4-1/a of the Law on Social Security and General Health Insurance Law) working in road and motorway construction sector and in tunnel operation works are provided in Table 16.3.

Table 16.3. Statistics on Work Accidents and Occupational Diseases for Road and Motorway Construction and Tunnel Operation

Activity Classification	Number of Insured Persons Having Work Accident by Incapacity Days in 2015		
	Male	Female	Total
Construction of roads and motorways	1.729	8	1.737
Operation of tunnels	0	0	0

**Source: Turkstat, 2016. Work Accidents and Occupational Diseases.*

The health services capacity of the region is well developed. State and private hospital located in the district where the Project is located are listed in Table 16.4.

Table 16.4. Health Facilities in the Vicinity of the Project

Section	Province	District	State and Private Hospitals
Section 4	Istanbul	Pendik	Pendik State Hospital
			Marmara University Pendik Egitim and Arastirma (Training and Research) Hospital
		Tuzla	Tuzla State Hospital
Section 5 Section 6	Kocaeli	Gebze	Gebze Fatih State Hospital
			Private Bogazici Hospital
			Private Gebze Central Hospital
			Private Yuyil Hospital
		Izmit	Izmit Seka State Hospital
			Kocaeli State Hospital
			Private Acibadem Kocaeli Hospital
			Private Kocaeli Akademi Hospital
			Private Konak Hospital
		Korfez	Korfez State Hospital
			Private Marmara Hospital
		Derince	Derince Pendik Egitim and Arastirma (Training and Research) Hospital
Section 6	Sakarya	Serdivan	Private Adatip Hospital
		Adapazari	Sakarya University Egitim and Arastirma (Training and Research) Hospital
			Private Bilge Hospital
			Private Bayhekim Hospital
			Private Vatan Hospital
		Akyazi	Akyazi State Hospital

**Source: http://www.istanbulsaglik.gov.tr/; http://www.kocaeli.bel.tr/; http://www.sakaryasm.gov.tr/*

16.3. Potential Impacts

As with the North Marmara Motorway, in projects that entail involvement of large numbers of personnel, management of working relationships and terms of employment, provision of adequate accommodation and working conditions, ensuring non-discrimination, equal opportunity and employee satisfaction and establishment of mechanisms for feedback are particularly important issues to establish a sound worker-management relationship. This relationship would ensure efficiency and productivity of the activities/operations and avoid any reputational risk that may jeopardize the Project. Accordingly, issues related with labor and working conditions, including safety and security of the workers, will have to be properly managed during the construction and operation phases of the North Marmara Motorway Project.

Since the Project Sponsors will comply with the requirements of Turkish labor law, which covers the basic principles of international labor standards and the IFC PS 2 in the issues of equal treatment of employees, restrictions on the working age and employment of children, avoidance of forced labor and ensuring occupational health and safety at the workplaces, and implement Project-specific labor and employment and health and safety policies (see Chapter 20 “Environmental and Social Management System” for the relevant Project policies), no significant risk is anticipated in labor issues during the construction and operation phases of the Project.

On the other hand, occupational health and safety is an important aspect of the construction and operation of large infrastructure projects, especially during the construction phase when large number of direct and contracted personnel is involved to perform large-scale earthwork and construction activities. Key labor and occupational health and safety issues associated with the construction of motorways primarily include the following:

- Labor issues and working conditions for the construction and operation phases
- Workers’ accommodation conditions and general occupational health and safety issues for the construction phase
- Physical and chemical hazards during the construction and operation phases
- Emergency preparedness and response during the construction and operation phases

16.3.1. Land Preparation and Construction Phase

Large-scale employment of workforce will occur during the land preparation and construction phase of the Project. Activities of the site personnel will involve typical construction risks observed at construction sites such as risks due to moving equipment, elevated work, chemical hazards, exposure to noise and dust emissions, etc. (*IFC, April 2007*). The rate of accidents will be highly dependent on the consciousness and cautiousness of the personnel regarding the specific hazards of the construction work they are involved in. These risks together with labor issues and working conditions have to be managed in accordance with the good management approaches and international construction site practices to avoid problems with the worker-employer relations and significant occupational health and safety risks.

Child labor is common in agricultural, industry and service sectors in Turkey. Accordingly, due to the nature of the Project, North Marmara Motorway is not likely to contribute to Turkey's child labor workforce.

Since the construction activities will be completed in 3 years (maximum), retrenchment will be an issue at the end of the construction phase that needs proper management. Additionally, resolving the complaints of the workers within the Project through an effective grievance mechanism would be very important to protect the reputation of the Project.

Workers Accommodation Conditions

Ensuring good standards in accommodation facilities is important in order to avoid safety hazards and to protect workers from diseases and/or illness resulting from humidity, bad/stagnant water (or lack of water), cold, spread of fungus, proliferation of insects or rodents, as well as to maintain a good level of morale. In this scope, the standards of the rooms or dormitory facilities are important to allow workers to rest properly and to maintain good standards of hygiene. Conditions ensuring a good standard of personal hygiene and hygiene in canteens need to be ensured to prevent contamination and the spread of diseases which result from inadequate sanitary facilities and may affect the community health and safety as well. Medical facilities (first-aid facilities, additional medical facilities) are also important to maintain workers' health and to provide adequate responses in case of health emergency situations. Additionally, basic leisure, social and telecommunication facilities are important for workers to rest and also to socialize during their free time. Since accommodation will be provided at Camp Sites in the scope of the Project, all these requirements at the facilities will need to be optimized to minimize potential impacts on the workers' welfare and risk of work-related accidents and maximize the overall productivity (*IFC/EBRD, 2009*).

Physical Hazards

Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity. Road construction personnel may be exposed to physical hazards during the land preparation and construction phase of the Project. These hazards may be due to the operation of heavy construction vehicles during the earthworks, working at height for the construction of bridges, overpasses, viaducts, exposure to severe weather conditions, exposure to high noise levels caused by construction machinery and equipments, etc. Poorly trained or inexperienced drivers would increase risk of accident with other vehicles, pedestrians, and equipment. Additionally, heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. These risks would be similar to any large scale infrastructure project and can be managed effectively with good management and implementation of occupational health and safety measures (*IFC, April 2007*).

Chemical Hazards

Significant volumes of earthworks and paving activities will be conducted within the long construction corridor of the Project. The dust to be emitted during earthworks, exhaust emissions from large number construction machinery, hazardous materials used for painting and paving operations are among main sources of chemical hazards for construction workforce (*IFC, April 2007*).

Emergency Preparedness and Response

As discussed in details in Chapter 15 ("Community Health and Safety"), emergencies such as accidents, fire, natural hazards, etc. may occur during the land preparation and construction phase of the Project and if not properly managed, associated risks may be posed on the health and safety of the Project personnel. Nevertheless, with effective implementation of the measures/actions defined in the Project's Emergency Preparedness and Response Plan presented in Annex-3, emergency situations can be controlled without causing significant risks and/or impacts on the health and safety of the Project personnel as well as local communities.

16.3.2. Operation Phase

In the operation phase, maintenance personnel (i.e. road maintenance and landscaping workers), especially workers on foot, may be subject to occupational health and safety risks if not properly mitigated. Road repairs have to be managed within a structured plan to ensure safety zone and minimize relevant risks. In addition to the maintenance, personnel will be employed at toll plazas and control centers. Sub-contractors may also be involved in the operation of service areas. Since the overall number of personnel to be involved in operation activities will reduce significantly during the operation phase when compared to land preparation and construction phase, associated labor and occupational health and safety issues are anticipated to be limited in this phase of the Project.

Physical and Chemical Hazards

Road maintenance personnel, as the workers on foot, may be exposed to physical hazards during the operation phase of the Project. Similar to the construction phase, operation, maintenance and landscaping personnel working on the Motorway may be subject to the chemical hazards due to exhaust emissions of the vehicles driving on the road or passing through the toll plazas and tunnels, or due to hazardous dust or asphalt fumes generated during activities such as pavement, painting, vegetation removal, etc.

Emergency Preparedness and Response

Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and/or the release of oil or hazardous materials (*IFC, April 2007*). Thus, an Emergency Preparedness and Response Plan, covering the emergency situations (involving vehicles and pedestrians) that may occur during the Motorway's operation, has to be prepared and implemented by trained personnel in order to avoid significant risks.

16.4. Mitigation Measures

Project Sponsors will strictly comply with the requirements of the Turkish Labor Law and Occupational Health and Safety Regulation regarding the management of occupational health and safety risks and protection of the health and safety of Project workers including the direct and contracted personnel. Additionally, Project's policy on Labor, Employment and Occupational Health and Safety are described in the Environmental and Social Management System (see Chapter 20), which will be implemented during the land preparation, construction and operation phases of the Project to ensure compliance with international standards on labor and working conditions. Contracted workers will also be required to comply with the Project policy on Labor, Employment and Occupational Health and Safety through contractual requirements.

Project Sponsors will ensure that the contractors and sub-contractors do have the technical capability to manage the occupational health and safety issues of their employees. Accordingly, all the contractors and sub-contractors who will be involved in the Project will be required to will be subject to the same contractual conditions with the Project Sponsors in the issue of occupational health and safety and will be required to implement Project's occupational health and safety policies.

Regarding the labor conditions, sub-contractors will be subject to the same contractual conditions with the Project Sponsors. Duration of the contracts to be made with the sub-contractors will not exceed the duration of BOT Contract.

In the management of occupational health and safety hazards, preventive and protective measures will be taken in the following order of priority in accordance with the following approach as recommended by IFC both during the construction and operation phases of the Project:

- The activity causing the hazard will be eliminated from the work process;
- Hazard will be controlled at its source through use of engineering controls.
- Hazard will be minimized through design of safe work systems and administrative or institutional control measures.
- Appropriate personal protective equipment (PPE) will be provided in conjunction with training, use, and maintenance of the PPE.

With effective implementation of occupational health and safety measures including compliance with the requirements of the relevant regulations, implementation of safe practices and procedures when conducting assignments, provision of occupational health and safety trainings, proper use of personal protection equipments (PPE) and monitoring of occupational health and safety impacts, number of accidents/incidents would be effectively reduced and associated risks with significant consequences are likely to be well managed throughout the construction and operation phases of the Project.

16.4.1. Land Preparation and Construction Phase

Land preparation and construction phase will involve a significant number of workforce, including both direct and contracted workers. Accommodation will be provided at Camp Sites in the scope of the Project. Thus, promotion of safe and healthy working conditions and provision of good labor and accommodation conditions will be important during this phase of the Project. Good management of the potential issues would positively affect not only the quality, efficiency and productivity but also the reputation of the Project and its sponsors.

Retrenchment of the construction workforce following the completion of construction activities will be done in compliance with all legal and contractual requirements.

Workers Accommodation Conditions

The Camp Sites will include facilities such as cafeteria, medical room, shower and toilets, wastewater treatment plants/septic tanks, water supply facilities (i.e. water well) etc. Only concrete plants will be located at the Camp Sites; asphalt and mechanical plants will be sited close to the quarries to the extent feasible (see Section 3.2.1 for the description of Camp Sites). General measures to be taken at the workers accommodation facilities will be as follows:

- The accommodation to be provided will be clean and safe and meet the basic needs of workers, providing minimum amounts of space for each worker; sanitary, laundry and cooking facilities. Overcrowding will be avoided.
- Heating, air-conditioning and ventilation will be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.
- Drinking water to be provided to Project workforce and water to be supplied to food preparation, washing and bathing areas will meet the requirements of the Turkish Regulation Concerning Water Intended for Human Consumption.
- Adequate lavatory facilities (toilets, urinals, washbasins and showers) will be provided for the number of people expected to work in the facility and allowances will made for indicating whether the toilet facility is “In Use” or “Vacant”. Toilet facilities will also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.

- Domestic wastewater and waste to be produced at Camp Sites will be properly managed and disposed of in line with the requirements of relevant Turkish regulations as well as good site practices described in this ESIA (see Chapter 7 for the management of wastes; see Chapter 8 for the management of wastewater).
- First aid and medical facilities as well as provisions for safety against potential hazards (fire, etc.) will be provided at the camp sites.
- Residents of the Camp Sites will be made aware of any rules governing the accommodation.
- Project's Grievance Mechanism to be established will provide means to the Project personnel to lodge their complaints. Project Sponsors will ensure that the workers are informed of the grievance mechanism at the time of recruitment and make it easily accessible to them.

Measures against Physical Hazards

- Safe work zone will be established to separate workers on foot from the traffic.
- For the construction works to be conducted at location where traffic exists, safe work zones will be established by taking relevant measures (closure of roads, diversion of traffic, use of protective barriers, cones, warning lights, etc.)
- The area around which elevated work is taking place will be barricaded to prevent unauthorized access and working under personnel on elevated structures will be avoided.
- Hoisting and lifting equipment will be rated and properly maintained, and operators trained in their use. Elevating platforms will be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings), equipment movement protocols (e.g. movement only when the lift is in a retracted position), repair by qualified individuals, and installation of locks to avoid unauthorized use by untrained individuals.
- Ladders will be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions.
- When working at height, proper fall protection measures will be implemented. Fixtures will be installed on bridge components. Safety belts with proper thickness and of suitable materials ensuring sufficient strength will be used. Rope safety belts will be replaced before signs of aging or fraying of fibers become evident. When operating power tools at height, workers will use a second (backup) safety strap.

- Personnel exposed to high levels of noise will be required to use personal hearing protection devices/equipments that will be provided by the Project Sponsors at no cost. Where required for specific works, work rotation programs will be implemented to reduce cumulative exposure.
- Weather forecasts will be monitored for outdoor work to provide advance warning of extreme weather and schedule the work accordingly. Protective clothing will be used where required.

Measures against Chemical Hazards

- Properly maintained construction machinery, equipments and vehicles will be used to minimize air emissions.
- Engine idling time will be reduced in construction sites.
- Direct diesel exhaust will be properly removed to minimize exposure of the operators.
- Indoor working areas where vehicles or engines are operated will be ventilated or the exhaust gases will be properly diverted.
- Lead-containing paint will be avoided and appropriate respiratory protection will be used when cutting galvanized steel.
- At work sites where dust levels are excessive, dust masks will be used by relevant personnel.
- Hazardous materials will be replaced with a less hazardous substitute.
- Engineering and administrative control measures will be performed in order to prevent or reduce the release of hazardous materials into the work site. Level of exposure will be kept below internationally established or recognized limits.
- The number of workers to be exposed will be kept in minimum.
- Hazardous materials will be labeled and marked properly considering national and international regulations and guidelines. Materials Safety Data Sheets (MSDS) will be prepared. All written communication will be readable and available to workers to be exposed and first-aid personnel.
- Workers will be trained in use of information related to hazardous materials (MSDSs etc.), safe work practices and appropriate use of PPE.

General Occupational Health and Safety Measures

Following additional measures will be taken in accordance with the KGM's Technical Specifications for Motorways to avoid and/or minimize risks due to moving equipments and vehicles or works to be conducted at height or elevated/overhead works, etc:

- Project Sponsors will ensure that qualified first-aid can be provided at all times at the working/construction sites.
- Adequate lightning (that would not distract drivers' sight) will be provided for works to be conducted at night-time. Lightning system will be moved forward in parallel to the progress of works.
-

- All the vehicles that will operate at night will have yellow colored overhead flashlights that will be activated during the time of works.
- During the tunnel excavations, measures will be taken to ensure that adequate air ventilation, lightning and drainage will be uninterruptedly provided. Air ventilation systems will meet the minimum international safety standards and requirements. Back-up generators, dewatering/drainage pumps, pipes and hand lamps will be kept available at all times in sufficient numbers and capacities at the tunnel excavation work sites. Accumulation of water within the tunnels will be strictly prevented.
- Good cooperation with the local medical services will be ensured.
- A system will be established for the reporting and recording of occupational accidents and dangerous occurrences/incidents.
- Personal protective equipments/devices (PPE/PPD) and seasonal working outfits, meeting the requirements of the relevant Turkish regulations and good site practices, will be provided to all construction personnel by the Project Sponsors at no cost. Effective use of the PPEs/PPDs by the construction personnel will be monitored and ensured by the Project Sponsors.
- Sub-contractor workers will also be strictly required to use necessary PPEs/PPDs by means of contractual stipulations to be done with the sub-contracting companies.

Use of Personal Protective Equipments (PPEs)

PPE will be considered as an additional protection for workers, on top of all other measures that will be taken to prevent and reduce the potential risks that may occur at the project site. Appropriate PPE will be determined based on the job to be performed and the kind of hazard that the workers are potentially exposed to. PPE will be provided to all workers who are in need of them and a training program, which explains proper uses of each PPE, would be conducted. All relevant personnel will be obliged to participate in the training program.

The Project will meet the requirements of Turkish Law on Occupational Health and Safety and Regulation on the Use of Personal Protective Equipment at/in Workplaces, which has been prepared in parallel with the relevant European Union Directives. PPEs will be selected based on the specific hazards and risks of the task to be performed and properly maintained to keep them effective and operational throughout their use.

Occupational Health and Safety Trainings

Training of the Project workers and other personnel including the management, supervisors, and even occasional visitors is a key in reducing the number of accidents during the construction phase. Basic occupational health and safety orientation trainings will be provided to all new personnel including direct and contracted workers, management, supervisors and occasional visitors. These trainings will include specific occupational health and safety subjects that include, but not limited to the following:

- Basic site rules and hazard awareness
- Hygiene requirements
- Potential risks to health
- Site-specific hazards
- Safe work practices
- Knowledge of materials, equipments and tools
- Wearing and use of protective equipment and clothing
- Hazards of working on foot around equipment and vehicles;
- Preventing injury to fellow workers
- Safe practice for work at night and in other low-visibility conditions (e.g. use of high-visibility safety apparel and proper illumination for the work space while controlling glare)
- Emergency procedures (e.g. during fires, natural disasters, etc.)

In addition to orientation trainings, all the direct and contracted workers will be provided with relevant trainings prior to commencement of new assignments (change of workplace/task, change of working machinery and equipments, introduction of new technologies, etc.). Workers with rescue and first-aid duties will be provided with dedicated training. Through appropriate contract specifications and monitoring, Project sponsors will ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

A visitor orientation and control program will be established to ensure visitors do not enter hazard areas unescorted. In this respect, relevant checkpoints and record keeping practices will be used for ensuring both safety of the works and the visitors.

Emergency Preparedness and Response

Against emergency situations arising at the construction/work sites and Camp Sites, relevant emergency preparedness and response measures will be taken in accordance with the Emergency Preparedness and Response Plan given in Annex-3.

16.4.2. Operation Phase

Some of the occupational health and safety measures described for the land preparation and construction phase for the mitigation of physical and chemical hazards, provision of occupational health and safety trainings, use of PPE, etc. would also be applicable for the management of operation phase risks and thus be implemented during the operation phase. Specific measures for the operation phase risks and impacts are described below. Regarding the management of emergencies, measures specified in the the Emergency Preparedness and Response Plan presented in Annex-3 will be implemented.

In accordance with the related terms of the BOT contract, Project Sponsors will ensure that the operation and maintenance personnel are properly trained in their specialty and successfully completed the necessary security investigations. Operation and Maintenance Plan will be submitted to the KGM 4 months ahead of the start of Motorway's operation. In accordance with the related terms of the BOT contract, 1 year ahead of the end of the contract duration, personnel designated by the KGM will be trained by the Project Sponsors on the aspects related with the operation and maintenance works of the Motorway.

Sub-contractors to be involved in the operation of service areas will be subject to the same contractual conditions with the Project Sponsors, sub-contractors will be required to apply occupational health and safety measures to be taken by the Project Sponsors.

Measures against Physical Hazards

Following measures will be taken to ensure safety during the road maintenance or landscaping works:

- Safe work zones will be established to separate workers on foot from the traffic by using proper methods/devices (e.g. use of protective barriers, traffic cones, barrels)
- When possible, traffic will be route to alternative roads.
- Proper land closure or traffic diversion measures will be taken in consideration of the width of the road.
- Protective barriers will be used to shield workers where required.
- Traffic flow will be primarily regulated by warning lights and use of flaggers will be avoided where possible.
- Maximum speed limits will be reduced in the work zones.
- Blind spots will be avoided to the maximum extent possible by means of proper design of the work space.

Measures against Chemical Hazards

- Pavers with exhaust ventilation systems will be used and proper maintenance of such systems will be ensured to maintain worker exposure to crystalline silica (millers and grinders) and asphalt fumes (pavers) below applicable occupational exposure levels.
- Correct asphalt product will be used for each specific application and application at the correct temperature will be ensured to reduce the fuming of bitumen during normal handling.
- Adequate ventilation will be provided in tunnels and other necessary areas with limited natural air circulation;
- Tollbooths will be equipped with proper ventilation and air filtration systems;
- Protective clothing will be used when working with cutbacks (a mixture of asphalt and solvents for the repair of pavement), diesel fuel, or other solvents.
- Appropriate respiratory protection will be used when removing paints.

16.5. Summary of Assessment and Residual Impacts

Project-related occupational health and safety risks would be minimized by taking relevant design, operational and administrative measures and implementation of an Emergency Preparedness and Response Plan, which meet the international requirements. Control of risks caused by third parties is more challenging, but they can also be properly mitigated by means of good management, contractual obligations and effective monitoring. Summary of the community health and safety assessments are presented in Table 16.5.

Table 16.5. Summary of the Assessments on Labor and Working Conditions

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Magnitude						Sensitivity/ Value of Resource/ Receptor	Impact Significance (Before Mitigation)	Measures to be Taken	Significance of Residual Impacts
				Geographic Extent	Duration	Magnitude	Reversibility	Frequency	Overall Magnitude				
Project Personnel	Land preparation and construction	Poor accommodation conditions resulting on safety hazards, spread of disesases and reduced level of morale	Adverse	Restricted	Medium	Medium (personnel will not be localized but distributed along the linear route and camp sites, quarries, etc.) •Section 4: 2.350 •Section 5: 2.250 personnel •Section 6: 4.500 personnel	Short term reversible	Continous	Moderate (B)	High (3)	High (B3)	•The accommodation to be provided will be clean and safe and meet the basic needs of workers, providing minimum amounts of space for each worker; sanitary, laundry and cooking facilities. Overcrowding will be avoided. •Heating, air-conditioning and ventilation will be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time. •Drinking water to be provided to Project workforce and water to be supplied to food preparation, washing and bathing areas will meet the requirements of the Turkish Regulation Concerning Water Intended for Human Consumption. •Adequate lavatory facilities (toilets, urinals, washbasins and showers) will be provided for the number of people expected to work in the facility and allowances will made for indicating whether the toilet facility is “In Use” or “Vacant”. Toilet facilities will also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices. •Domestic wastewater and waste to be produced at Camp Sites will be properly managed and disposed of in line with the requirements of relevant Turkish regulations as well as good site practices described in this ESIA (see Chapter 7 for the management of wastes; see Chapter 8 for the management of wastewater). •First aid and medical facilities as well as provisions for safety against potential hazards (fire, etc.) will be provided at the camp sites. •Residents of the Camp Sites will be made aware of any rules governing the accommodation. •Project’s Grievance Mechanism to be established will provide means to the Project personnel to lodge their complaints. Project Sponsors will ensure that the workers are informed of the grievance mechanism at the time of recruitment and make it easily accessible to them.	Low
		General occupational health and safety hazards	Adverse	Restricted	Medium	Low (there may be several cases with minor results)	Short term reversible	Intermittent	Minor (C)	High (3)	Medium (C3)	•Project Sponsors will ensure that qualified first-aid can be provided at all times at the working/construction sites. •Adequate lightning (that would not distract drivers’ sight) will be provided for works to be conducted at night-time. Lightning system will be moved forward in parallel to the progress of works. •All the vehicles that will operate at night will have yellow colored overhead flashlights that will be activated during the time of works. •During the tunnel excavations, measures will be taken to ensure that adequate air ventilation, lightning and drainage will be uninterruptedly provided. Air ventilation systems will meet the minimum international safety standards and requirements. Back-up generators, dewatering/drainage pumps, pipes and hand lamps will be kept available at all times in sufficient numbers and capacities at the tunnel excavation work sites. Accumulation of water within the tunnels will be strictly prevented. •Good cooperation with the local medical services will be ensured. •A system will be established for the reporting and recording of occupational accidents and dangerous occurrences/incidents. •Personal protective equipments/devices (PPE/PPD) and seasonal working outfits, meeting the requirements of the relevant Turkish regulations and good site practices, will be provided to all construction personnel by the Project Sponsors at no cost. Effective use of the PPEs/PPDs by the construction personnel will be monitored and ensured by the Project Sponsors. •Sub-contractor workers will also be strictly required to use necessary PPEs/PPDs by means of contractual stipulations to be done with the sub-contracting companies. •Basic occupational health and safety orientation trainings will be provided to all new personnel including direct and contracted workers, management, supervisors and occasional visitors. •In addition to orientation trainings, all the direct and contracted workers will be provided with relevant trainings prior to commencement of new assignments (change of workplace/task, change of working machinery and equipments, introduction of new technologies, etc.). Workers with rescue and first-aid duties will be provided with dedicated training. Through appropriate contract specifications and monitoring, Project sponsors will ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin. •A visitor orientation and control program will be established to ensure visitors do not enter hazard areas unescorted. In this respect, relevant checkpoints and record keeping practices will be used for ensuring both safety of the works and the visitors. •Emergency Preparedness and Response Plan will be implemented.	Low
				Restricted	Medium	Medium (there may be rare cases with significant results)	Irreversible	One-off	Moderate (B)	High (3)	High (B3)		

Affected	Project	Definition of	Type of	Impact Magnitude						Sensitivity/ Value	Impact	Measures to be Taken	Significance
		Phsyical and chemical hazards due to operation of heavy vehicles, earthworks, exposure to noise, emissions	Adverse	Restricted	Medium	Medium (machinery/ activities will not be localized but distributed along the linear route, use of chemicals will be limited)	Short term reversible	Intermittent	Moderate (B)	High (3)	High (B3)	•Emergency Preparedness and Response Plan will be implemented. •Hazardous materials will be replaced with a less hazardous substitute. •Engineering and administrative control measures will be performed in order to prevent or reduce the release of hazardous materials into the work site. Level of exposure will be kept below internationally established or recognized limits. •The number of workers to be exposed will be kept in minimum. •Hazardous materials will be labeled and marked properly considering national and international regulations and guidelines. Materials Safety Data Sheets (MSDS) will be prepared. All written communication will be readable and available to workers to be exposed and first-aid personnel. •Workers will be trained in use of information related to hazardous materials (MSDSs etc.), safe work practices and appropriate use of PPE. •Safe work zone will be established to separate workers on foot from the traffic. •For the construction works to be conducted at location where traffic exists, safe work zones will be established by taking relevant measures (closure of roads, diversion of traffic, use of protective barriers, cones, warning lights, etc.) •The area around which elevated work is taking place will be barricaded to prevent unauthorized access and working under personnel on elevated structures will be avoided. •Hoisting and lifting equipment will be rated and properly maintained, and operators trained in their use. Elevating platforms will be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings), equipment movement protocols (e.g. movement only when the lift is in a retracted position), repair by qualified individuals, and installation of locks to avoid unauthorized use by untrained individuals. •Ladders will be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions. •When working at height, proper fall protection measures will be implemented. Fixtures will be installed on bridge components. Safety belts with proper thickness and of suitable materials ensuring sufficient strength will be used. Rope safety belts will be replaced before signs of aging or fraying of fibers become evident. When operating power tools at height, workers will use a second (backup) safety strap. •Personnel exposed to high levels of noise will be required to use personal hearing protection devices/equipments that will be provided by the Project Sponsors at no cost. Where required for specific works, work rotation programs will be implemented to reduce cumulative exposure. •Weather forecasts will be monitored for outdoor work to provide advance warning of extreme weather and schedule the work accordingly. Protective clothing will be used where required. •Properly maintained construction machinery, equipments and vehicles will be used to minimize air emissions. •Engine idling time will be reduced in construction sites. •Direct diesel exhaust will be properly removed to minimize exposure of the operators. •Indoor working areas where vehicles or engines are operated will be ventilated or the exhaust gases will be properly diverted. •Lead-containing paint will be avoided and appropriate respiratory protection will be used when cutting galvanized steel. •At work sites where dust levels are excessive, dust masks will be used by relevant personnel.	Low
		Emergencies such as accidents, fires, natural hazards, etc.	Adverse	Restricted	Medium	Medium	Short term reversible	One-off	Moderate (B)	High (3)	High (B3)		Low
				Restricted	Medium	High	Irreversible	One-off	Moderate (B)	High (3)	High (B3)		Low
		Retrenchment of construction workforce at he end of construction phase	Adverse	Restricted	Short	Hgih	Short term reversible	One-off	Moderate (B)	Medium (2) (Since the Project will not cause retrenchment of personnel from an existing workplace but from a Project construction with predefined limited duration sensitivity of personnel is asummed as medium instead of high)	Medium (B2)	•Retrenchment of the construction workforce following the completion of construction activities will be done in compliance with all legal and contractual requirements. •A Retrenchment Plan in compliance with IFC PS2 will be prepared and implemented during the retrenchment process.	Low

Affected	Project	Definition of	Type of	Impact Magnitude						Sensitivity/ Value	Impact	Measures to be Taken	Significance
	Operation	Phsyical and chemical hazards during road maintenace and landscaping works.	Adverse	Restricted	Long	Medium (stationary personnel) •Road maintenance personnel, workers on foot	Short term reversible	Intermittent	Moderate (B)	High (3)	High (B3)	•In accordance with the related terms of the BOT contract, Project Sponsors will ensure that the operation and maintenance personnel are properly trained in their specialty and successfully completed the necessary security investigations. Operation and Maintenance Plan will be submitted to the KGM 4 months ahead of the start of Motorway's operation. In accordance with the related terms of the BOT contract, 1 year ahead of the end of the contract duration, personnel designated by the KGM will be trained by the Project Sponsors on the aspects related with the operation and maintenance works of the Motorway. •Sub-contractors to be involved in the operation of service areas will be subject to the same contractual conditions with the Project Sponsors, sub-contractors will be required to apply occupational health and safety measures to be taken by the Project Sponsors. •Safe work zones will be established to separate workers on foot from the traffic by using proper methods/devices (e.g. use of protective barriers, traffic cones, barrels) •When possible, traffic will be route to alternative roads. •Proper land closure or traffic diversion measures will be taken in consideration of the width of the road. •Protective barriers will be used to shield workers where required. •Traffic flow will be primarily regulated by warning lights and use of flaggers will be avoided where possible. •Maximum speed limits will be reduced in the work zones. •Blind spots will be avoided to the maximum extent possible by means of proper design of the work space. •Pavers with exhaust ventilation systems will be used and proper maintenance of such systems will be ensured to maintain worker exposure to crystalline silica (millers and grinders) and asphalt fumes (pavers) below applicable occupational exposure levels. •Correct asphalt product will be used for each specific application and application at the correct temperature will be ensured to reduce the fuming of bitumen during normal handling. •Adequate ventilation will be provided in tunnels and other necessary areas with limited natural air circulation; •Tollbooths will be equipped with proper ventilation and air filtration systems; •Protective clothing will be used when working with cutbacks (a mixture of asphalt and solvents for the repair of pavement), diesel fuel, or other solvents. •Appropriate respiratory protection will be used when removing paints.	Low

CHAPTER 17

CUMULATIVE IMPACT ASSESSMENT

CHAPTER 17. CUMULATIVE IMPACT ASSESSMENT

Project-level environmental and social impacts of the Project have been assessed in the previous chapters of this ESIA Report. This Chapter aims to assess the potential cumulative impacts that may result from the incremental impacts from other past, existing or future (reasonably foreseeable) developments/activities implemented or planned in the region.

17.1. Assessment Methodology and Data Sources

Cumulative Impact Assessment study to be done in the scope of this ESIA will follow the main principles of the Good Practice Handbook of the International Finance Corporation (*IFC, August 2013*) on the Cumulative Impact Assessment and Management Guidance, which is one of the latest and most comprehensive documents available to CIA practitioners and compiles the fundamental approaches of key reference documents on the assessment of cumulative impacts. Additional key references to be used in the scope of the assessment will include the following:

- World Bank's Sample Guidelines on Cumulative Environmental Impact Assessment for Hydropower Projects in Turkey published under the Energy Sector Management Assistance Program (*ESMAP, 2012*);
- Cumulative Effects Assessment and Management Guidance published by International Association for Impact Assessment (IAIA) (*Canter L., and William R., 2009; http://www.iaia.org/*);
- European Commission's (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (*May, 1999*);
- Cumulative Effects Assessment Practitioners Guide prepared by the Cumulative Effects Assessment Working Group and AXYS Environmental Consulting Ltd. for the Canadian Environmental Assessment Agency (*Hegmann, G. C. Cockling, R. Creasey, S. Dupuis, Kennedy, L. Kingsley, W. Rodd, H. Spaling and D. Stalker; February, 1999*).

Cumulative impacts are defined as the "impacts that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as "developments") when added to other existing, planned, and/or reasonably anticipated future ones (*IFC, August 2013*). Several stand alone activities/projects/developments with insignificant impacts individually may together cause a cumulative impact that may be significant (*EC, May 1999; see Table 17.1*).

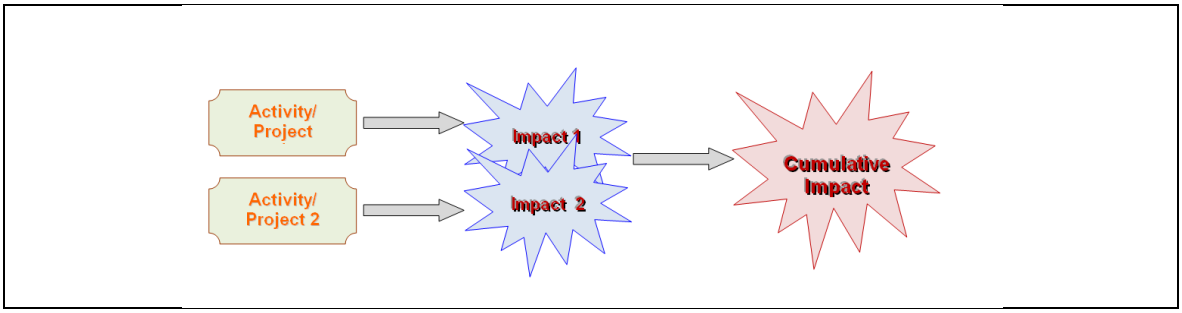


Figure 17.1. Illustration of Cumulative Impacts (*Adapted from EC, May 1999*)

Cumulative Impact Assessment is defined by IFC as the process of analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Ecosystem Components (VECs), which are the environmental and social attributes that are considered to be important in assessing risks, over time, and proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible (*IFC, August 2013*). In accordance with the methodology specified in IFC's CIA Good Practice Handbook, the main steps of the Cumulative Impact Assessment to be done for the North Marmara Motorway Project will comprise the following:

Step 1: Scoping Phase I – VECs, Spatial and Temporal Boundaries
Step 2: Scoping Phase II – Other Activities and Environmental Drivers
Step 3: Establish Information on Baseline Status of VECs
Step 4: Assess Cumulative Impacts on VECs
Step 5: Assess Significance of Predicted Cumulative Impacts
Step 6: Management of Cumulative Impacts – Design and Implementation

In the scope of the Cumulative Impact Assessment, North Marmara Motorway Project, including both the European and Asian sections will be taken into consideration as the source Project that may cause cumulative impacts together with other projects/activities/developments affecting the same VECs. The existing Third Bosphorus Bridge and its associated Motorway section (Odayeri-Pasakoy) part of the North Marmara Motorway Project will be included in the assessment as an "other" project.

Step 1: Scoping Phase I

In line with the good practice, the Cumulative Impact Assessment study will be conducted with a focus on the VECs that would be environmentally or socially important in assessing the risks of the Project. Accordingly, since the Cumulative Impact Assessment should be looked at "from the VECs point of view", in which the combined (i.e., cumulative) effects of the various actions on each VEC are assessed, as the first step of the assessment, VECs, for which cumulative impacts are to be assessed and managed, will be identified for the Project. A comparative illustration of the Project-centered perspective of the ESIA and the VEC-centered perspective of Cumulative Impact Assessment processes is illustrated in Figure 17.2.

It should be noted that only the VECs to be affected by the North Marmara Motorway Project will be considered in the assessment. In other words, any VEC (e.g. protected areas, sensitive habitats, water resources, etc.) that would be affected by other developments, but not by the North Marmara Motorway Project, will not be taken into account in the assessment in accordance with Cumulative Impact Assessment. This approach is exemplified in Figure 17.3, where the arrows indicate an action causing an effect on a VEC. As can be seen in the example given in the figure, although the fish is affected by one of the other actions, it should not be considered as VEC in the scope of a cumulative impact assessment to be done for the proposed project, because it is not affected by the proposed action under review.

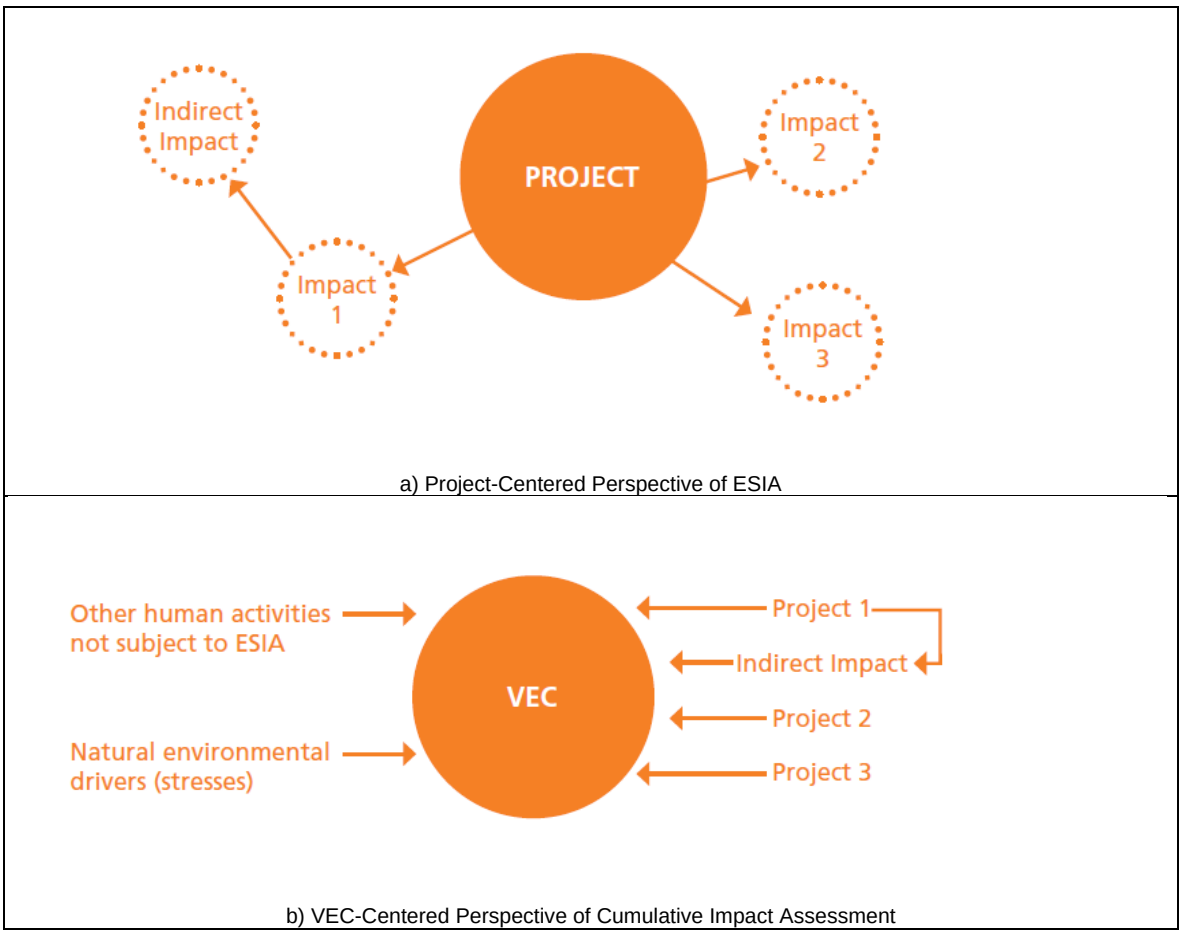


Figure 17.2. A Comparative Illustration of the ESIA and Cumulative Impact Assessment Perspectives

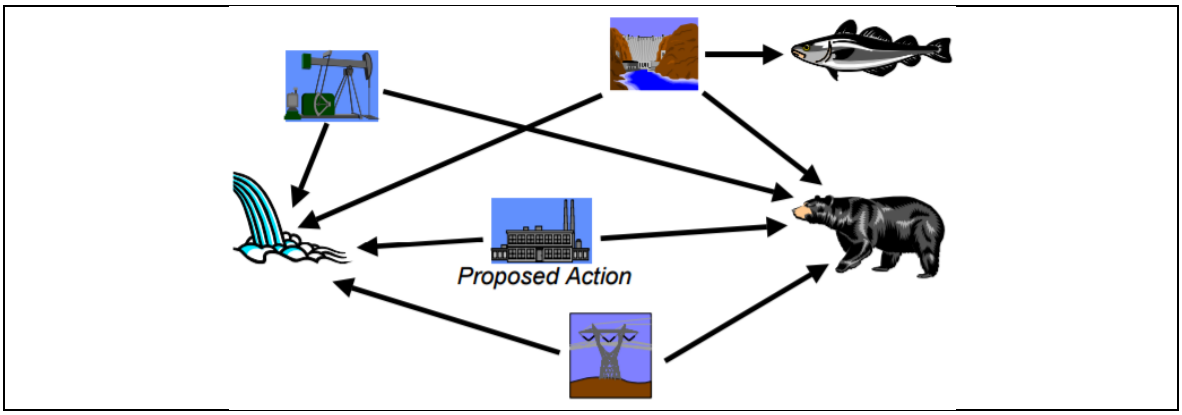


Figure 17.3. Focusing on Effects on VECs
(Source: Effects Assessment Working Group for the Canadian Environmental Assessment Agency; Hegmann, G. C. Cockling, R. Creasey, S. Dupuis, Kennedy, L. Kingsley, W. Rodd, H. Spaling and D. Stalker, February 1999)

Regarding the temporal extent of the impacts, the assessment will cover the impacts of past, present and reasonably foreseeable future developments that would correspond to the economic life of the Project to the maximum extent practical.

Regarding the geographical extent of impacts, a Cumulative Impact Assessment area, which will extend beyond the area of influence (for Project's stand alone impacts) defined in the ESIA Report, will be identified. The boundaries of the Cumulative Impact Assessment area will be expanded to the point at which the VECs will be no longer affected significantly, in consideration of relevant geographical, topographical, hydrological, etc. boundaries, if available.

It should be noted that the determination of the Cumulative Impact Assessment area may be an iterative process, which may be initially proposed by educated guess and improved together with assessments to be done.

Step 2: Scoping Phase II

Once the Cumulative Impact Assessment area is determined, other activities and environmental drivers within this geographical boundary that would affect the condition of the VECs selected for the Cumulative Impact Assessment will be determined based on a desk-based review of the readily available sources (e.g. Environmental Master Plans, EIA Positive Decisions issued for Projects, etc.) and the databases of the Turkish Ministry of Transport, Maritime Affairs and Communications that are available to the Project Sponsors. The assessment will primarily focus on the transportation infrastructure projects.

As recommended by World Bank in its Sample Guidelines on Cumulative Environmental Impact Assessment for Hydropower Projects in Turkey published under the Energy Sector Management Assistance Program (*ESMAP, 2012*), the selection of future actions to be considered in the scope of the Cumulative Impact Assessment should at least reflect the certain scenario and at best the most likely future scenario. Rigid adherence to minimum regulatory requirement however is increasingly becoming unacceptable to many stakeholders if there is reason to believe that at least some reasonably foreseeable projects could have a significant cumulative effect with the project under review (also, precedent setting court and panel decisions on project approvals will continue the evolution of change regarding what is and is not expected and acceptable practice). Experts are therefore encouraged to consider the opportunity to also include reasonably foreseeable actions. Mainly, foreseeable future actions would include those projects that; have some sort of official approval (e.g. EIA positive decision, official site allocation, etc.), are in the regulatory review process for approval, and are included in an approved development plan (e.g. Regional development plan, master plan, etc.).

Selection of future actions must consider the certainty of whether the action will actually proceed. Figure 17.4 lists criteria that may be used in the selection process. According to this figure, future actions classified as; “Certain” will proceed or there is a high probability the action will proceed; classified as “Reasonably Foreseeable” may proceed, but there is some uncertainty about this conclusion; and classified as “Hypothetical” is assumed to have considerable uncertainty whether the action will ever proceed. In the scope of the assessment, all future projects, except the hypothetical ones, will be taken into consideration.

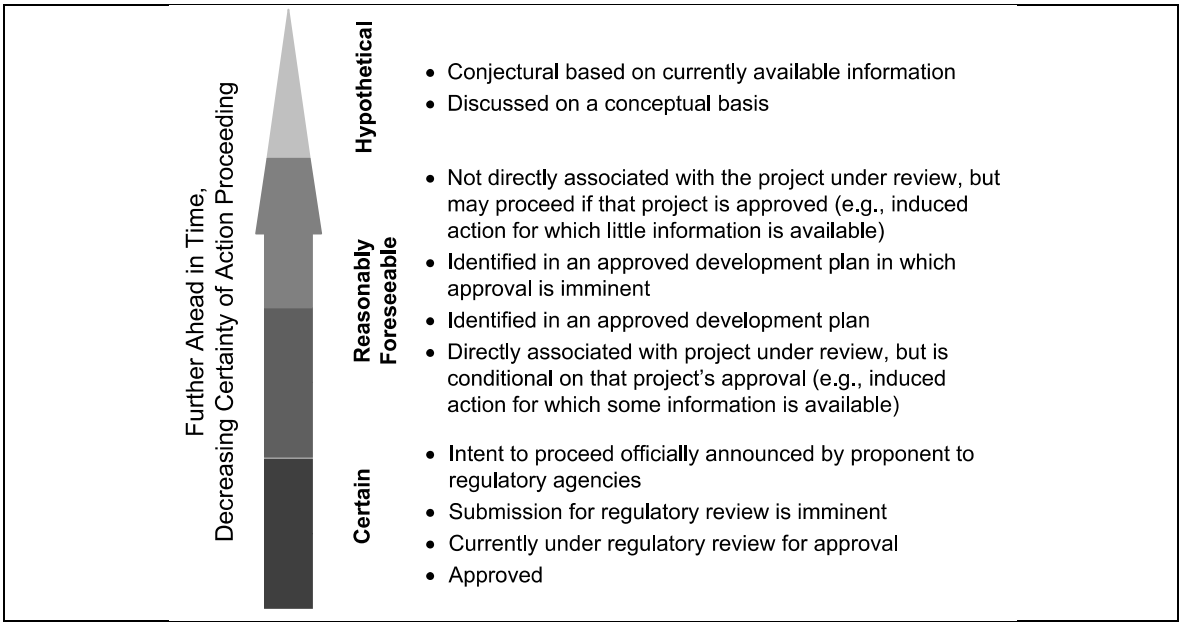


Figure 17.4. Categorization of Future Actions

Step 3: Establish Information on Baseline Status of VECs

The baseline conditions for the VECs to be assessed in the scope of this study will be based on the information gathered for each environmental and social subject in the scope of the ESIA process. Relevant information on the VECs is provided in the related chapters of this ESIA Report.

Step 4: Assess Cumulative Impacts on VECs

Cumulative impacts on the VECs will be analyzed by estimating the future state of the VECs under the aggregated effect of past, present and future (reasonably foreseeable activities/projects/developments). The assessment will be based on a qualitative approach and will focus on the final status of the corresponding VEC under the impact of all impact factors.

Step 5: Assess Significance of Predicted Cumulative Impacts

When considered in isolation, the environmental effects of any single project upon any single receptor/ resource may not be significant. However, when individual effects are considered in combination, the resulting cumulative effect may be significant. The focus in assigning significance to cumulative effects should be determined by the extent to which the impacts can be accommodated by the receptor/resource. Thresholds (limits beyond which cumulative change becomes a concern) and indicative levels of acceptable performance of a receptor/resource may also aid the assessment process (*UK Highways Agency 205/08: Design Manual for Roads and Bridges; http://www.standardsforhighways. co.uk /ha/standards/dmrb/*). The standardized matrix developed by UK Highway Agency for the assessment of cumulative impacts' significance is presented in Table 17.1.

Table 17.1. Criteria for Determining Significance of Cumulative Impacts

Significance	Impact
Severe	Impacts that the decision-maker must take into account as the receptor/Resource is irretrievably compromised.
Major	Impacts that may become key decision-making issue
Moderate	Impacts that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Impacts that are locally significant.
Not Significant	Impacts that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

Source: *UK Highways Agency 205/08: Design Manual for Roads and Bridges; http://www.standardsforhighways. co.uk /ha/standards/dmrb/*

Significance of predicted cumulative impacts will be estimated in terms of the vulnerability and/or risk to the sustainability of the VECs assessed, which will be directly related with the existing sensitivity/vulnerability conditions of the VECs and the applicable thresholds that are the limits beyond which changes resulting from cumulative impacts become of concern. For practical purposes, if the cumulative impacts of all combined developments on a VEC do not exceed a limit or threshold, the development will be considered acceptable.

Step 6: Management of Cumulative Impacts – Design and Implementation

At the final step of the CIA, management measures will be suggested for any cumulative impacts that are anticipated to be significant. However, it should be noted that since cumulative impacts typically result from the actions of multiple stakeholders, the responsibility for their management will be collective, requiring individual actions to eliminate or minimize individual development's contributions, which could not be ensured solely by the efforts of the Project owner. Thus, the assessment will continue to focus on the management of standalone Project impacts that make substantial contribution to cumulative impacts, if there is any, if the specific project mitigation is likely to be effective in preventing unacceptable cumulative impacts.

17.2. Potential Impacts

Cumulative impact assessment will be conducted below on a step-by-step basis in accordance with the methodology described in the previous section.

Step 1: Scoping Phase I

For the initial identification of VECs, the environmental and social aspects covered in the scope of the impact assessment conducted for the North Marmara Motorway Project in the previous chapters of this ESIA and also the ESIA prepared separately for the European sections of the Project, will be taken into consideration. The VECs to be focused in the Cumulative Impact Assessment have been selected as follows:

- Land use
  - Forests
  - Agricultural lands
- Water resources
  - Drinking water reservoirs/dams
  - Natural lakes
- Sensitive habitats
  - Key Biodiversity Areas
- Protected areas
  - Nature parks, etc.
  - Registered cultural heritage/archaeological sites
- Local communities (air quality, noise, socio-economy)

Regarding the temporal extent of the impacts, the assessment will cover the impacts of past, present and reasonably foreseeable future developments that would correspond to the economic life of the Project to the maximum extent practical.

Regarding the geographical extent of impacts, the area encompassed by the provincial boundaries of Istanbul, Kocaeli and Sakarya has been determined as the Cumulative Impact Assessment area. The route of the North Marmara Motorway within this Cumulative Impact Assessment area is demonstrated on the map given in Figure 17.5. This area extends beyond the North Marmara Motorway's area of influence defined in Chapter 4 ("ESIA Methodology") of this ESIA Report.

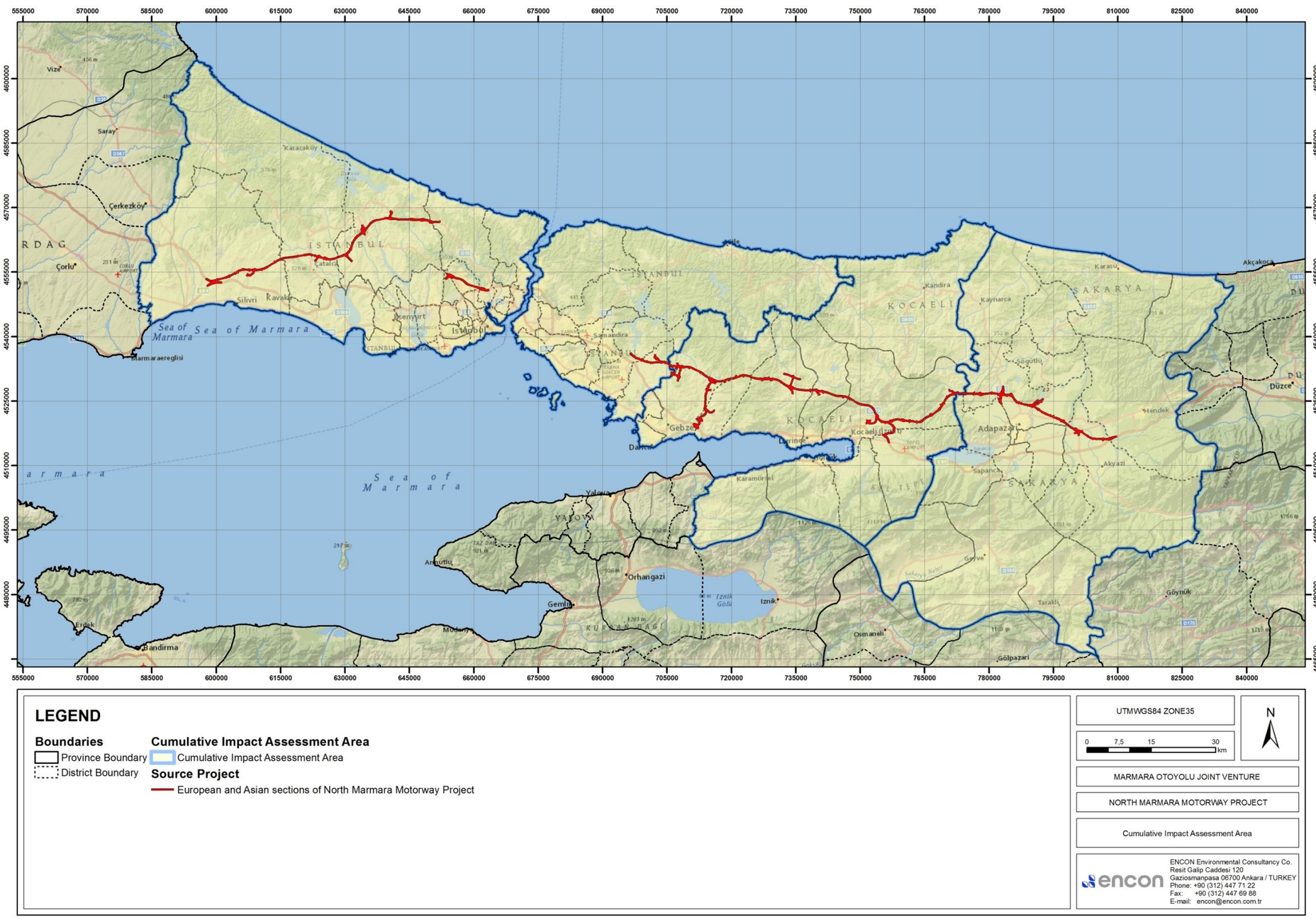


Figure 17.5. Cumulative Impact Assessment Area

Step 2: Scoping Phase II

Following the determination of the Cumulative Impact Assessment area, other past, present and future (reasonably foreseeable) transportation infrastructure activities/developments within this are that would affect the condition of the selected VECs have been identified based on a desk-based review of the databases of the Turkish Ministry of Transport, Maritime Affairs and Communications and other readily available sources (e.g. Environmental Master Plans, EIA Positive Decisions issued for Projects, etc.) as listed in Table 17.2. It should be noted that the list given in Table 17.2 is a comprehensive list covering all major transportation projects in the region. In the last column of the table, potential of other projects/activities/developments for affecting selected VECs have been identified.

Table 17.2. Other Projects/Activities/Developments in Transportation Sector in Istanbul, Kocaeli and Sakarya

Transport Sub-sector	Province	Other Projects/Activities/ Developments	Status	Construction		Project Cost	Potential for Affecting the Selected VECs	
				Start	End		Yes	No
Road	Istanbul	Istanbul Third Bosphorus Bridge and Motorway (Odayeri-Pasakoy)	In operation	2013	2016	3,5 billion USD		
	Istanbul	Eurasia (Avrasya) Tunnel	In operation	2013	2016	1,2 billion USD		
	Istanbul	Hasdal Interchange-Kemerburgaz-Yassioren	Under construction	1994	2017	2,3 billion TL		
	Istanbul	Sile-Agva-Kandira-Kaynarca Divided Road	Under construction	2011	2017	8,2 million TL		
	Istanbul	Yassioren-Subasi-Catalca Divided Road	Under construction	2016	2018	155,5 million TL		
	Istanbul	Kinali-Tekirdag-Canakkale-Balikesir Motorway (inc. 1915 Bridge Crossing)	Project-Design	2017	2023	10,3 billion TL		
	Kocaeli	Izmit Bay Bridge (as a part of the Istanbul-Gebze-Orhangazi-Izmir Motorway)	Under construction	2013	2016	8 billion USD (inc. Motorway)		
	Istanbul, Kocaeli	D100 Istanbul-Gebze-Izmit-Divided Road	Under construction	2015	2017	101 million TL		
	Sakarya	Kaynarca-Karasu Divided Road	Under construction	2010	2017	205 million TL		
	Istanbul	1st Ring Road/D100 State Road	In operation	1970s	-	Not known		
	Istanbul	2nd Ring Road (E-80 European Motorway)	In operation	1980s	-	Not known		
Railway	Istanbul	Marmaray Rail Transportation	In operation	2004	2014	3,3 billion TL		
	Istanbul	Istanbul Grand (New) Airport Rail System Connection	Project-Design	Not known at this stage				
	Istanbul, Kocaeli, Sakarya	Adapazari Northern Railway Passage	Project-Design	Not known at this stage				
	Istanbul	Grand Istanbul Tunnel (3 storey)	Project-Design	Not known at this stage				
	Istanbul	Halkali-Kapikule High Speed Railway	Under construction	2016	2019	2,2 billion TL		
	Kocaeli	Ankara-Istanbul High Speed Railway	In operation	2004	2014	9,2 billion TL		
Airway	Istanbul	Istanbul Grand Airport (inc. access roads)	Under construction	2014	2018	22 billion Euro		
Maritime	Istanbul	Channel Istanbul	Preparatory	Not known at this stage				

Source: Turkish Ministry of Transport, Maritime Affairs and Communications, 2017; http://www.ubak.gov.tr. 2003/2016 in Transportation and Communication: 34 Istanbul

As mentioned previously, in the Cumulative Impact Assessment to be conducted for the North Marmara Motorway Project, only the projects/activities/developments that may have a potential for affecting the selected VECs (marked as "Yes" in the last column of Table 17.2) will be taken into consideration in accordance with the VEC-centered perspective of Cumulative Impact Assessment practices. There is no project that would be considered as "past" in this assessment as all the past transportation projects are currently operating. The projects, which are in operation, will be considered as existing projects in the scope of the assessment. Regarding the selection of future Projects, the approach described under Step 2 in Section 17.1 ("Assessment Methodology and Data Sources") has been adopted. In this context, the projects that are under construction or in project-design phase (as declared by the Ministry of Transport, Maritime Affairs and Communications) and that may have a potential to affect the selected VECs will be included in the assessment as reasonably foreseeable projects. Only Channel Istanbul Project, falls into the category of "hypothetical" thus it will not be considered as a future project in the scope of this Cumulative Impact Assessment. Projects to be included in the Cumulative Impact Assessment are listed in Table 17.3.

Table 17.3. Projects to be included in the Cumulative Impact Assessment

Source Project (Project under Assessment)	Other Existing Projects	Reasonably Foreseeable Projects
• European and Asian sections of North Marmara Motorway Project	• Istanbul Third Bosphorus Bridge and Odayeri-Pasakoy Motorway section	• Hasdal Interchange-Kemerburgaz-Yassioren
	• Istanbul 2nd Ring Road (E-80 European Motorway)	• Yassioren-Subasi-Catalca Divided Road
		• D100 Istanbul-Gebze-Izmit- Divided Road
		• Istanbul Grand (New) Airport Rail System Connection (Halkali-Airport-Gayrettepe)
		• Adapazari Northern Railway Passage (Connection to Istanbul Third Bosphorus Bridge-Istanbul Grand Airport-Halkali)
		• Halkali-Kapikule High Speed Railway
		• Istanbul (New) Grand Airport (inc. access roads)

Step 3: Establish Information on Baseline Status of VECs

The baseline conditions for the VECs to be assessed in the scope of this study will be based on the information gathered for each environmental and social subject in the scope of the ESIA process. Relevant information on the VECs is provided in the related chapters of this ESIA Report.

Step 4: Assess Cumulative Impacts on VECs

The results of the assessment of cumulative impacts of the North Marmara Motorway Project (European and Asian sections) together with other projects/activities/developments identified in the region on the selected VECs has been summarized in Table 17.4. The assessment has been based on a qualitative approach. Interaction between the transportation projects and VECs considered in the scope of Cumulative Impact Assessment are shown on the map given In Figure 17.6.

In the scope of the assessment, cumulative impact potential on the VECs has been evaluated in consideration of the number of projects affecting them besides the European and Asian sections of the North Marmara Motorway Project. In this respect, cumulative impact potential on each VEC has been classified as none, low, medium or high depending on the criteria described below. As can be seen from the assessment, there are a few VECs that are under the effect of multiple projects resulting in “high” cumulative impact potential:

- None; if the VEC is to be affected only by the European and Asian sections of the North Marmara Motorway Project;
- Low; if the VEC is to be affected by only 1 other project in addition to the European and Asian sections of the North Marmara Motorway Project;
- Medium; if the VEC is to be affected by 2 other projects in addition to the European and Asian sections of the North Marmara Motorway Project;
- High; if the VEC is to be affected by only 3 or more other projects in addition to the European and Asian sections of the North Marmara Motorway Project.

It should be noted that the assessment has been restricted by the level of technical information readily available to the practitioners of this Cumulative Impact Assessment. For example the above and underground components of the railway/rail system projects, if there is any, could not been reflected to the assessment. Additionally, the assessment has been based on the currently-known routes, thus any change to made on the routing of the projects may change the affection status of the VECs.

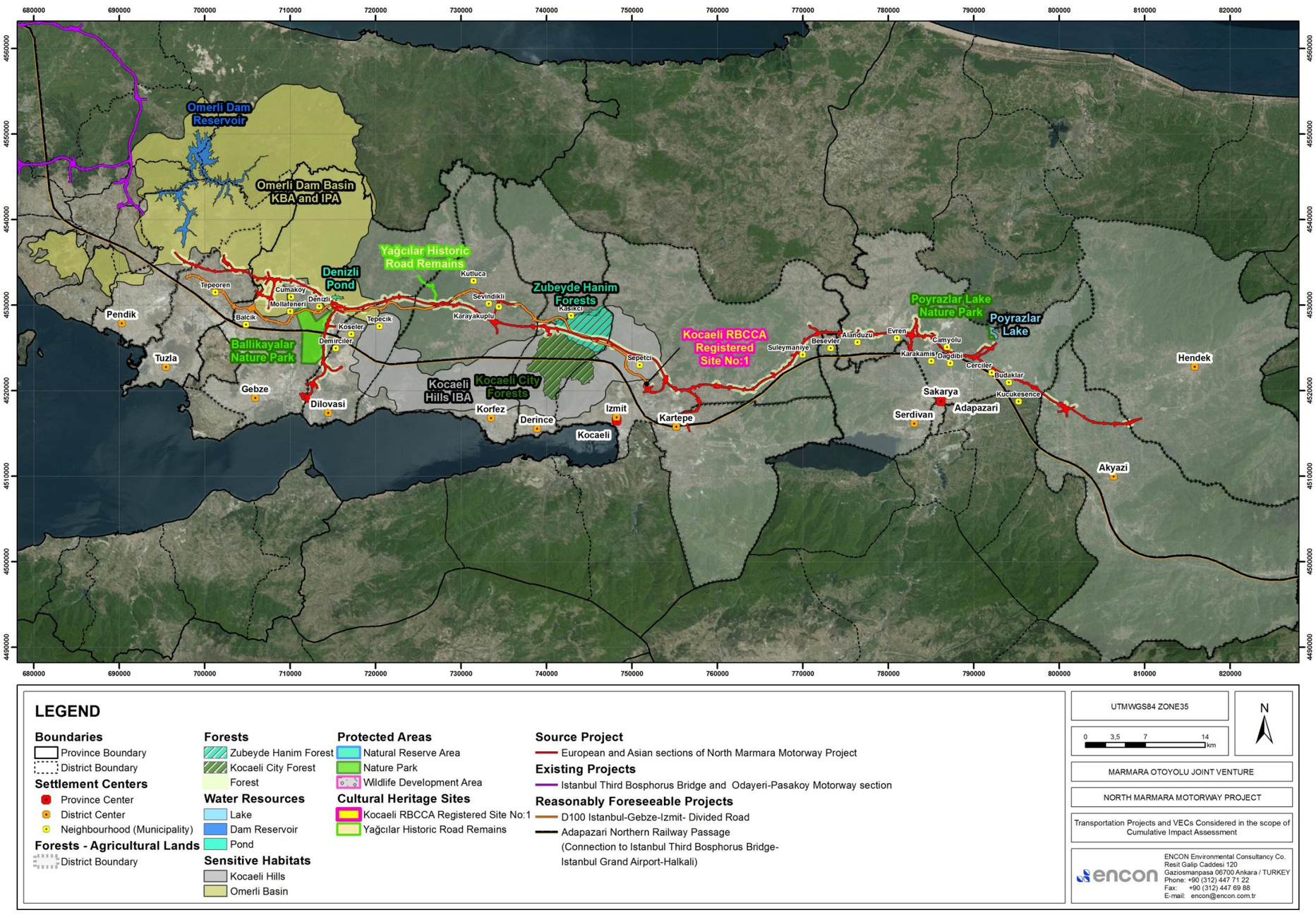
Table 17.4. Interaction of Projects with Selected VECs

VECs		Source Project	Existing Projects		Future Projects – Reasonably Foreseeable Projects							Cumulative Impact Potential
		European and Asian Sections of North Marmara Motorway Project	Istanbul Third Bosphorus Bridge and Odayeri-Pasakoy Motorway section	Istanbul 2nd Ring Road (E-80 European Motorway)	Hasdal Interchange-Kemerburgaz-Yassioren	Yassioren-Subasi-Catalca Divided Road	D100 Istanbul-Gebze-Izmit-Divided Road	Istanbul Grand (New) Airport Rail System Connection (Halkali-Airport-Gayrettepe)	Adapazari Northern Railway Passage (Connection to Istanbul Bosphorus Bridge-Istanbul Grand Airport-Halkali)	Halkali-Kapikule High Speed Railway	Istanbul (New) Grand Airport (inc. access roads)	
Forests												
Section 1	Catalca district	■										None
Section 2	Arnavutkoy district	■	■					■	■		■	High
Section 4	Gebze district	■					■					Low
	Dilovasi district	■					■		■			Medium
Section5	Korfez district	■					■		■			Medium
	Derince district	■					■		■			Medium
Section 6	Izmit district	■							■			Low
	Adapazari district	■										None
	Akyazi district	■										None
Agricultural Lands												
Section1	Silivri district	■								■		Low
	Catalca district	■				■				■		Medium
Section 2	Arnavutkoy district	■				■						Low
Section 4	Pendik district	■										None
	Tuzla district	■					■					Low
Section 5	Gebze district	■					■		■			Medium
	Dilovasi district	■					■					Low
	Korfez district	■					■		■			Medium
	Derince district	■										None
Section 6	Izmit district	■					■					Low
	Kartepe district	■							■			Low
	Adapazari district	■							■			Low
	Serdivan district	■							■			Low
	Akyazi district	■							■			Low

VECs		Source Project	Existing Projects		Future Projects Reasonably Foreseeable Projects							Cumulative Impact Potential
		European and Asian Sections of North Marmara Motorway Project	Istanbul Third Bosphorus Bridge and Odayeri-Pasakoy Motorway section	Istanbul 2nd Ring Road (E-80 European Motorway)	Hasdal Interchange-Kemerburgaz-Yassioren	Yassioren-Subasi-Catalca Divided Road	D100 Istanbul-Gebze-Izmit-Divided Road	Istanbul Grand (New) Airport Rail System Connection (Halkali-Airport-Gayrettepe)	Adapazari Northern Railway Passage (Connection to Istanbul Bosphorus Bridge-Istanbul Grand Airport-Halkali)	Halkali-Kapikule High Speed Railway	Istanbul (New) Grand Airport (inc. access roads)	
Water Resources												
Section1	Buyukcekmece Lake	■		■						■		Medium
Section 7	Alibey Dam Reservoir	■			■							Low
Section 4	Denizli Pond	■					■					Low
Section 6	Poyrazlar Lake	■										None
Sensitive Habitats												
Section 1	Buyukcekmece Lake KBA and IBA	■		■						■		Medium
Section 7	West Istanbul Pastures KBA and IPA	■	■	■				■				High
Section 4	Omerli Dam Basin KBA and IPA		■						■			Low
Section 5	Kocaeli Hills IBA						■		■			Low
Protected Areas												
Section 4	Ballikayalar Nature Park	■					■		■			Medium
Section 6	Poyrazlar Lake Nature Park	■										None
Cultural Heritage Sites												
Section 1	Anastasian Walls	■		■						■		Medium
	Umurtepe Kartepe 2nd Degree Arch. Site	■										None
Section 2	Cakmak Line Historic Military Fortifications	■								■		Low
Section 7	Roman Aquaducts	■	■			■		■			■	High
	Terkos Kagithane Water Transmission Line	■	■		■			■			■	High
	Kirkcesme Water Tunnel Line	■			■			■				Medium
Section 5	Kocaeli RBCCA Registered Site No:1	■					■					Low
	Yağcılar Historic Road Remains	■					■					Low
Local Communities												
Section 1	Kucukkilicli neighborhood	■		■								Low
	Alipasa neighborhood	■		■								Low
	Izzettin neighborhood	■										None
	Incegiz neighborhood	■				■				■		Medium

VECs		Source Project	Existing Projects		Future Projects Reasonably Foreseeable Projects							Cumulative Impact Potential
		European and Asian Sections of North Marmara Motorway Project	Istanbul Third Bosphorus Bridge and Odayeri-Pasakoy Motorway section	Istanbul 2nd Ring Road (E-80 European Motorway)	Hasdal Interchange-Kemerburgaz-Yassioren	Yassioren-Subasi-Catalca Divided Road	D100 Istanbul-Gebze-Izmit-Divided Road	Istanbul Grand (New) Airport Rail System Connection (Halkali-Airport-Gayrettepe)	Adapazari Northern Railway Passage (Connection to Istanbul Bosphorus Bridge-Istanbul Grand Airport-Halkali)	Halkali-Kapikule High Speed Railway	Istanbul (New) Grand Airport (inc. access roads)	
	Kaleici neighborhood											Low
	Gokceali neighborhood											Low
	Akoren neighborhood											None
	Nakkas neighborhood											None
Section 2	Tayakadin neighborhood											Low
	Boyalik neighborhood											None
	Baklali neighborhood											None
	Ihsaniye neighborhood											High
	Isiklar neighborhood											High
Section 7	Cebeci neighborhood											None
	Eskihabibler neighborhood											None
	Gazi neighborhood											None
	Zubeydehanim neighborhood											Low
	Yunusemre neighborhood											Low
	Guzeltepe neighborhood											Medium
Section 4	Tepeoren neighborhood											Medium
	Balcik neighborhood											Medium
	Mollafenari neighborhood											Low
	Cumakoy neighborhood											None
	Denizli neighborhood											Low
	Demirciler neighborhood											Low
Section5	Koseler neighborhood											Low
	Tepecik neighborhood											Low
	Yagcilar neighborhood											Low
	Sevindikli neighborhood											Low
	Karayakuplu neighborhood											Low
	Kutluca neighborhood											Low

VECs		Source Project	Existing Projects		Future Projects Reasonably Foreseeable Projects							Cumulative Impact Potential
		European and Asian Sections of North Marmara Motorway Project	Istanbul Third Bosphorus Bridge and Odayeri-Pasakoy Motorway section	Istanbul 2nd Ring Road (E-80 European Motorway)	Hasdal Interchange-Kemerburgaz-Yassioren	Yassioren-Subasi-Catalca Divided Road	D100 Istanbul-Gebze-Izmit-Divided Road	Istanbul Grand (New) Airport Rail System Connection (Halkali-Airport-Gayrettepe)	Adapazari Northern Railway Passage (Connection to Istanbul Bosphorus Bridge-Istanbul Grand Airport-Halkali)	Halkali-Kapikule High Speed Railway	Istanbul (New) Grand Airport (inc. access roads)	
	Kasikci neighborhood											Low
	Sepetci neighborhood											Medium
Section 6	Cayirkoy neighborhood											Medium
	Uzunbey neighborhood											Low
	Sapakpinar neighborhood											None
	Suleymaniye neighborhood											Low
	Alanduzu neighborhood											Low
	Evrenkoy neighborhood											Low
	Besevler neighborhood											Low
	Camyolu neighborhood											Low
	Karakamis neighborhood											Low
	Dagdiibi neighborhood											Low
	Cerciler neighborhood											Low
	Budaklar neighborhood											Low
	Kucukesence neighborhood											Low



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Forests - Agricultural Lands
- District Boundary

Forests
- Zubeyde Hanim Forest
- Kocaeli City Forest
- Forest

Water Resources
- Lake
- Dam Reservoir
- Pond

Sensitive Habitats
- Kocaeli Hills
- Omerli Basin

Protected Areas
- Natural Reserve Area
- Nature Park
- Wildlife Development Area

Cultural Heritage Sites
- Kocaeli RBCCA Registered Site No:1
- Yağcılar Historic Road Remains

Source Project
- European and Asian sections of North Marmara Motorway Project

Existing Projects
- Istanbul Third Bosphorus Bridge and Odayeri-Pasakoy Motorway section

Reasonably Foreseeable Projects
- D100 Istanbul-Gebze-Izmit- Divided Road
- Adapazari Northern Railway Passage (Connection to Istanbul Third Bosphorus Bridge-Istanbul Grand Airport-Halkali)

UTMWGS84 ZONE35

0 3,5 7 14 km

N

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Transportation Projects and VECs Considered in the scope of Cumulative Impact Assessment

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Figure 17.6. Transportation Projects and VECs Considered in the scope of Cumulative Impact Assessment (Asian Part)

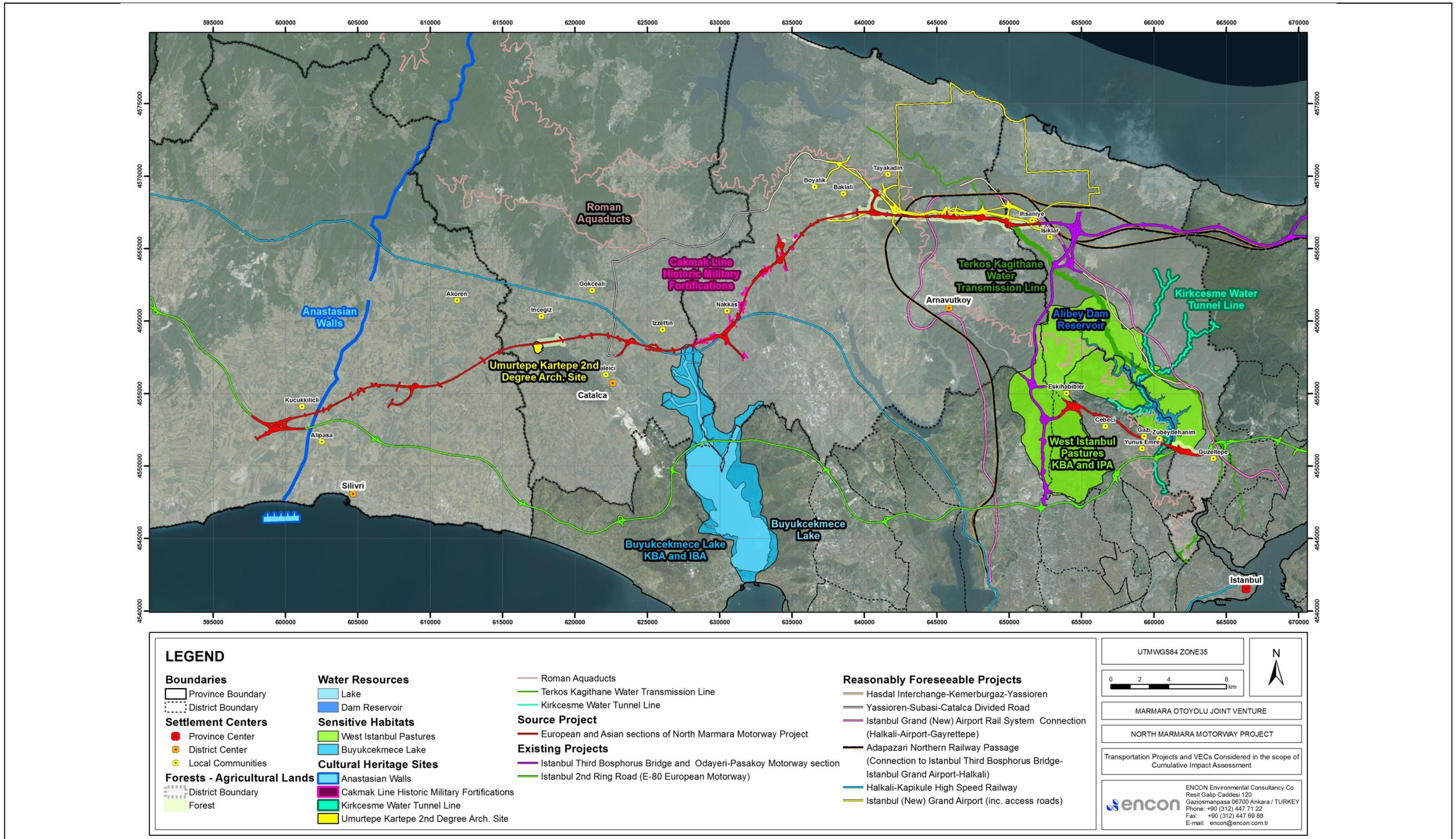


Figure 17.6. Transportation Projects and VECs Considered in the scope of Cumulative Impact Assessment (European Part)

Step 5 and Step 6: Assess Significance of Predicted Cumulative Impacts and Management of Cumulative Impacts – Design and Implementation

In Table 17.5, VECs with cumulative impact potential low, medium or high (according to the assessment done in Step 4) have been listed. Significance of cumulative impacts has then been determined according to the criteria given in Table 17.1. Among the VECs assigned with highly and moderately significant cumulative impacts, the forests in Arnavutkoy in the European side and Dilovasi, Korfez and Derince in Asian side are under stress of multiple actions, thus optimization of projects would be required to minimize the cumulative impacts to the extent possible. North Marmara Motorway's route has been revised to minimize Project's intrusion into the protection borders of the Ballikayalar Nature Park (General Directorate of State Highways has made applications to the related authorities to obtain their official views and permissions and the process is still underway). There are other projects whose route is crossing the nature park thus optimization is required in the routing of those projects to avoid/minimize the cumulative impacts on this legally protected area. Similarly, registered cultural heritage sites are within the impact area of multiple projects, thus collaboration with the related authorities is essential and route and project optimization may be required to avoid/minimize cumulative impacts. Cumulative impacts on most of the settlements would be of local importance, yet a few settlements would be under particular impact of multiple projects. During the public participation meetings, representatives of some of the settlements raised the following concerns:

- Exaggeration of existing noise impacts caused by a single project in the current situation following the implementation of several projects (e.g. Ihsaniye neighborhood);

- Exaggeration of existing noise impacts caused by a single project in the current situation following the implementation of several projects (e.g. Kucukkilicli neighborhood);

- Trapping of settlements between the infrastructure of two linear transportation projects (e.g. Suleymaniye neighborhood where the railway route is passing from the south and Motorway route is passing from the north of the settlement.

Table 17.5. Significance of Potential Cumulative Impacts

VECs		Cumulative Impact Potential	Significance of Cumulative Impact
Forests			
Section 2	Arnavutkoy district	High	Moderate
Section 4	Gebze district	Low	Minor
	Dilovasi district	Medium	Moderate
Section5	Korfez district	Medium	Moderate
	Derince district	Medium	Moderate
Section 6	Izmit district	Low	Minor
Agricultural Lands			
Section1	Silivri district	Low	Minor
	Catalca district	Medium	Minor
Section 2	Arnavutkoy district	Low	Minor
Section 4	Tuzla district	Low	Minor
Section 5	Gebze district	Medium	Minor
	Dilovasi district	Low	Minor
	Korfez district	Medium	Minor
Section 6	Izmit district	Low	Minor
	Kartepe district	Low	Minor
	Adapazari district	Low	Minor
	Serdivan district	Low	Minor
	Akyazi district	Low	Minor
Water Resources			
Section1	Buyukcekmece Lake	Medium	Not significant
Section 7	Alibey Dam Reservoir	Low	Not significant
Section 4	Denizli Pond	Low	Not significant
Sensitive Habitats			
Section 1	Buyukcekmece Lake KBA and IBA	Medium	Minor
Section 7	West Istanbul Pastures KBA and IPA	High	Minor
Section 4	Omerli Dam Basin KBA and IPA	Low	Minor
Section 5	Kocaeli Hills IBA	Low	Minor
Protected Areas			
Section 4	Ballikayalar Nature Park	Medium	Moderate
Cultural Heritage Sites			
Section 1	Anastasian Walls	Medium	Major
Section 2	Cakmak Line Historic Military Fortifications	Low	Major
Section 7	Roman Aquaducts	High	Major
	Terkos Kagithane Water Transmission Line	High	Major
	Kirkcesme Water Tunnel Line	Medium	Major
Section 5	Kocaeli RBCCA Registered Site No:1	Low	Major
	Yağcılar Historic Road Remains	Low	Major
Local Communities			
Section 1	Kucukkilicli neighborhood	Low	Minor
	Alipasa neighborhood	Low	Minor
	Incegiz neighborhood	Medium	Minor
	Kaleici neighborhood	Low	Minor
	Gokceali neighborhood	Low	Minor
Section 2	Tayakadin neighborhood	Low	Minor
	Ihsaniye neighborhood	High	Moderate
	Isiklar neighborhood	High	Moderate
Section 7	Zubeydehanim neighborhood	Low	Minor
	Yunusemre neighborhood	Low	Minor
	Guzeltepe neighborhood	Medium	Moderate
Section 4	Tepeoren neighborhood	Medium	Moderate
	Balcik neighborhood	Medium	Moderate
	Mollafenari neighborhood	Low	Minor
	Denizli neighborhood	Low	Minor
	Demirciler neighborhood	Low	Minor
Section5	Koseler neighborhood	Low	Minor
	Tepecik neighborhood	Low	Minor
	Yagcilar neighborhood	Low	Minor
	Sevindikli neighborhood	Low	Minor

VECs		Cumulative Impact Potential	Significance of Cumulative Impact
	Karayakuplu neighborhood	Low	Minor
	Kutluca neighborhood	Low	Minor
	Kasikci neighborhood	Low	Minor
	Sepetci neighborhood	Medium	Moderate
Section 6	Cayirkoy neighborhood	Medium	Moderate
	Uzunbey neighborhood	Low	Minor
	Suleymaniye neighborhood	Low	Moderate
	Alanduzu neighborhood	Low	Moderate
	Evrenkoy neighborhood	Low	Moderate
	Besevler neighborhood	Low	Minor
	Camyolu neighborhood	Low	Minor
	Karakamis neighborhood	Low	Minor
	Dagdibi neighborhood	Low	Minor
	Cerciler neighborhood	Low	Minor
	Budaklar neighborhood	Low	Minor
	Kucukesence neighborhood	Low	Minor

It is important to underline that since cumulative impacts typically result from the actions of multiple stakeholders, the responsibility for their management is collective, requiring individual actions to eliminate or minimize individual development's contributions. The actions to be taken in the scope of North Marmara Motorway Project to minimize the project-level impacts are described in the previous chapters of this ESIA Report (*IFC, August 2013*). IFC recommends the following specific actions that may be needed to effectively manage cumulative impacts. Implementation of these measures would only be possible with the understanding, support and approval of the Turkish Ministry of Transport, Maritime Affairs and Communications as the owner of the transportation infrastructure projects and cooperation with other related planning and permitting authorities:

- Project design changes to avoid cumulative impacts (location, timing, technology);
- Project mitigation to minimize cumulative impacts, including adaptive management approaches to project mitigation;
- Mitigation of project impacts by other projects (not under control of the proponent to further minimize impacts on VECs);
- Collaborative protection and enhancement of regional areas to preserve biodiversity;
- Collaborative engagement in other regional cumulative impact management strategies;
- Participation in regional monitoring programs to assess the realized cumulative impacts and efficacy of management efforts.

CHAPTER 18

ANALYSIS OF ALTERNATIVES

CHAPTER 18. ANALYSIS OF ALTERNATIVES

As explained in Chapter 1, the North Marmara Motorway was initially planned as an integrated Project starting at Kinali interchange in Silivri, Istanbul and ending at the Akyazi interchange in Akyazi, Sakarya, which crosses the sea by a Third Bosphorus Bridge. Once the location of the Bosphorus Bridge (between Garipce and Poyraz neighborhoods) has been selected by the KGM by taking mainly the social and environmental aspects into consideration, the Motorway route has started to be delineated accordingly. In the following paragraphs, the criteria that affected the selection of the route during the feasibility and tender stages and optimization of the route in the scope BOT Contract are explained.

18.1. Route Selection

Route selection for the North Marmara Motorway has been done in two stages. The first stage included the design of the route by the KGM during the feasibility and tender stages. Following the BOT tenders and appointment of the related companies of the European and Asian sections, contractors have conducted further work to optimize the route and the locations, numbers and/or lengths of the road structures such as tunnels, viaducts, bridges, interchanges, overpasses, underpasses, culverts, etc.

In the selection of the route by KGM at the feasibility and tendering stages, the following environment, social and economic criteria were taken into consideration to the extent the specified physical and geometric standards of the Motorway specifications allowed:

- Avoidance of impacts on legally protected areas including cultural heritage sites;
- Avoidance and/or minimization of impacts on ecologically sensitive forests;
- Avoidance and/or minimization of the crossing of residential and industrial areas;
- Keeping sufficient distance to the borders of the residential areas to the extent possible;
- Avoidance and/or minimization of the impacts on important water resources (rivers, lakes, reservoirs, ponds etc.) and their protection areas where available;
- Integration with existing transportation infrastructure so that the existing traffic loads/problems can be mitigated and potential needs of future industrial and residential developments;
- Geotechnical/geological conditions/risks (i.e. landslide sites, hills, seismicity)
- Minimization of the expropriation costs;
- Minimization of construction costs (i.e. need for soil works, optimized number and length of viaduct, tunnel, etc. requirements, costs for access roads);
- Interaction potential with existing infrastructure (e.g. energy transmission lines, water supply/distribution, sewerage system, oil and gas pipelines, water channels, telecommunication lines, railways, etc.);
- Operation costs (i.e. fuel, amortization, workforce losses, etc.);

- Local climate conditions that may affect winter maintenance and operation of the Motorway;
- Integration with transportation networks of nearby ports and airports;
- Existing and planned zoning plans within the municipality borders.

Details of the route selection processes in each stage are provided in the following paragraphs.

Route Selection during Feasibility and Tender Stages by KGM

The Feasibility Study prepared by the KGM for the North Marmara Motorway defined the Asian sections of the Project as Section 4: Pasakoy-Gebze (Mollafenari), Section 5: Gebze (Mollafenari)-Izmit (Durhasan) and Section 6: Izmit (Durhasan)-Akyazi as summarized in Table 18.1 and shown in Figure 18.1.

Table 18.1. Asian Sections of the North Marmara Motorway Project

Section No	Section Name	Length of the Motorway (km)		
		Main Road	Access Road	Total
4	Pasakoy-Gebze (Mollafenari)	23,1	20,5	43,6
5	Gebze (Mollafenari)-Izmit (Durhasan)	55,7	15,2	70,9
6	Izmit (Durhasan)-Akyazi	58,6	13,2	71,8
Total		**137,4**	**48,9**	**186,3**

Source: KGM, August 2010.

Later in the process, the authorities decided to separate the Third Bosphorus Bridge and its associated Motorway section from the Project and tender it out individually due to emerging conditions. Accordingly, tender for Section 3, including the Third Bosphorus Bridge, was made in 2012 and the tender for the Asian sections (Section 4, 5 and 6) was made in May 2016. In this tender, Section 4 was: Kurtkoy-Gebze (Mollafenari), while the other sections remained the same. The connection of Section 4's starting point at Kurtkoy with the end point of existing Section 3 at Pasakoy has been later included in the scope of work of Section 3's Contractor.

Optimization of the Route and Project Design in the scope of BOT Contract (by Appointed Company with the Approval of KGM)

Following the finalization of the tendering stage and appointment of KMO Anadolu Otoyol Isletme A.S. with the signing of BOT Contract in July 2016, Project Sponsors' design team has continued the optimization studies. Figure 18.2 presents a map showing the Route at the Tender Stage and the Revised Route as of March 2016.

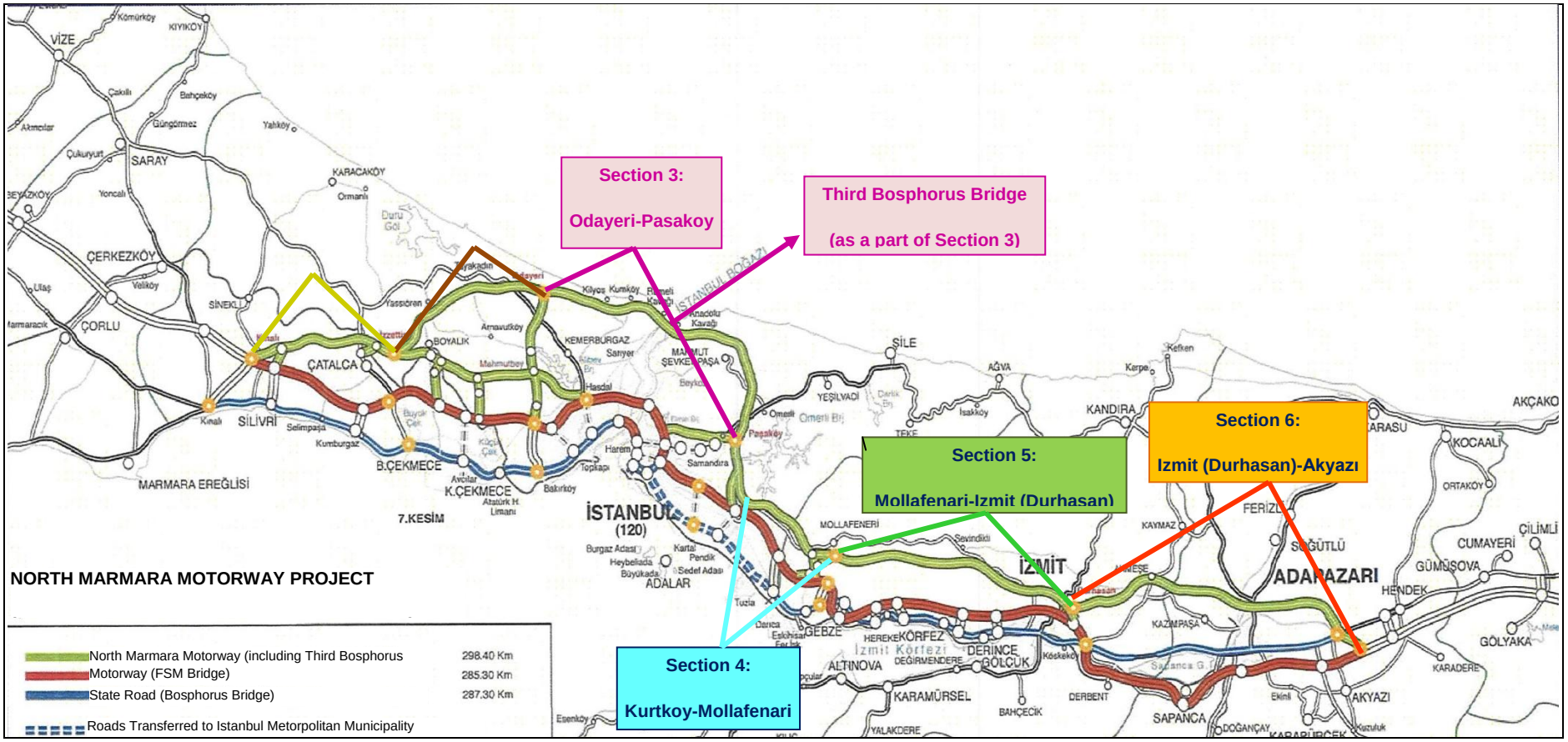
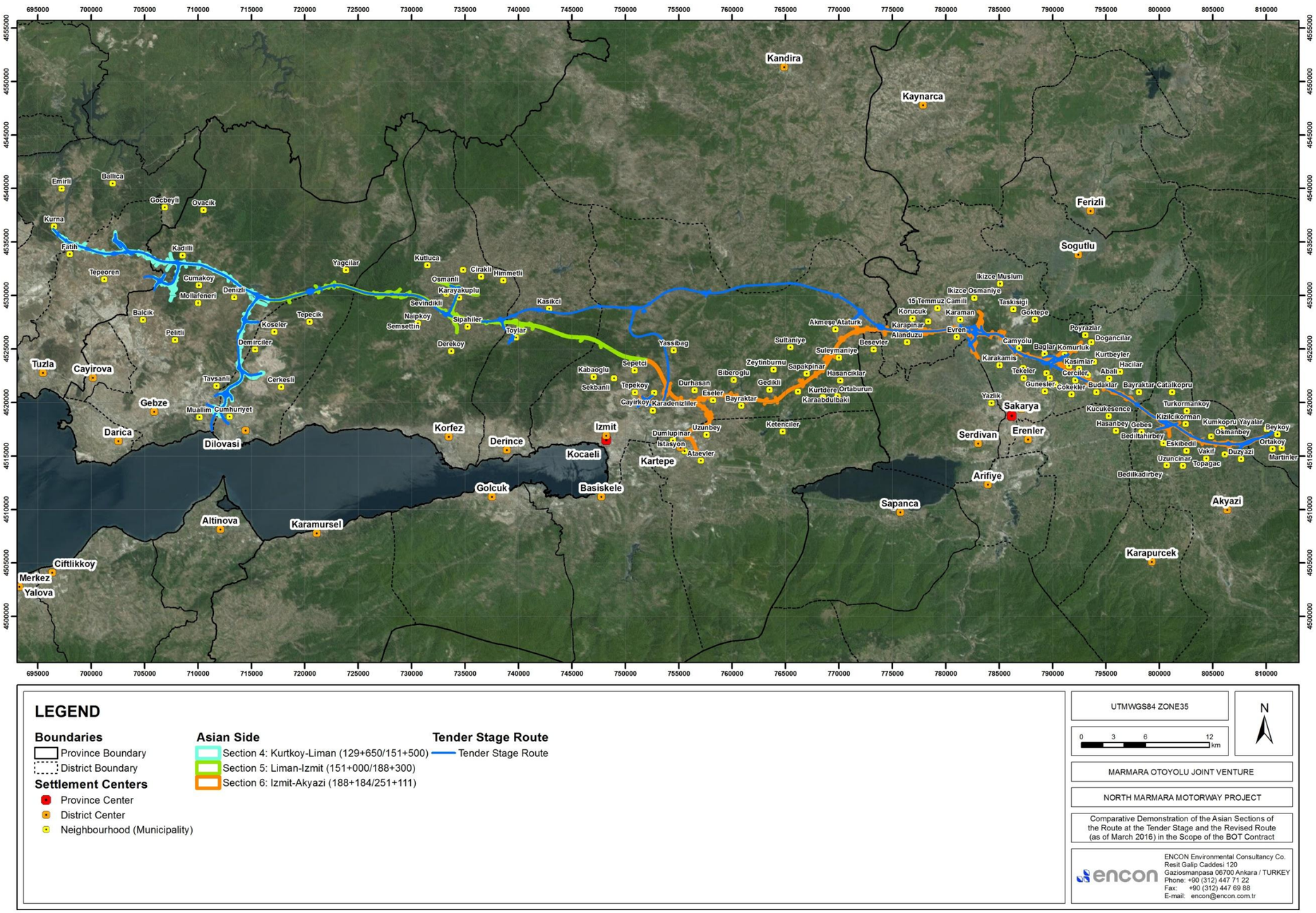


Figure 18.1. North Marmara Motorway Project Route at the Feasibility Stage *(Source: KGM, August 2010)*



LEGEND

Boundaries
- Province Boundary
- District Boundary

Settlement Centers
- Province Center
- District Center
- Neighbourhood (Municipality)

Asian Side
- Section 4: Kurtkoy-Liman (129+650/151+500)
- Section 5: Liman-Izmit (151+000/188+300)
- Section 6: Izmit-Akyazi (188+184/251+111)

Tender Stage Route
- Tender Stage Route

UTMWGS84 ZONE35

N

0 3 6 12 km

MARMARA OTOYOLU JOINT VENTURE

NORTH MARMARA MOTORWAY PROJECT

Comparative Demonstration of the Asian Sections of the Route at the Tender Stage and the Revised Route (as of March 2016) in the Scope of the BOT Contract

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Figure 18.2. Comparative Demonstration of the Asian Sections of the Route at the Tender Stage and the Revised Route (as of March 2017) in the Scope of the BOT Contract

Section 4

KM 150+500; 0+000-14+000

In this section, Liman Access Road is located adjacent to the Ballikayalar Nature Park's protection borders between KM 0+500 and KM 7+000. The initial route at the feasibility stage was crossing the Ballikayalar Nature Park with a viaduct. Then at the tender stage, to minimize interaction of the route with the nature park, revisions have been made on the route. The final route has been shifted outside the protection area of the nature park, with the exception of KM 5+000 and KM 6+000, where the route intersects 13.132 m^2 (direct interaction area of the road) of the Nature Park's protection area. Regarding this issue, KGM has made an application to the related authorities to obtain their official views and permissions. The process is still underway. Figure 18.3 shows the location of the Ballikayalar Nature Park and the route changes done in this section.

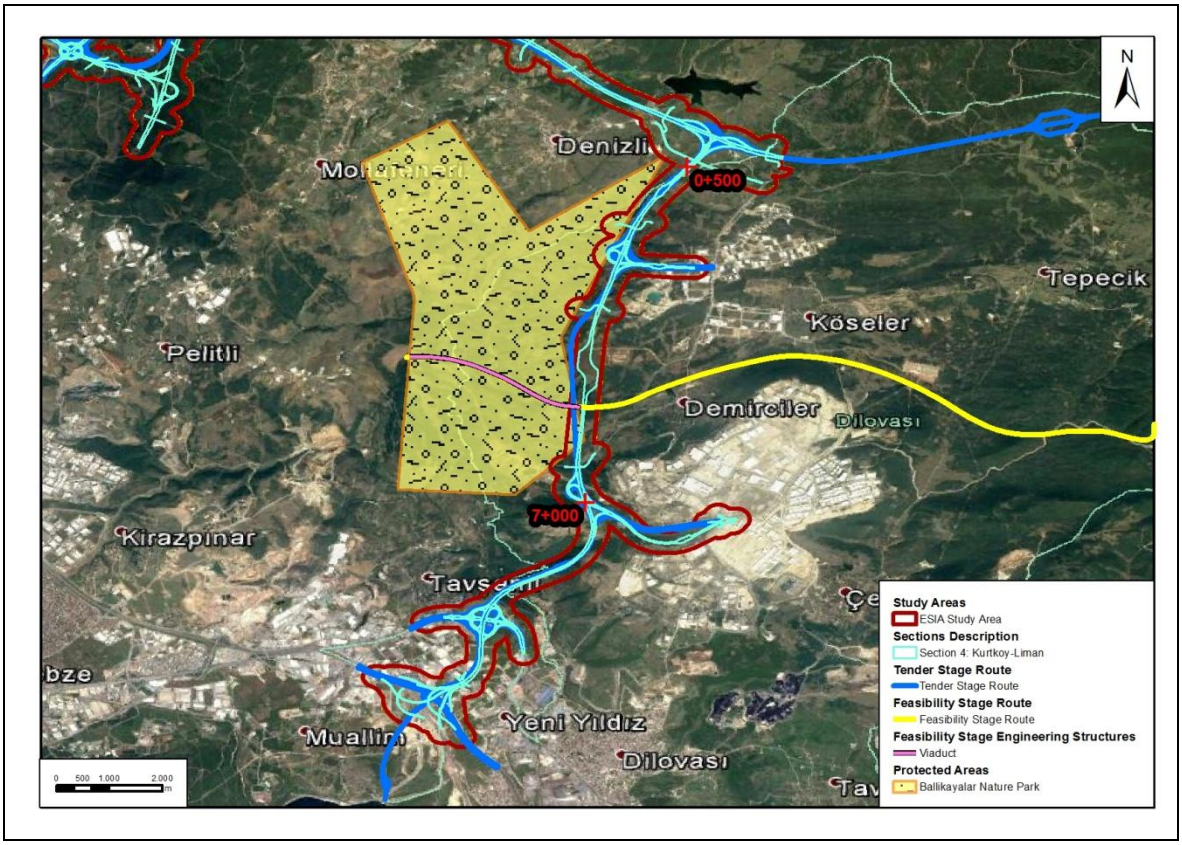


Figure 18.3. Route Change in Section 4: KM 150+500; 0+000-14+000

Other important criteria considered in the route selection process of this section were the geotechnical risks and reuse potential for excavated materials. In this respect, between KM 150+500; 3+500 and KM 150+500; 7+000, route has been revised due to geotechnical risks and to avoid requirement for supply of additional fill materials and allow the reuse of materials to be excavated. No quarry will need to be used for materials extraction as a result of the final design thus the construction costs will also be reduced.

Section 5

KM 165+000-188+000

Sevindikli Interchange has been added to provide access to Karayakuplu and Sevindikli neighborhoods at around KM 169+000. Starting from KM 175+000, a major change in the route has been done in this section. The former route was passing a few kilometers north and crossing mainly agricultural lands. The route has been revised to pass through a valley within the Kocaeli City Forests and Zubeyde Hanim Forest resulting in avoidance of socio-economic interactions and associated costs for the expropriation. This change increased use of forest lands, where bare areas within the forests have been preferred to the extent possible. On the other hand, the new route necessitated integration of several successive tunnels in order to minimize physical interaction with forest lands and cope with the topographical conditions. Route changes in this section are shown in Figure 18.4.

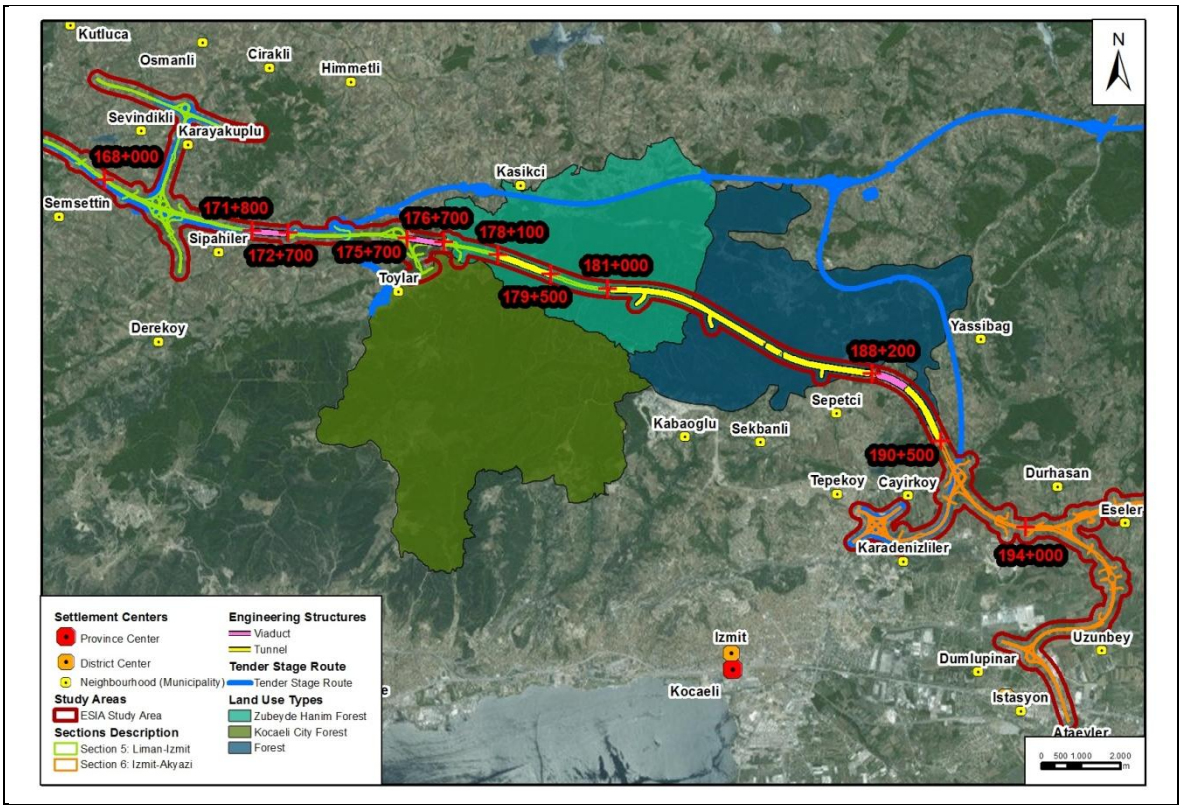


Figure 18.4. Route Change in Section 5: KM 165+000-188+000

The changes made on the main road have also resulted in a reduction in the requirement for access road construction. In this respect, design of the Izmit Access Route has been optimized. Due to unsuitable geological and geotechnical conditions that prevail along the former route (i.e. high elevation difference that makes tunnel integration impossible, fault lines, mountainous terrain, carstic formations), the design included several bends and curves and thus the access route could not meet the Motorway standards along this route. Thus, with the revision made, the new route has become a more convenient alternative in terms of Motorway standards.

Section 6

KM 188+000-212+000

Following the major route change done in the last 20 kilometers of the Section 5, the initial part of Section 6 also runs around 10 kilometers south of the tender stage route. The former route was crossing mainly forest lands and the catchment area of DSI's Akmese Dam. Following the change, socio-economic interaction potential with the surrounding settlements has increased as the new route passes close to several settlements especially after Adapazari. From KM 212+000 until the end of the Motorway in Akyazi, mainly the tender stage route has been maintained. Locations of the studfarms, greenhouses and agricultural areas with special incentives have been considered while siting the Motorway along the new route. Route changes in this section are shown in Figure 18.5.

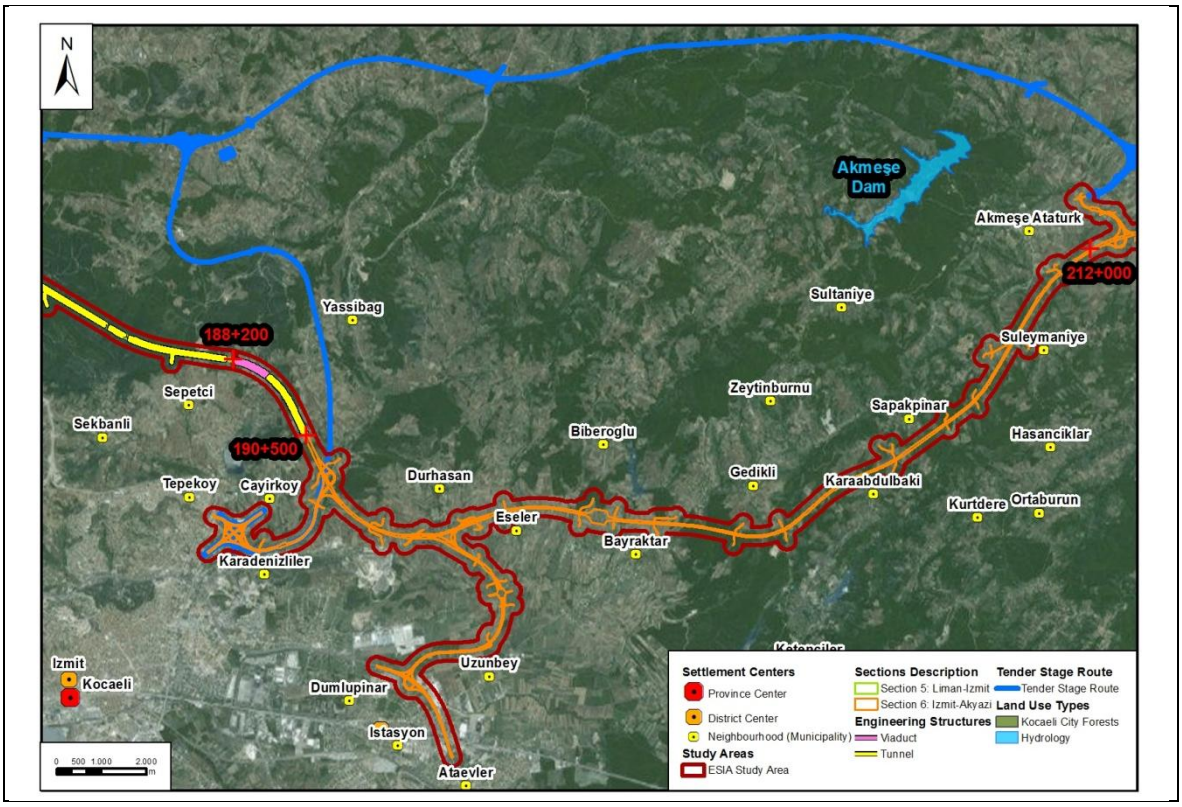


Figure 18.5. Route Change in Section 5: KM 188+000-212+000

18.2. Motorway Design

Motorways are access-controlled highways that have 2 or more traffic lanes in each direction and provide uninterrupted flow. Some of the ideal design conditions for the motorways are specified in the Highways Capacity Handbook 2000 (HCM 2000) as follows (*KGM, August 2010*):

- Maximum capacity for each traffic lane shall be 2.400 passenger vehicles/hour;
- Minimum width of each traffic lane shall be 3,6 m;
- Speed of the free flow shall be 100 km/hour or more;
- Distance between interchanges shall be 3 km or more;
- Terrain shall be completely flat.

Capacity analyses have been done by the KGM for the North Marmara Motorway in the scope of the feasibility studies. The design speed for the North Marmara Motorway has been determined as 120 km/hour. Width of the traffic lanes have varied between 2x4 and 2x3 for different sections in the feasibility design, while in the current design all of the lanes will have a width of 3,75 m and the geometric standard of the road will be 2x4 in all sections. Distance between interchanges is more than 3 kilometers in most of the Motorway route, while Section 4 (on the Liman Access Road) necessitated siting of more frequent interchanges due to connection requirements to D100 and TEM on Liman Access Road. Siting the route on flat terrain has been the priority to the extent feasible however where the environmental and/or social (i.e. topography, geology, geotechnics, ecological sensitivities, important water bodies, protected areas, cultural heritage sites, etc.) conditions did not allow road structures such as viaducts, tunnels, bridges, etc. have been added to the design to cross non-flat terrains.

18.3. No Project Alternative

An integrated economic analysis of the North Marmara Motorway has been done in the scope of the feasibility studies in consideration of the overall Project including the Third Bosphorus Bridge and all of the seven Motorway sections. In the scope of this appraisal, vehicle operating costs (i.e. fuel consumption, time loss) and cost savings due to reduced number of accidents were considered and Project costs were estimated separately for each section. Overall benefits to be gained as a result of the implementation of the Project were compared with the costs of the Project.

According to the results of the analysis, the overall North Marmara Motorway Project, with the implementation of all sections, is anticipated to improve the traffic flow conditions in the existing 1st and 2nd Ring Roads including the Bogazici and FSM bridges. As a result of the anticipated reduction in the existing traffic density due to the shift of a certain part of the vehicles to the new Motorway route, the vehicle speeds on the existing arteries would increase resulting in reduced fuel consumption rates, reduced air and noise emissions and reduced time and workforce losses. In return, the vehicles that will move to the new Motorway will be another source of fuel consumption, air and noise emissions and road accidents but the rates would be different when compared to the existing roads as the design speed and geometric standards of the North Marmara Motorway will be more advanced.

The new Motorway is anticipated to cause a decrease in the number of traffic accidents. In the scope of the assessment of the benefits to be created as a result of the reduced number of accidents, it has been assumed that the accident rates will drop by 25% with the construction and operation of the North Marmara Motorway. Benefits such as reduced material damage and associated costs for repairmen and reduced number of accidents ending up with deaths or severe injuries would be gained as a result of the construction and operation of the North Marmara Motorway.

As the physical and geometric standards of the existing arteries and the North Marmara Motorway are similar, no considerable change/benefit could be identified in the vehicle operating costs as a result of the assessments done by means of Highway Development and Management Tool. Nevertheless, time, workforce and fuel savings would be made as a result of the improvement of the traffic flow conditions.

It should be noted that the third section of the North Marmara Motorway Project has already been constructed and taken into operation as of August 2016. As the European and Asian sections of the Motorway are integral parts of the Project, these sections are required to be constructed and put in service to ensure viability of the overall Motorway. If the European and Asian sections of the North Marmara Motorway Project are not constructed, the potential environmental and social impacts identified and assessed in this ESIA Report would not be created. In this scenario, the changes foreseen on the land use character (i.e. forest, agricultural) and habitat types along the planned Motorway route would not occur. The associated socio-economic impacts on the local people due to expropriation of lands would not occur in the no Project alternative, while the local people would also not benefit from the expropriation compensations or the employment opportunities. As there will be no shift from the existing arteries towards the new Motorway route, no additional emissions would occur along the new route while no improvement would occur along the existing roads and the emissions would actually intensify as the existing traffic problems are anticipated to intensify.

CHAPTER 19

PUBLIC CONSULTATION AND STAKEHOLDER ENGAGEMENT ACTIVITIES

CHAPTER 19. PUBLIC CONSULTATION AND STAKEHOLDER ENGAGEMENT ACTIVITIES

19.1. Introduction

The North Marmara Motorway was initially planned as an integrated Project starting at Kinali interchange in Silivri, Istanbul and ending at the Akyazi TEM interchange in Akyazi, Sakarya, which crosses the Marmara sea by a Third Bosphorus Bridge. Once the location of the Third Bosphorus Bridge has been selected between Garipce (Sariyer, Istanbul) and Poyrazköy (Beykoz, Istanbul) neighborhoods, feasibility studies were conducted by the General Directorate of Highway (KGM) by dividing the entire Motorway route between Kinali and Akyazi into seven different sections. Later in the process, the authorities decided to separate the Third Bosphorus Bridge and its associated Motorway section from the Project and tender it out individually due to emerging conditions. Accordingly, Section 3 of the Project, which included the Third Bosphorus Bridge and its associated Motorway section between Odayeri and Pasakoy, has been separately constructed and taken into operation in August 2016.

Following the feasibility stage and tendering of Section 3 (including the Third Bosphorus Bridge), the European and Asian sections of the Project have been revised, keeping the ultimate starting (Kinali) and ending (Akyazi) points of the feasibility route the same and ensuring connection to Section 3 of the Motorway at Odayeri (European sections) and Pasakoy (Asian sections) locations as originally planned. Consequently, the European and Asian sections of the Project were tendered out in May 2016. In this tender, the European sections included Section 1: Kinali-Yassioren, Section 2: Yassioren-Odayeri and Section 7: Habibler-Hasdal; and the Asian sections included Section 4: Kurtkoy-Liman, Section 5: Liman-Izmit, and Section 6: Izmit-Akyazi. This ESIA Report has been prepared for the European sections (Section 1, 2 and 7) of the North Marmara Motorway Project, where the Asian sections (Section 4, 5 and 6) are subject of a separate ESIA study conducted in parallel to this study.

In accordance with the terms of the BOT Contract signed between the KGM and the Project Sponsors, the Project includes financing, planning/design, building/construction, operation, full range of maintenance and repair works during the operation period and transfer of the Motorway to the KGM at the end of the Contract Duration free from any debt or commitment and in a well-maintained, operating, in-service condition, without any charge. The rights of the Project Sponsors to operate, maintain and repair the Motorway will expire at the end of the Contract Duration.

According to the BOT Contract, Contract Duration covers both the construction and operation phases. Contract Duration for the European sections has been specified as 7 years 9 months 12 days and the total investment cost for these sections has been estimated as 2.710.065.000 TL including the expropriation costs up to 500 Million TL and excluding the value added tax (VAT). Maximum construction period is 3 years after the effective (signing) date of the contract. If the construction period exceeds 3 years, the delay time (the time after 3 years) will be deducted from the operation period. If the construction of the Motorway is completed before the end of foreseen construction period (3 years), the remaining time will be added to operation period.

19.2. Regulatory Requirements

19.2.1. National Requirements

Under Turkey's Environmental Impact Assessment Regulation No. 29186 dated 25th November 2014, reference is made concerning information disclosure and stakeholder participation. Under the 1st clause of Article 9 of the regulation, it is a legal obligation for the Project Owner to organize a Public Participation Meeting within the Project area on a date determined in agreement with the Ministry of Environment and Urbanization. The aim of the Public Participation Meeting is to inform people potentially affected by the Project about the proposed development and provide the opportunity for their concerns and comments about the Project to be collated.

The 2nd clause of Article 9 states that activities such as questionnaires and seminars/workshops can also be conducted by the Project Owner prior to the Environmental Impact Assessment (EIA) process and recommends these in addition to Public Participation Meeting, with the aim of increasing public participation.

However, since the North Marmara Motorway (including the Third Bosphorus Bridge) Project was put in the public investment program before 07/02/1993 and the Kinali-Odayeri (inc. the access roads) and Kurtkoy-Akyazi (inc. the access roads) section have been approved as the integral components of the North Marmara Motorway (including the Third Bosphorus Bridge) Project, the EIA exemption decision issued for the North Marmara (inc. the Third Bosphorus Bridge) Motorway Project with the official letter of the MoEU dated 31/07/2009 was evaluated by the MoEU to be applicable to the North Marmara Motorway Project as well, which includes the construction, operation and transfer of the Kinali-Odayeri (inc. the access roads) and Kurtkoy-Akyazi (inc. the access roads) sections. Thus, no full or limited EIA report has been required for the Project. On the other hand, the ESIA Report to be prepared for the Project will aim to cover the relevant methodological requirements of the Turkish EIA Regulation. Accordingly, all the relevant stakeholder engagement and public consultation activities were performed in line with international standards and requirements, specifically International Finance Corporation (IFC) Performance Standards 1 - Assessment and Management of Environmental and Social Risks and Impacts.

19.2.2. International Requirements and Standards

The proposed Project is intended to meet applicable international standards. This document and SEP (see Annex 11 – Stakeholder Engagement Plan) has been prepared in accordance with the guidance of the applicable IFC Performance Standards.

Where a project and a Project Owner receives project financing from IFC, or another financial institution adopting IFC requirements, IFC Performance Standards must be applied for the duration of that project finance. As of 1 January 1th, 2012, the following eight IFC Performance Standards are applicable to the Project as a whole:

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

Performance Standard 1[1] specifically relates to stakeholder engagement on the basis that it establishes the importance of: (i) integrated assessment to identify the social and environmental 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; and (iii) management of social and environmental performance throughout the life of the Project. The objectives of this standard are as follows[2]:

- To identify and assess social and environment impacts, both adverse and beneficial, in the Project's Area of Influence;
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- To promote improved social and environment performance of companies through the effective use of management systems.

To meet these objectives, a Stakeholder Engagement Plan (SEP) is designed to guide stakeholder consultations leading up to and during the period of the ESIA studies, as well as during the further stages of project implementation, i.e. excavation, construction and operation (see Annex 11 – Stakeholder Engagement Plan).

19.3. Public Consultation Meetings and Stakeholder Engagement Activities

A comprehensive program of Public Consultation Meetings (PCMs) was held in March 2017 in the scope of the North Marmara Motorway Project. As a part of this program 8 PCMs were held along the entire Motorway route between Silivri district of Istanbul and Akyazi district of Sakarya. In this report, organizational details and findings of the PCMs held at Asian section are documented. A separate report has been prepared to describe the information related with PCMs conducted for European sections.

[1] PS1 is specifically relevant, because it contains clear requirements for community engagement, disclosure of information and consultation. These requirements are the main concerns of this Chapter.
[2] IFC Performance Standards, January 2012.

Selection of the PCM locations was done during the scoping stage of the ESIA process based on the findings of the key informant questionnaires and focus group meetings conducted in the region by the social expert team of the Project. As known, the overall North Marmara Motorway route has a length of 274 km including the main carriageway and the access roads. Since it would not be possible to organize a meeting in every settlement that is located within the study area, in the selection of the settlements at which the public consultation meetings are planned, it has been aimed that a meeting location is determined at every 20-30 (plus minus) km along the Motorway route to ensure to the extent possible that the meeting location is accessible for the local people from the surrounding settlements. In the selection of the settlements the following criteria have been considered.

- Distance between the settlements and the Project components;
- Population of the settlements;
- Effects of the Project on livelihoods such as agricultural and pasture lands and business;
- Sensitivity to environmental impacts;
- Land acquisition impacts;
- Cumulative impacts potential;
- Level of impacts on infrastructures such as access roads, power supply etc.;
- Cultural and social aspects of the settlements;
- Economical condition of the residential place;
- Ethnical and ethnographical structure (based on initial observation during the reconnaissance) of the residential place.

For the Asian part of the Project, 5 meeting locations were selected as Demirciler (Kocaeli, Dilovasi), Sevindikli (Kocaeli, Korfez), Cayirkoy (Kocaeli, Izmit), Korucuk (Sakarya, Adapazari) and Osmanbey (Sakarya, Akyazi) neighborhoods. Principally local neighborhood teahouses were preferred as the meeting venue, where they have proper capacity and physical conditions, as participation levels have been generally higher in such local venues in the previous experiences.

Prior to PCMs several information methods were used to inform the related public authorities (including provincial governorates, district governorates, municipality mayors, etc.) neighborhood headmen and local people, national and local media agencies and wider public including Non-governmental Organizations (NGOs), etc. A list summarizing the methods used to inform each party is provided in Table 19.1.

Table 19.1. Stakeholder Notification Methods for Public Participation Meetings in Asian Sections

Stakeholder Group	Shared Project Documents	Means of Notification
Governorship of Istanbul	• Program of Meetings	Official Letter
Governorship of Kocaeli		Official Letter
Governorship of Sakarya		Official Letter
Dilovasi Municipality		Phone Call
Korfez Municipality		Phone Call
Izmit Municipality		Phone Call
Adapazari Municipality		Phone Call
Akyazi Municipality		Phone Call / Official Letter
Kurnakoy Neighborhood		Official Letter / Neighborhood Meeting
Demirciler Neighborhood		Official Letter / Neighborhood Meeting
Kadilli Neighborhood		Official Letter / Neighborhood Meeting
Tepecik Neighborhood		Official Letter / Neighborhood Meeting
Karayakuplu Neighborhood		Official Letter / Neighborhood Meeting
Toylar Neighborhood		Official Letter / Neighborhood Meeting
Cayirkoy Neighborhood		Official Letter / Neighborhood Meeting
Eseler Neighborhood		Official Letter / Neighborhood Meeting
Karaabdulbaki Neighborhood		Official Letter / Neighborhood Meeting
Suleymaniye Neighborhood		Official Letter / Neighborhood Meeting
Korucuk Neighborhood		Official Letter / Neighborhood Meeting
Osmanbey Neighborhood		Official Letter / Neighborhood Meeting
Yagcilar Neighborhood		Official Letter / Neighborhood Meeting
Denizli Neighborhood		Official Letter / Neighborhood Meeting
Kasikci Neighborhood		Official Letter / Neighborhood Meeting
Kutluca Neighborhood		Official Letter / Neighborhood Meeting
Sevindikli Neighborhood		Official Letter / Neighborhood Meeting
Balcik Neighborhood		Official Letter / Neighborhood Meeting
Tepeoren Neighborhood	• Project Information Brochure • Comment and Grievance Form • Announcements of Public Participation Meetings	Neighborhood Meeting / Phone Call
Akfirat Neighborhood		Neighborhood Meeting / Phone Call
Tavsanli Neighborhood		Neighborhood Meeting / Phone Call
Sipahiler Neighborhood		Neighborhood Meeting / Phone Call
Sepetci Neighborhood		Neighborhood Meeting / Phone Call
Durhasan Neighborhood		Neighborhood Meeting / Phone Call
Bayraktar Neighborhood		Neighborhood Meeting / Phone Call
Sapakpinar Neighborhood		Neighborhood Meeting / Phone Call
Alanduzu Neighborhood		Neighborhood Meeting / Phone Call
Evrenkoy Neighborhood		Neighborhood Meeting / Phone Call
Karaman Neighborhood		Neighborhood Meeting / Phone Call
Camyolu Neighborhood		Neighborhood Meeting / Phone Call
Poyrazlar Neighborhood		Neighborhood Meeting / Phone Call
Dogancilar Neighborhood		Neighborhood Meeting / Phone Call
Celebiler Neighborhood		Neighborhood Meeting / Phone Call
Kasimlar Neighborhood		Neighborhood Meeting / Phone Call
Cerciler Neighborhood		Neighborhood Meeting / Phone Call
Haciramazanlar Neighborhood		Neighborhood Meeting / Phone Call
Budaklar Neighborhood		Neighborhood Meeting / Phone Call
Abali Neighborhood		Neighborhood Meeting / Phone Call
Kizilcikorman Neighborhood		Neighborhood Meeting / Phone Call
Vakif Neighborhood		Neighborhood Meeting / Phone Call
Topagac Neighborhood		Neighborhood Meeting / Phone Call
Wider Public and Interested Parties	• Program of Meetings and Organizational Details	Newspaper announcements

During the information process in advance of the PCMs, initially announcements were published in national and local newspapers on February 22, 2017 (in accordance with the standards described in the national Environmental Impact Assessment (EIA) Regulation). In addition, relevant provincial and district governorates were informed of the program by means of official letters. Headmen of the neighborhoods located within a 1 km corridor (keeping 500 meters at each side of the Motorway's centerline/axis) were individually contacted by means of face-to-face meetings or phone calls depending on the time constraints. Information documents and official invitation letters were distributed as necessary. For this purpose, a Project Information Brochure and grievance/comment forms have been prepared and delivered to neighborhood headmen prior to the meetings. Municipality mayors were also contacted and informed of the PCM program by means of phone calls. Information documents used in the overall process are provided in Section 19.4.1.

Following the information process, PCMs for the Asian sections were conducted on March 13-16, 2017 at Kadikoy (Istanbul, Silivri), Nakkas (Istanbul, Catalca) and Tayakadin (Istanbul, Arnavutkoy) neighborhoods. Organizational details of the meetings are summarized in Table 19.2. and the map of PCM locations is presented in Figure 19.1.

The meetings were held with the participation of representatives of Project Sponsors (senior officials and technical Project team members including design and expropriation) and the Independent Environmental and Social Impact Assessment (ESIA) Consultant (ENCON Environmental Consultancy Co.). Authorities from 1st Regional Directorate of KGM were invited to the meetings to represent the state but the Directorate officials did not prefer to attend the meetings.

The Independent ESIA Consultant performed the moderation of the meetings. The meetings started with an introduction and explanation of the purpose and scope of the meeting and followed by a presentation given by the Independent ESIA Consultant and a final discussion session where questions, concerns and suggestions were received and responded. The main topics covered in the presentations were as follows:

- What is the North Marmara Motorway Project?
- Who are the Project Owner and the Project Sponsors?
- What are the Anticipated Benefits of the Project?
- What is the Environmental and Social Impact Assessment Process?
- Stakeholder Engagement: How to Participate into the Process?
- Discussion (Questions and Answers) Session

Table 19.2. Organizational Details of the Public Consultation Meetings conducted in the Asian Part of the Project

PCM No	Motorway Section	Province	District	Neighborhood	KM Chainage	Population (Turkstat, 2016)	Date of the Meeting	Time of the Meeting	Meeting Venue	Number of Participants	
										Estimated Number of Actual Participants	Number of Participants who Signed the List of Participants
Asia											
1	4	Kocaeli	Dilovası	Demirciler	150+500; 5+000	507	13.03.2017	16:00	Demirciler Neighborhood Teahouse	80	30
2	5	Kocaeli	Körfez	Sevindikli	168+000	244	14.03.2017	11:00	Sevindikli Neighborhood Teahouse	150	67
3	5	Kocaeli	İzmit	Cayirköy	191+000	1.486	15.03.2017	11:00	Çayırköy Mahalle Kahvehanesi	150	121
4	6	Sakarya	Adapazarı	Korucuk	218+000	20.331	15.03.2017	16:00	Korucuk Ulubey Tesisleri	80	60
5	6	Sakarya	Akyazı	Osmanbey	249+000	985	16.03.2017	11:00	Osmanbey Mahalle Kahvehanesi	200	134

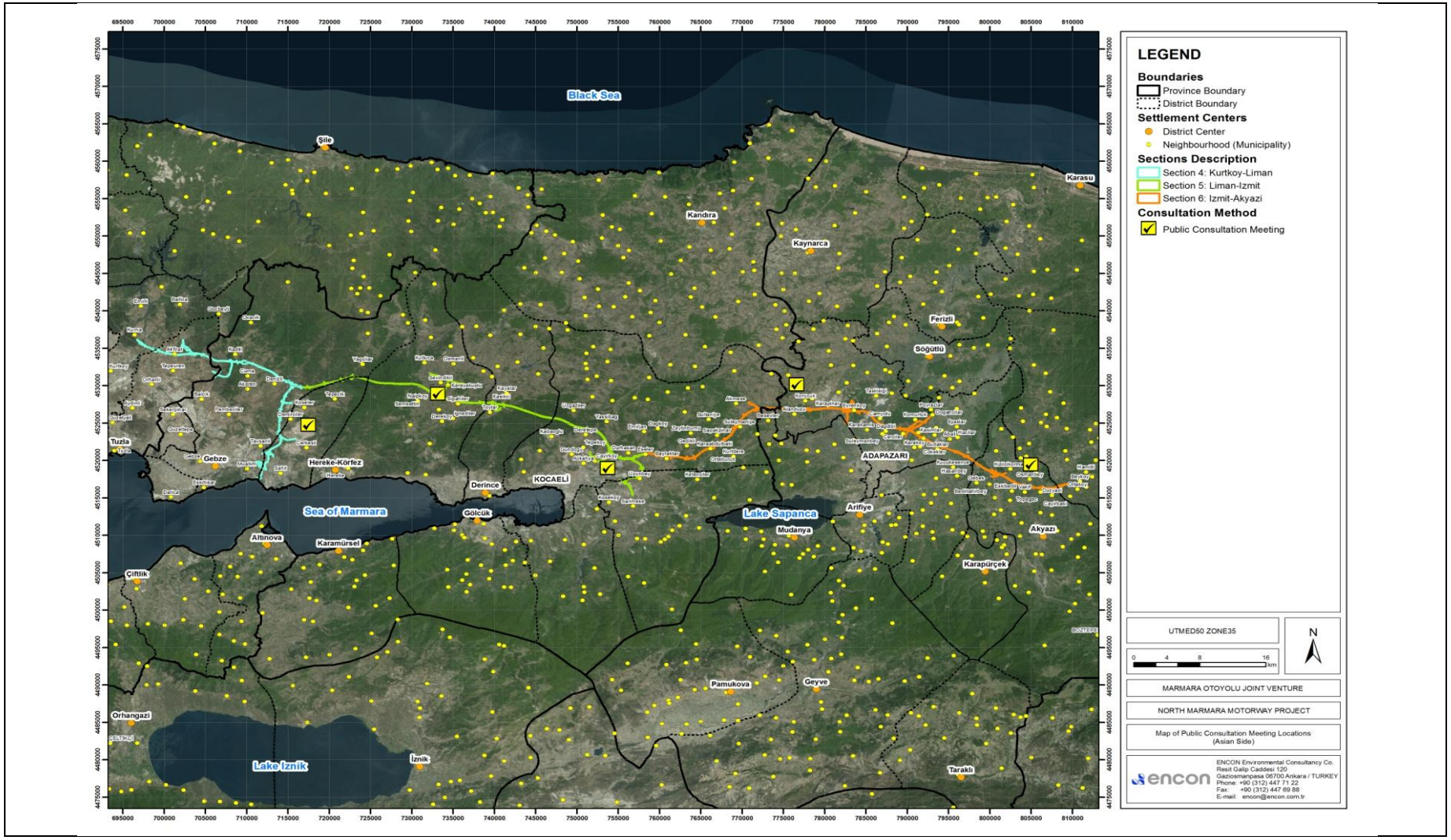


Figure 19.1. Map of Public Consultation Meeting Locations

Presentation template used during the PCMs is provided in Section 19.4.1. Large-scale (in A2 format) maps showing the relevant part of the route in each meeting were posted on the walls of the meeting venue. Comment and grievance forms were kept ready and participants interested in the submission of comments and grievances during the meetings were guided by the officials of Project Sponsors.

As a result of the information efforts, participation levels were high especially at the meetings held at local neighborhood teahouses. Attendance of different parties including state officials or adjacent neighborhoods (significantly) as well as representatives of media in addition to local people was achieved as summarized in Table 19.3. In general, participation of women was restricted with a few representatives.

Table 19.3. Summary of Participants Profiles

PCM No	Meeting Location	Adjacent Neighborhoods from which Representatives (Headmen or Local People) had Participated in the Meeting	Other Parties Participated in the Meeting (Public Authorities, Media, etc.)
1	Demirciler	Kadilli, Tavsanli, Yagcilar (including a group of women participants from the neighborhood), Tepecik	N/A
2	Sevindikli	Kutluca, Semsettin, Kasikci, Sipahiler, Karayakuplu, Osmanli, Kiyirli, Martilar, Himmetli	Vice Mayor of Korfez Municipality City Councilor of Korfez Municipality Local Media
3	Cayirkoy	Karaabdulbaki, Suleymaniye, Sapakpinar, Durhasan, Eseler, Solaklar, Bayraktar, Akmese Ataturk, Sepetci, Kartepe-Ertugrul, Hacioglu, Kartepe-Uzunbey, Gokceviran, Arpalik İhsaniye, Karadenizliler, Uzunciftlik, Yesilova, Murat, Deretepe, Izmit district center	Local Media Political party representatives Local business owners
4	Korucuk	Akmese, Besevler, Suleymanbey, Alanduzu, Karapinar, Dagdibi, Celebiler, Kucuk Esence, Meseli, Haciramazanlar, Koprubasi, Cerciler, Adapazari district center	Local business owners
5	Osmanbey	Budaklar,Kizilcikorman, Topagac, Sofular, Balballi, Vakif, Eskiorman, Yenidogan, Abali, Akarca, Kucuk Esence, Duzyazi, Akyazi district center,	N/A

Participation lists were kept by the Project Sponsors and it should be noted that not all participants preferred to sign the participation lists thus actual participant numbers were higher than the number of participants who signed the lists. Due to high level of participation at teahouses, some of the participants had to stay outside. Microphones and audio systems were used to ensure that the participants outside the teahouse could follow the presentations and the discussions and submit their views and concerns. On average, each meeting last for 1-1,5 hours. Following the official meeting durations, questions of the participants were replied at the unofficial conversations held after the meetings. Photographs taken during the meetings are presented in Section 19.4.2.

The questions, issues, concerns and suggestions raised by the participants during the PCMs were grouped under four main categories as follows. Each main category included sub-categories and a summary of the PCM findings is provided in Table 19.4:

- Technical/Design
- Environment
- Socio-economy
- Stakeholder Engagement

Table 19.4. Summary of the PCM Findings for the Asian Sections

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
Asia					
1	**Kocaeli, Dilovasi, Demirciler Neighborhood (13.03.2017)**				
1.1	Headman of Demirciler Neighborhood	Socio-economy	Urgent Expropriation	Parcels listed in the urgent expropriation decision and published in the Official Gazette are different from the parcels on which construction activities are going on. Information requested on the process to be proceeded for such parcels which were listed in the Official Gazette but are now out of the current expropriation corridor. For some of those parcels, no notification has been done yet but construction has started. Deviation from the information given in Official Gazette should have been informed in advance.	Revised lists have been prepared for the final route and submitted by KGM to Council of Ministers for approval. Expropriation process is considered irreversibly completed for any parcel that was listed in the former Official Gazette and compensation payments have been done. There is no way that compensation payments would be requested back by authorities for such parcels. The route has been mostly finalized and would not change unless major problems (e.g. geological-geotechnical) are encountered.
		Technical	Engineering Structures	Requests for additional passage structures were raised. A culvert or underpass has been requested to be added at KM 4+900 as other passages already included in the design would not be sufficient for Demirciler neighborhood. Culverts and underpasses should have sufficient dimensions to allow passage of pedestrians, animals and vehicles. It has been underlined that use of hydraulic culverts for the passage of pedestrians would not be possible during winter months due to flow conditions.	Information on the locations of the passages near Demirciler neighborhood has been given. In every 1 km, underpasses, overpasses and/or culverts have been planned. Local people have been recommended to submit their requests through Project's grievance/comment mechanisms so that such requests can be considered by design team.
1.2	Resident of Demirciler Neighborhood	Socio-economy	Fragmentation Restriction of access to lands	Information requested on the means of access to agricultural lands from the locations of passage structures.	Stabilized side roads (having a width of 6 m) will be constructed in parallel to the Motorway near agricultural areas/zones to provide access to agricultural lands.
		Socio-economy	Community Health and Safety	It would not be possible to provide access between agricultural lands and neighborhood roads through culverts during the time of floods.	There are different types of passage structures including hydraulic culverts, service culverts, underpasses/overpasses. Design of passage structures and selection of dimension has been done in consideration of usage requirements.
1.3	Resident of Demirciler Neighborhood	Socio-economy	Construction Impacts Existing Infrastructure	A concrete irrigation channel conveying spring water may be crossed by the Motorway route.	All the existing infrastructure will be relocated if crossed by the Motorway. A hydraulic culvert has already been planned at the location of the spring water.
1.4	Headman of Kadilli Neighborhood	Socio-economy	Expropriation	Information was requested about cases when user of the land is not the legal owner and the notification process (which party-owner of the land or user of the land- will receive the notification) to be followed in such cases.	Legal owners of the lands (owner of the title deed) will receive the notification and compensations.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
		Socio-economy	Construction Impacts Existing Infrastructure	A waterway coming from the forests may be crossed by the Motorway.	All the existing infrastructure will be relocated if crossed by the Motorway. A hydraulic culvert has already been planned at the location of the spring water.
1.5	Residents of Tavsanli Neighborhood	Socio-economy	Expropriation	No notification has been received by the neighborhood so far. Recommendations were requested for legal owners whose lands are cultivated by renters.	It has been recommended that regular/daily activities would be continued until notification is made by authorities.
1.6	Women Residents from Yagcilar Neighborhood	Socio-economy	Expropriation	Information was requested on the affection status of specific parcels.	Parcel numbers have been and contact details of related persons noted down for further evaluation and feedback.
2	**Kocaeli, Körfez, Sevindikli Neighborhood (14.03.2017)**				
2.1	Vice Mayor of Korfez Municipality	Environment Socio-economy	Fragmentation Restriction of access to lands	The route has changed several times in the previous process. Structures providing access of pedestrians and wild life in the north-south direction should be provided with frequent/sufficient intervals.	Information on the locations of the passages (culverts, underpasses, overpasses) in this section has been given. It has been underlined that number of engineering structures has increased as a result of each revision done.
		Environment	Agricultural Lands	Cooperation should be made with the Ministry of Agriculture, Food and Livestock as land consolidation covers the neighborhoods of Sipahiler, Sevindikli, Kasikci and Karayakuplu in this region.	Ministry of Agriculture, Food and Livestock and its local organizations were collaborated by KGM during the route selection process. Balance between impacts on agricultural lands, forest areas, water resources, etc. was aimed to be established by means of several revisions done on the route.
2.2	Headman of Sevindikli Neighborhood	Technical	Engineering Structures	It was questioned if the Project Sponsors will cooperate with the headmen of the neighborhoods regarding the locations of the culverts, especially for the passage of harvesters.	Locations of planned culverts are marked on the hard copy maps presented in the meeting room. Additional requests can be considered, if there is any.
2.3	Resident of Sevindikli Neighborhood (Lawyer)	Socio-economy	Urgent Expropriation	Information was requested on the process to be executed for the parcels listed in the urgent expropriation decision published in the Official Gazette have changed. It has been noted by the lawyer that normally lawsuits would last for 2-3 years if urgent expropriation is not applied.	Revised lists have been prepared for the final route and a new decision will be published in the Official Gazette with regard to urgent expropriation decision. Execution of the expropriation process is under the authority and responsibility of KGM. Expropriation process has been explained. Information on the processes to be conducted for the agreement and non-agreement cases. It has been informed that Article 27 of the Expropriation Law, which is related with urgent expropriation processes, will be applied by KGM in this Project if agreements cannot be settled as a result of negotiations to be done. Since there has been route change in the Asian sections, expropriation process has started with delay.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
2.4	Headman of Kutluca Neighborhood	Environment Socio-economy	Water Resources	The headman gave information on the Kutluca Pond planned by the State Hydraulic Works (DSI) for irrigation and drinking water purposes and underlined the expected benefits and importance of this pond especially for Kutluca, Sevindikli and Osmanli neighborhoods as well as for meeting the water requirements of the Kutluca Camp Site. The headman suggested that the embankment material required for the construction of this pond may be supplied from North Marmara Motorway Project's earthworks. On the other hand, regarding the administrative process of the pond project, the headman informed that the pond site is located within the long distance protection zone of Istanbul Water and Sewerage Administration (ISKI).	Feasibility of Kutluca Pond will be reviewed in terms of permitting (if there is any obstacle due to ISKI's water protection zones) and construction (if embankment material can be supplied by the Project). It is understood that there is an official view provided by ISKI and the Kutluca headman can provide this view.
2.5	City Councilor of Korfez Municipality	Stakeholder Engagement	Public Consultation Meetings	The Korfez City Councilor declared his discontent that related state authorities from Kocaeli province and Korfez District, who would be the representatives of this region, have not attended this meeting and stood up for the local people to assert their rights.	Information has been provided on the methods used for informing stakeholders such as letters and announcements delivered to neighborhood headmen and invitations sent to relevant public authorities through letters or phone calls (governorates, municipalities).
2.6	Resident of Sevindikli Neighborhood	Socio-economy	Expropriation	Information was requested regarding the process to be conducted for the existing crops or crops to be cultivated.	Information on the expropriation/land acquisition procedure being/to be followed under Expropriation Law and other legislation (forestry, pasturelands) has been given. It has been informed that the expropriation process would be completed within 45-60 days if agreement is settled. Compensation would be provided for the existing crops at the time of notification/valuation. No further compensation would be provided for crops cultivated after the date of notification/valuation.
2.7	Resident of Sevindikli Neighborhood	Socio-economy	Expropriation	Information was requested regarding the partial expropriation of lands (for an example case of 10 da of land, of which only 5 da is located within the expropriation corridor)	For the given example case, it has been informed that only the area located within the expropriation corridor would be expropriated as the remaining land would still be viable for economic activities. It has been further explained that if the land portion remaining from expropriation would not be viable anymore, eligible persons may request the expropriation of the entire parcel including the remaining portion, even if this portion is out of the expropriation corridor. All the trees, characteristics of the crops, etc. will be considered in valuation of lands in accordance with the Exp. Law.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
2.8	Resident of Semsettin Neighborhood (Woman Participant)	Socio-economy	Expropriation	With regard to the changes done on the parcels listed in the urgent expropriation decision published in the Official Gazette, it has been questioned if the changes in Semsettin neighborhood are significant.	It has been replied that no significant change was made in Semsettin neighborhood.
		Socio-economy	Expropriation	Information was requested on how equity and fair treatment will be ensured	The objective criteria method described in the Expropriation Law have been explained. The agreement levels achieved in European sections have been given as an indicator of satisfaction of owners.
2.9	Resident of Sevindikli Neighborhood	Technical	Final Route	The participant submitted his concern about the uncertainty of the Motorway route. Explanation was requested on the method through which they would receive correct information.	It has been informed that the route has been finalized and the information on the final route and expropriation process will be delivered through neighborhood headmen and Conciliation Commission. It has been also advised that the parcels published in the Official Gazette as an annex to the urgent expropriation decision may change thus the notifications to be done by KGM on the basis of the title deed ownership should be awaited for certain information.
2.10	Resident of Sevindikli Neighborhood	Environment Socio-economy	Cumulative Impacts	It has been informed that a separate Ring Road project is planned in the region in addition to the North Marmara Motorway Project.	The Project team confirmed that other projects are planned in the region.
2.11	Headman of Kasikci Neighborhood	Environment Socio-economy	Water Resources Community Health and Safety	There are water resources of the community near the working site. Additionally, truck traffic pose risks.	Relevant impacts will be considered in the ESIA studies. Local people have also been recommended to submit their complaints through Project's grievance/comment mechanisms so that they would be considered.
2.12	Resident of Sipahiler Neighborhood (Kadikoy)	Socio-economy	Expropriation Physical Resettlement	It has been informed that houses and other structures (barns, etc.) will be affected in their settlement. Information requested on the expropriation program to get prepared for the time when the construction equipments start to operate.	It has been informed that first the expropriation will start and take place, then construction will follow some time after. Thus, there will be time between the expropriation and start of construction to get prepared. Especially, sufficient time is given for the locations where buildings/houses are affected. Process under Turkish law (Resettlement Law) for physical resettlement has been explained.
2.13	Resident of Sevindikli Neighborhood	Stakeholder Engagement	Next Phases of the ESIA	Information was requested if further meetings will take place in the upcoming process.	Local people have also been recommended to submit their proposals/wills for additional meetings through Project's grievance/comment mechanisms so that they would be considered in the planning of next phases.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
3	**Kocaeli, Izmit, Cayirkoy Neighborhood (15.03.2017)**				
3.1	Headman of Cayirkoy Neighborhood	Socio-economy	Expropriation	The headman claimed that Cayirkoy is the mostly affected settlement in the scope of the North Marmara Motorway Project. The headmen requested expropriation of entire parcel when the area of the parcel to be expropriation is less than 2-3 decares.	Information on the partial expropriation has been given. It has been informed that if the land portion remaining from expropriation would not be viable anymore, eligible persons may request the expropriation of the entire parcel including the remaining portion, even if this portion is out of the expropriation corridor. If the holder of the right prefers the use the remaining portion of the parcel that has been expropriated, he/she can continue his/her activities on that land. It was added that KGM is the decision maker in this process.
		Socio-economy	Expropriation	It has been informed that no notification has been received yet, thus construction works should not start on privately owned parcels until expropriation is done.	It has been explained that the expropriation has started at priority areas (such as viaduct locations, etc.) and notifications will be made within a schedule at all areas to be expropriated. It has been informed that construction starts on privately owned lands that have not been expropriated yet only if bilateral agreements are done with the owners.
		Socio-economy	Expropriation	Information requested on the trees, vineyards, orchards, etc. to be affected and the criteria considered in the valuation of poplar trees that are not old enough for logging as they are normally logged at the age of 12-13. The headman suggested KGM to cooperate with affected people during the valuation process.	Information on the expropriation/land acquisition procedure being/to be followed under Expropriation Law has been given. It has been informed that valuation is done by the Valuation Committee. It has been informed that cooperation with affected people may be done in case of involvement of expert witnesses during the court processes. All the trees, characteristics of the crops, structures (fences, walls, etc.) etc. will be considered in valuation of lands in accordance with the Expropriation Law based on the objective criteria. Actual age of trees would be taken into consideration in this process. Compensation would be provided for the existing crops at the time of notification/valuation. No further compensation would be provided for crops cultivated after the date of notification.
		Socio-economy	Construction impacts	Potential for impacts of/damage due to construction activities on adjacent lands, which are out of the expropriation corridor, was questioned. Compensation measures to be taken in case of damage outside the expropriation corridor was requested.	Local people has been recommended to submit their complaints/grievance in case of damage on adjacent lands. Additional information has been given on the service roads to be constructed and how the traffic will be avoided

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
		Technical	Final Route	The headman stated that the route has changed several times and questioned if the route is final yet. It causes problems to explain the process to the local people when the route changes.	Information was given on the background of the Project and revisions done since 2006 in consideration of the views/requests of more than 60 state authorities including governorates, State Hydraulic Works, cultural heritage authorities, etc. It has been confirmed that the route has been mainly finalized and construction of viaducts, tunnels, etc. will start in the upcoming weeks.
		Technical	Engineering Structures	Cooperation of Project Sponsors with neighborhood headmen was suggested for the selection/finalization of the locations of the underpasses, overpasses and culverts.	Information on the locations of the passages (culverts, underpasses, overpasses) in this section has been given.
		Environment	Water Resources	Surface runoff to be collected along the route was suggested to be discharged into nearby receiving water bodies instead of discharge onto the agricultural lands due avoid any damage.	Drainage projects have been developed for the collection of surface runoff along the Motorway by means of ditches and diversion of the collected water to the nearest receiving water bodies. The design criteria for the drainage system are in accordance with motorway standards.
3.2	Headman of Kartepe-Ertugrul Gazi Neighborhood	Environment	Indirect Impacts	The headman requested indirect impacts to be taken into consideration.	It has been informed that both direct and indirect impacts will be considered in the ESIA.
		Stakeholder Engagement	Public Participation Meetings	The headman claimed that they did not receive any information/invitation for the meeting.	Information has been provided on the methods used for informing stakeholders such as newspaper announcements and letters delivered to neighborhood headmen and invitations sent to relevant public authorities (governorates, municipalities).
		Technical	Engineering Structures	The headman requested the culvert dimensions to be adjusted in alignment with the dimensions of the zoning roads.	It has been informed that road dimensions will be taken into account.
		Socio-economy	Property Ownership	The headman complained about the fact that there is a considerable uncertainty since 2006, which affects the real estate purchase and sales in the region.	It has been informed that the implementation of the Project has accelerated since the Build-Operate-Transfer tender and the construction works will speed up in the upcoming periods.
3.3	Resident of Hacioglu Neighborhood	Socio-economy	Non-owner Users	Information requested on the procedure to be applied for non-owners users of the lands, for a specific example of greenhouses.	It has been informed that owners of the lands will be the eligible persons under the Turkish law. Compensation will be provided to owners to be determined based on title deeds.
		Socio-economy	Expropriation	Information on the compensation to be provided for the lands located close to the tunnel portals was requested as no houses or structures will be allowed to be built near the tunnel portals.	Information has been provided on the constitution of easement rights in accordance with Expropriation Law for areas to be directly affected.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
3.4	Resident of Kartepe-Uzunbey Neighborhood	Socio-economy	Expropriation	It was requested that the agricultural parcels located adjacent to the industrial parcels are to be appraised based on industrial parcel prices.	The valuation process will be conducted by KGM in accordance with Expropriation Process.
		Technical	Other Infrastructure Projects	Motorway intersects with the route of railway project planned in the region. Information was requested on the priority levels of both projects.	It has been informed that the land preparation works for the Motorway has already started. However, railway project components have been considered in the design based on the views of the relevant authorities. Underpasses and overpasses will be used for intersection points.
3.5	Headman of Suleymaniye Neighborhood	Environment Socio-economy	Cumulative Impacts	The headman submitted their complaint that the neighborhood will be trapped by the Motorway passing from the north of the settlement and the railway project planned in the south of the settlement.	It has been informed that cumulative impacts on Suleymaniye neighborhood will be considered in the ESIA.
3.6	Headman of Durhasan Neighborhood	Socio-economy	Expropriation Physical Resettlement	It has been informed that 11 houses will be affected by the Project and route revision should be considered as there is available plain in the south of the area.	Process under Turkish law (Resettlement Law) for physical resettlement has been explained. Probable options that may be produced in the scope of international standards (land for land, allocation of treasury lands for construction of houses in the same area, 0% interest rates for new houses) have been introduced. It has been informed that the route is mostly finalized and any route change to be done would result in other impacts.
3.7	Resident of Cayirkoy Neighborhood	Socio-economy	Expropriation Economic Displacement	The Project will result in the restriction of areas used for economic activities. Cayirkoy Access Road will affect the Cayirkoy Plain. Route revision has been suggested.	It has been informed that the route is mostly finalized and any route change to be done would result in other impacts.
		Socio-economy Environment	Cumulative Impacts	It has been suggested that the Project may be integrated with the planned Kandira Double Road (already tendered).	Kandira Double Road Project will be considered in the ESIA.
3.8	Resident of Gokceviran Neighborhood	Socio-economy	Urgent Expropriation	Parcels listed in the urgent expropriation decision and published in the Official Gazette are different from the parcels on the revised route.	It has been informed that the parcels listed in the Official Gazette reflect the route of the Motorway at the time of publishing. Revised lists have been prepared for the final route and a new decision will be published in the Official Gazette with regard to urgent expropriation decision.
3.9	Resident of Bayraktar Neighborhood	Socio-economy	Benefits of the Project for Locals	The participant submitted his concerns regarding the selection of the access road route as it is considered that this route has been selected to provide benefits to the Asim Kibar Organized Zone and not to local people engaged with agri. activities.	It has been informed that the connection of the route to organized zone will be considered and evaluated in the ESIA.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
3.10	Resident of Hacioglu Neighborhood	Environment Socio-economy	Soil Community Health and Safety	It was suggested that vehicle/wheel wash basins are constructed to minimize transportation of sediments/mud and pollution/dustiness of public roads.	It has been informed that the suggestion will be considered in the ESIA.
3.11	Resident of Akmese Ataturk	Stakeholder Engagement	Public Consultation Meetings	An additional meeting was requested to be held at a central location close to Akmese Ataturk, Suleymaniye, Karaabdulbaki and Sapakpinar. The participants from these settlements complained about the distance of the Cayirkoy meeting location to their settlement and the capacity of the teahouses.	It has been informed that the suggestion will be considered by the Project team in consideration of the ESIA schedule.
3.12	Resident of Cayirkoy Neighborhood (Business Owner)	Socio-economy	Expropriation Economic Displacement	The participant informed that their marble workshop will be affected.	Local people have been recommended to submit their information request/proposal through Project's grievance/comment mechanisms so that they would be considered.
4	**Sakarya, Adapazari, Korucuk Neighborhood (15.03.2017)**				
4.1	Resident of Korucuk	Technical	Location of Engineering Structures	Information was requested on the locations of interchanges in the region.	Information has been provided on the locations of the interchanges in this region. Additional information has been provided on the numbers and locations of the underpasses and overpasses, as well as their dimensions.
4.2	Headman of Besevler Neighborhood	Environment	Noise	Information was requested on the noise studies conducted.	Information has been provided on the baseline noise measurements conducted and the noise modeling studies to be performed as a part of the ESIA. It has been added that necessary measures, such as noise barriers, etc., will be suggested based on the results of the ESIA.
		Socio-economy	Urgent Expropriation	Parcels listed in the urgent expropriation decision and published in the Official Gazette are different from the parcels on the revised route.	It has been informed that the parcels listed in the Official Gazette reflect the route of the Motorway at the time of publishing. Revised lists have been prepared for the final route and a new decision will be published in the Official Gazette with regard to urgent expropriation decision. Additional information will be provided through neighborhood headmen.
4.3	Resident of Adapazari District (Business Owner)	Socio-economy	Expropriation	Information was requested on the expropriation program and procedure (e.g. how compensation for the crops will be obtained, when the compensation amounts will be paid) as this would affect the cultivation activities (e.g. foreseen date for expropriation, activities to be conducted on the cultivated lands)	Information on the expropriation/land acquisition procedure being/to be followed under Expropriation Law has been given including the steps such as identification of owners, notification, valuations and negotiation. It has been informed that the expropriation process would be completed within 45-60 days if agreement is settled. Compensation would be provided for the existing crops

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
					at the time of notification/valuation. No further compensation would be provided for crops cultivated after the date of notification.
4.4	Resident of Karapinar Neighborhood (Board Member of Chamber of Agriculture)	Stakeholder Engagement	Grievance/Comment Mechanism	It was questioned if grievance/comment boxes will be placed at all settlements including Karapinar Neighborhood or will local people living in other settlements be required to bring their forms to nearby settlements, which would not be practical for them.	It has been informed that placement of boxes are going on. It will be checked and if not placed yet, boxes will be placed at Karapinar Neighborhood.
4.5	Resident of Korucuk Neighborhood	Socio-economy	Expropriation	Information was requested regarding the partial expropriation of lands (for an example case of 20 da of land, of which 15 da is located within the expropriation corridor and 5 da is located outside the expropriation corridor)	For the given example case, it has been informed that only the area located within the expropriation corridor would be expropriated as the remaining land would still be viable for economic activities. It has been further explained that if the land portion remaining from expropriation would not be viable anymore, eligible persons may request the expropriation of the entire parcel including the remaining portion, even if this portion is out of the expropriation corridor.
4.6	Headman of Korucuk Neighborhood	Stakeholder Engagement	Public Consultation Meetings	The headman claimed that headmen of the nearby settlements did not receive any information/invitation for the meeting. He stated that all the headmen in the region are interested in the Project, irrelevant of the fact that their settlement is directly affected or not, and suggested that such information can be effectively disseminated if done by/in coordination with headmen.	Information has been provided on the methods used for informing stakeholders such as newspaper announcements and letters delivered to neighborhood headmen and invitations sent to relevant public authorities (governorates, municipalities). It has been added that some of the headmen from this region have participated in the Cayirkoy meeting.
5	**Sakarya, Akyazi, Osmanbey Neighborhood (16.03.2016)**				
5.1	Headman of Budaklar Neighborhood	Socio-economy	Expropriation	Information was requested on the expropriation program and procedure (e.g. how compensation for the crops will be obtained, when the compensation amounts will be paid and construction will start) as this would affect the cultivation activities (e.g. foreseen date for expropriation, activities to be conducted on the cultivated lands)	Information on the expropriation/land acquisition procedure being/to be followed under Expropriation Law has been given. It has been informed that the expropriation process would be completed within 45-60 days if agreement is settled. Compensation would be provided for the existing crops at the time of notification/valuation. No further compensation would be provided for crops cultivated after the date of notification. All the structures (trees, ladders, walls, fences, etc.) present on the lands at the time of notification will be considered in valuation of lands in accordance with the Expropriation Law. Information on the lawsuit processes has also been provided.

PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
5.2	Resident of Osmanbey Neighborhood	Socio-economy	Expropriation	Information was requested regarding the partial expropriation of lands (for an example case of 10 da of land, of which 5 da is located within the expropriation corridor and 5 da is located outside the expropriation corridor)	For the given example case, it has been informed that only the area located within the expropriation corridor would be expropriated as the remaining land would still be viable for economic activities. It has been further explained that if the land portion remaining from expropriation would not be viable anymore (200-300 m^2), eligible persons may request the expropriation of the entire parcel including the remaining portion, even if this portion is out of the expropriation corridor.
5.3	Resident of Kizilcikorman Neighborhood	Socio-economy	Expropriation	The participant informed that no notification has been received and how they will be informed of their affection status.	It has been explained that the expropriation has started at priority areas (such as viaduct locations, etc.) and notifications will be made by KGM within a schedule at all areas to be expropriated.
5.4	Resident of Budaklar Neighborhood	Socio-economy	Expropriation	Information was requested again on the expropriation program and procedure (e.g. how compensation for the crops will be obtained, when the compensation amounts will be paid and construction will start)	It has been informed one more time that compensation would be provided for the existing crops at the time of notification/valuation. No further compensation would be provided for crops cultivated after the date of notification.
5.5	Resident of Budaklar Neighborhood	Technical	Engineering Structures	Question was raised against the risk of flooding at the underpasses locations.	It has been informed that number of overpasses is more in Section 6 when compared to number of underpasses mainly due to the soil conditions in the area. Depending on the soil and groundwater conditions, there may be a risk of water accumulation in the underpass. Thus in such cases overpasses have been planned. Inclination at the overpasses will be optimized to ensure that large vehicles such as harvesters can effectively use the road.
5.6	Resident of Budaklar Neighborhood	Socio-economy	Expropriation	Information was requested regarding the procedure to be applied for renters having rental agreements.	It has been informed that legal owners of the lands (owner of the title deed) will receive the notification and compensations. Business relations with legal owners and renters should be made internally.
5.7	Resident of Budaklar Neighborhood	Socio-economy	Expropriation	Complaints were submitted related with cases where drilling works were conducted on lands which have not been expropriated yet.	Technical team informed that privately-owned lands are used only if official consent letters are taken from the owners. In such cases, studies are conducted under the terms of official commitment letters. For other cases where consent and commitment letters were missing, participants have been recommended to record such cases, if there is any, together with the neighborhood headman. It has been informed that such work can only be conducted on privately owned lands if bilateral agreements are done with the owners. Participants have

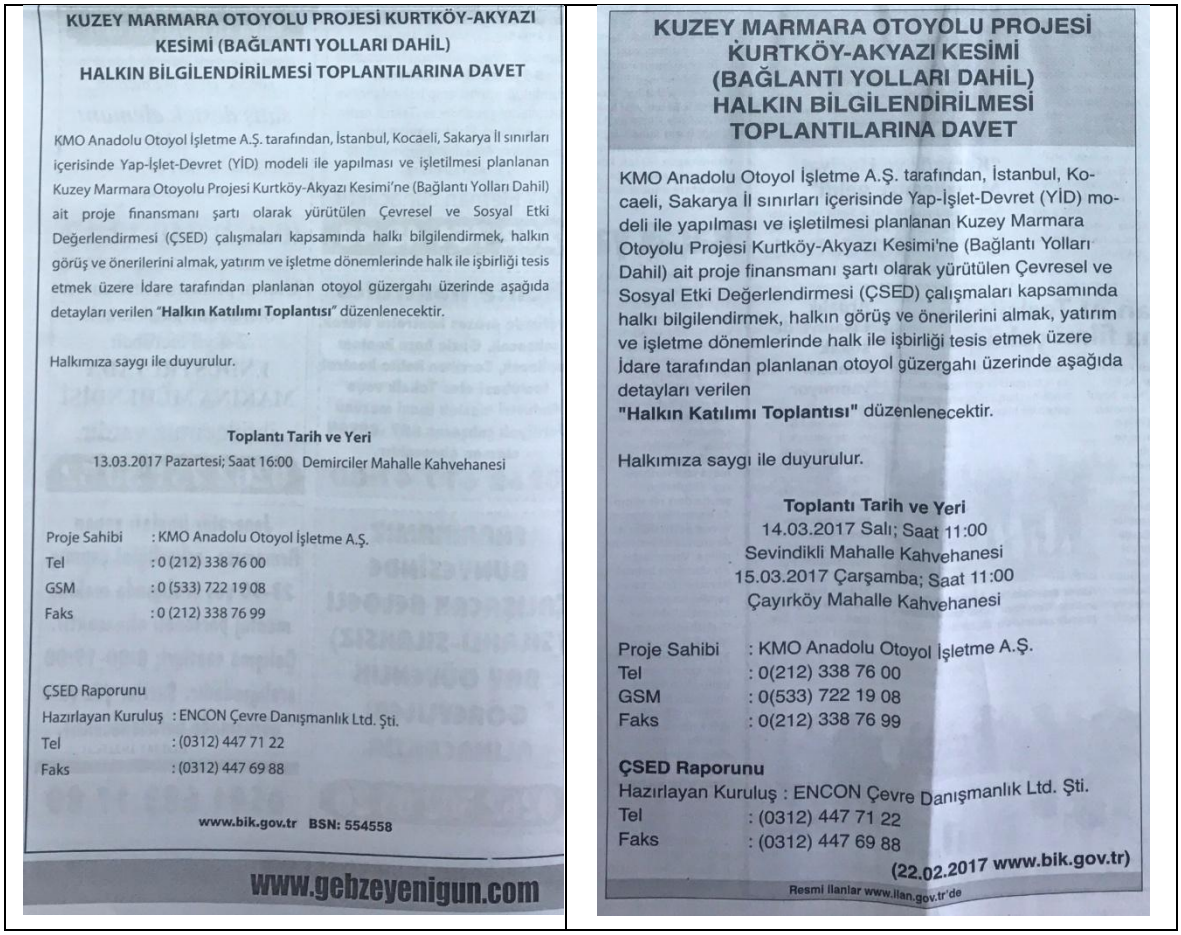
PCM No	Party who Raised the Question/ Issue/Concern/ Suggestion	Category	Sub-category	Question/Issue/Concern/ Suggestion Raised	Response of Project Sponsors/ Environmental Consultant
					also been recommended to submit their complaints through Project's grievance/comment mechanisms so that they would be considered and corrective measures would then be taken.
5.8	Resident of Kizilcikorman Neighborhood	Socio-economy	Expropriation	Information was requested on the procedure to be followed for the notification of right holders for the expropriation of joint-owned parcels.	It has been informed that initially share holders are identified through registry offices and e-state mechanism and all the eligible share holders will be separately contacted. Afterwards negotiations will be done individually with each share holder and it will not be required to achieve agreement of all shareholders. All the shareholders will be compensated in the ratio of his/her share.
5.9	Resident of Budaklar Neighborhood	Socio-economy	Expropriation Economic Displacement	It has been claimed that a factory is affected by the route.	It has been informed that route change has been done and the factory is not being affected in the current situation.
5.10	Resident of Budaklar Neighborhood	Environment	Water Resources	It has been stated that the drainage channels constructed in previous railway projects are not functioning effectively.	Information on the technological advancements has been given and drainage projects developed for the collection of surface runoff along the Motorway by means of ditches are in accordance with motorway standards.
5.11	Resident of Osmanbey Neighborhood	Environment Socio-economy	Benefits of the Project for Locals	Information was requested on the benefits of the Project for local people and settlements.	National benefits of the Project have been explained.
5.12	Resident of Osmanbey Neighborhood	Socio-economy	Expropriation	Information was requested on the procedure to be applied for parcels with title deed and parcels being used for 17 years.	Information has been given on the procedure to be followed for the preparation of entitlement lists. The question was handled as a special case and it has been informed that eligibility will be evaluated by KGM.

19.4 Documents Related to the Public Consultation Meetings and Stakeholder Engagement Activities

Various documents and information tools were used within the scope of Public Consultation Meetings and Stakeholder Engagement Activities such as: brochures, invitation letters, newspaper announcements, presentations etc. These documents are presented under this section with pictures from the PCMs.

19.4.1. Information Documents

Information documents and evidences of the meetings that were used within the scope of Public Consultation Meetings are presented between Figure 19.2. and Figure 19.9.



KUZEY MARMARA OTOYOLU PROJESİ KURTKÖY-AKYAZI KESİMİ (BAĞLANTI YOLLARI DAHİL) HALKIN BİLGİLENDİRİLMESİ TOPLANTILARINA DAVET

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya İl sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile yapılması ve işletilmesi planlanan Kuzey Marmara Otoyolu Projesi Kurtköy-Akyazı Kesimi'ne (Bağlantı Yolları Dahil) ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmaları kapsamında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen "**Halkın Katılımı Toplantısı**" düzenlenecektir.

Halkımıza saygı ile duyurulur.

Toplantı Tarih ve Yeri

13.03.2017 Pazartesi; Saat 16:00 Demirciler Mahalle Kahvehanesi

Proje Sahibi : KMO Anadolu Otoyol İşletme A.Ş.
Tel : 0 (212) 338 76 00
GSM : 0 (533) 722 19 08
Faks : 0 (212) 338 76 99

ÇSED Raporunu
Hazırlayan Kuruluş : ENCON Çevre Danışmanlık Ltd. Şti.
Tel : (0312) 447 71 22
Faks : (0312) 447 69 88

www.bik.gov.tr BSN: 554558

www.gebzeyenigun.com

KUZEY MARMARA OTOYOLU PROJESİ KURTKÖY-AKYAZI KESİMİ (BAĞLANTI YOLLARI DAHİL) HALKIN BİLGİLENDİRİLMESİ TOPLANTILARINA DAVET

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya İl sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile yapılması ve işletilmesi planlanan Kuzey Marmara Otoyolu Projesi Kurtköy-Akyazı Kesimi'ne (Bağlantı Yolları Dahil) ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmaları kapsamında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen
"Halkın Katılımı Toplantısı" düzenlenecektir.

Halkımıza saygı ile duyurulur.

Toplantı Tarih ve Yeri
14.03.2017 Salı; Saat 11:00
Sevindikli Mahalle Kahvehanesi
15.03.2017 Çarşamba; Saat 11:00
Çayırköy Mahalle Kahvehanesi

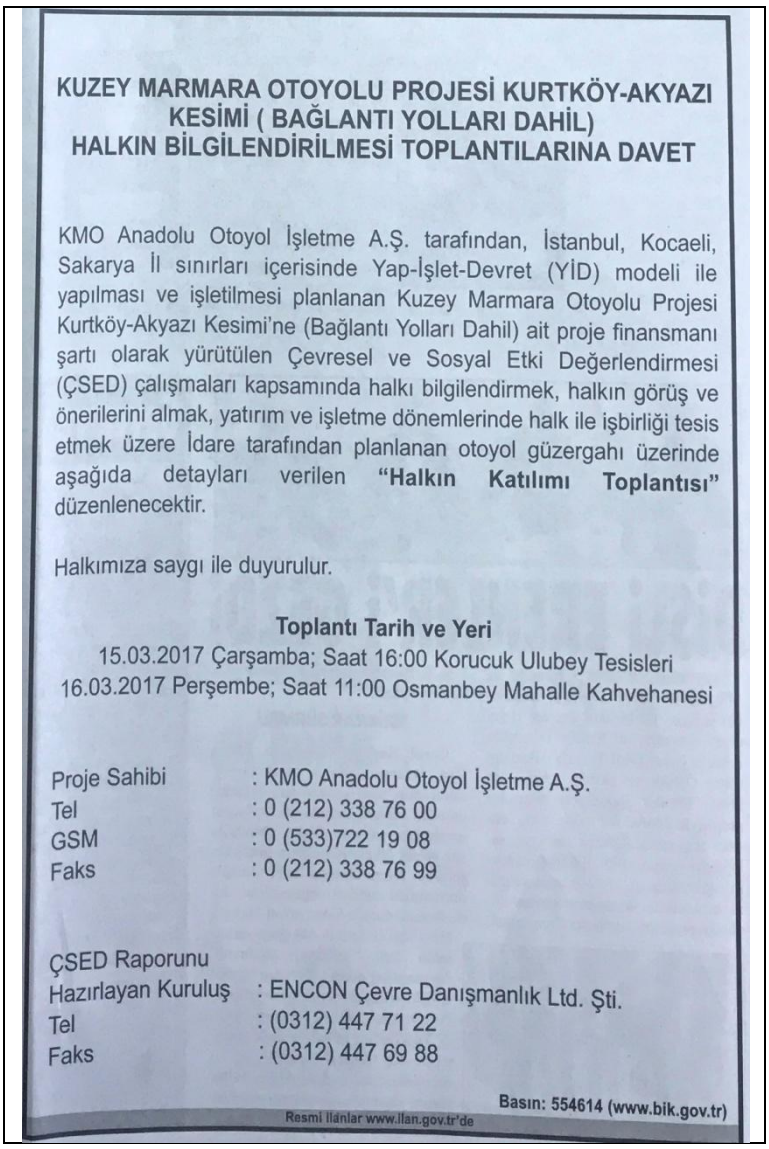
Proje Sahibi : KMO Anadolu Otoyol İşletme A.Ş.
Tel : 0(212) 338 76 00
GSM : 0(533) 722 19 08
Faks : 0(212) 338 76 99

ÇSED Raporunu
Hazırlayan Kuruluş : ENCON Çevre Danışmanlık Ltd. Şti.
Tel : (0312) 447 71 22
Faks : (0312) 447 69 88

(22.02.2017 www.bik.gov.tr)

Resmi ilanlar www.ilan.gov.tr'de

Figure 19.2. Local Newspaper Announcements



KUZEY MARMARA OTOYOLU PROJESİ KURTKÖY-AKYAZI KESİMİ (BAĞLANTI YOLLARI DAHİL) HALKIN BİLGİLENDİRİLMESİ TOPLANTILARINA DAVET

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya İl sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile yapılması ve işletilmesi planlanan Kuzey Marmara Otoyolu Projesi Kurtköy-Akyazı Kesimi'ne (Bağlantı Yolları Dahil) ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmaları kapsamında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen **"Halkın Katılımı Toplantısı"** düzenlenecektir.

Halkımıza saygı ile duyurulur.

Toplantı Tarih ve Yeri

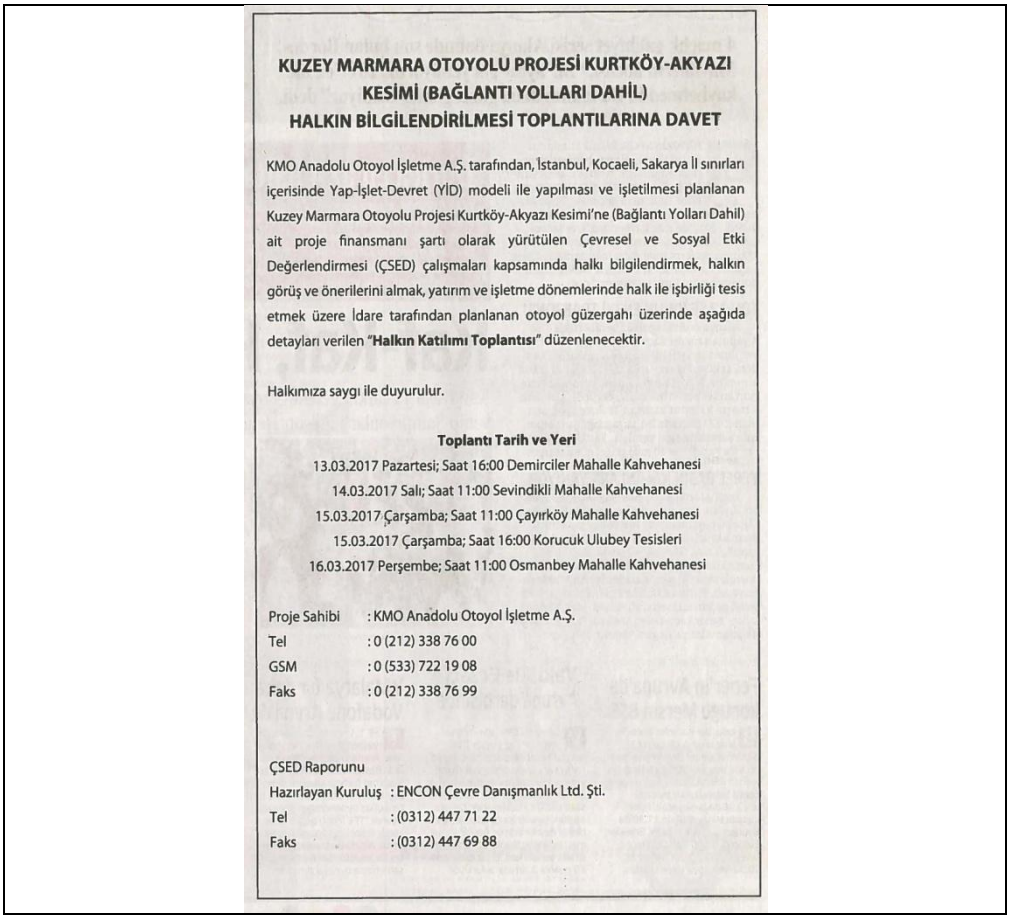
15.03.2017 Çarşamba; Saat 16:00 Korucuk Ulubey Tesisleri
16.03.2017 Perşembe; Saat 11:00 Osmanbey Mahalle Kahvehanesi

Proje Sahibi	: KMO Anadolu Otoyol İşletme A.Ş.
Tel	: 0 (212) 338 76 00
GSM	: 0 (533)722 19 08
Faks	: 0 (212) 338 76 99

ÇSED Raporunu Hazırlayan Kuruluş	: ENCON Çevre Danışmanlık Ltd. Şti.
Tel	: (0312) 447 71 22
Faks	: (0312) 447 69 88

Basın: 554614 (www.bik.gov.tr)
Resmi İlanlar www.ilan.gov.tr'de

Figure 19.3. Local Newspaper Announcement



KUZEY MARMARA OTOYOLU PROJESİ KURTKÖY-AKYAZI KESİMİ (BAĞLANTI YOLLARI DAHİL) HALKIN BİLGİLENDİRİLMESİ TOPLANTILARINA DAVET

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya İl sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile yapılması ve işletilmesi planlanan Kuzey Marmara Otoyolu Projesi Kurtköy-Akyazı Kesimi'ne (Bağlantı Yolları Dahil) ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmaları kapsamında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen "**Halkın Katılımı Toplantısı**" düzenlenecektir.

Halkımıza saygı ile duyurulur.

Toplantı Tarih ve Yeri

13.03.2017 Pazartesi; Saat 16:00 Demirciler Mahalle Kahvehanesi
14.03.2017 Salı; Saat 11:00 Sevindikli Mahalle Kahvehanesi
15.03.2017 Çarşamba; Saat 11:00 Çayırköy Mahalle Kahvehanesi
15.03.2017 Çarşamba; Saat 16:00 Korucuk Ulubey Tesisleri
16.03.2017 Perşembe; Saat 11:00 Osmanbey Mahalle Kahvehanesi

Proje Sahibi : KMO Anadolu Otoyol İşletme A.Ş.
Tel : 0 (212) 338 76 00
GSM : 0 (533) 722 19 08
Faks : 0 (212) 338 76 99

ÇSED Raporunu
Hazırlayan Kuruluş : ENCON Çevre Danışmanlık Ltd. Şti.
Tel : (0312) 447 71 22
Faks : (0312) 447 69 88

Figure 19.4. National Newspaper Announcement

KMO ANADOLU OTOYOL İŞLETMESİ A.Ş.

Sayı : KMO-AO-2017-095 22.02.2017
Konu : HKT Bilgilendirme

KOCAELİ VALİLİĞİ'NE
Körfez Mah. Ankara Karayolu Cad. No:129 41040
İzmit/KOCAELİ

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya il sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile projelendirme ve yapım çalışmaları devam eden Kuzey Marmara Otoyolu (3.boğaz köprüsü dahil) Projesi Kurtköy-Akyazı (bağlantı yolları dahil) Kesimi'ne ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmasının bir parçası olarak paydaş katılımı çerçevesinde proje hakkında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen "Halkın Katılımı Toplantıları" düzenlenecektir.

Gereğini bilgilerine arz ederim.

Toplantı Tarih ve Yerleri

13.03.2017 Pazartesi; Saat 16:00	Demirciler Mahalle Kahvehanesi
14.03.2017 Salı; Saat 11:00	Sevindikli Mahalle Kahvehanesi
15.03.2017 Çarşamba; Saat 11:00	Çayırköy Mahalle Kahvehanesi

Metin TURAN
Proje Müdürü

DAĞITIM:
Gereği:
Kocaeli Valiliği

Bilgi:
Dilovası Kaymakamlığı
Körfez Kaymakamlığı
İzmit Kaymakamlığı

Adres: Altunizade Mahallesi Kısıklı Caddesi No 37 Üsküdar İSTANBUL
Telefon : +90 216 554 53 00 Faks: +90 216 474 97 30 – 474 11 22

Figure 19.5. Official Letter Sent to Kocaeli Government

KMO ANADOLU OTOYOL İŞLETMESİ A.Ş.

Sayı : KMO-AO-2017-079 22.02.2017
Konu : HKT Bilgilendirme

SAKARYA VALİLİĞİ'NE
Resmi Daireler Kampüsü 54290
Camili / Adapazarı / Sakarya

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya il sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile projelendirme ve yapım çalışmaları devam eden Kuzey Marmara Otoyolu (3.boğaz köprüsü dahil) Projesi Kurtköy-Akyazı (bağlantı yolları dahil) Kesimi'ne ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmasının bir parçası olarak paydaş katılımı çerçevesinde proje hakkında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen "Halkın Katılımı Toplantıları" düzenlenecektir.

Gereğini bilgilerine arz ederim.

Toplantı Tarih ve Yerleri

15.03.2017 Çarşamba; Saat 16:00	Korucuk Ulubey Tesisleri
16.03.2017 Perşembe; Saat 11:00	Osmanbey Mahalle Kahvehanesi

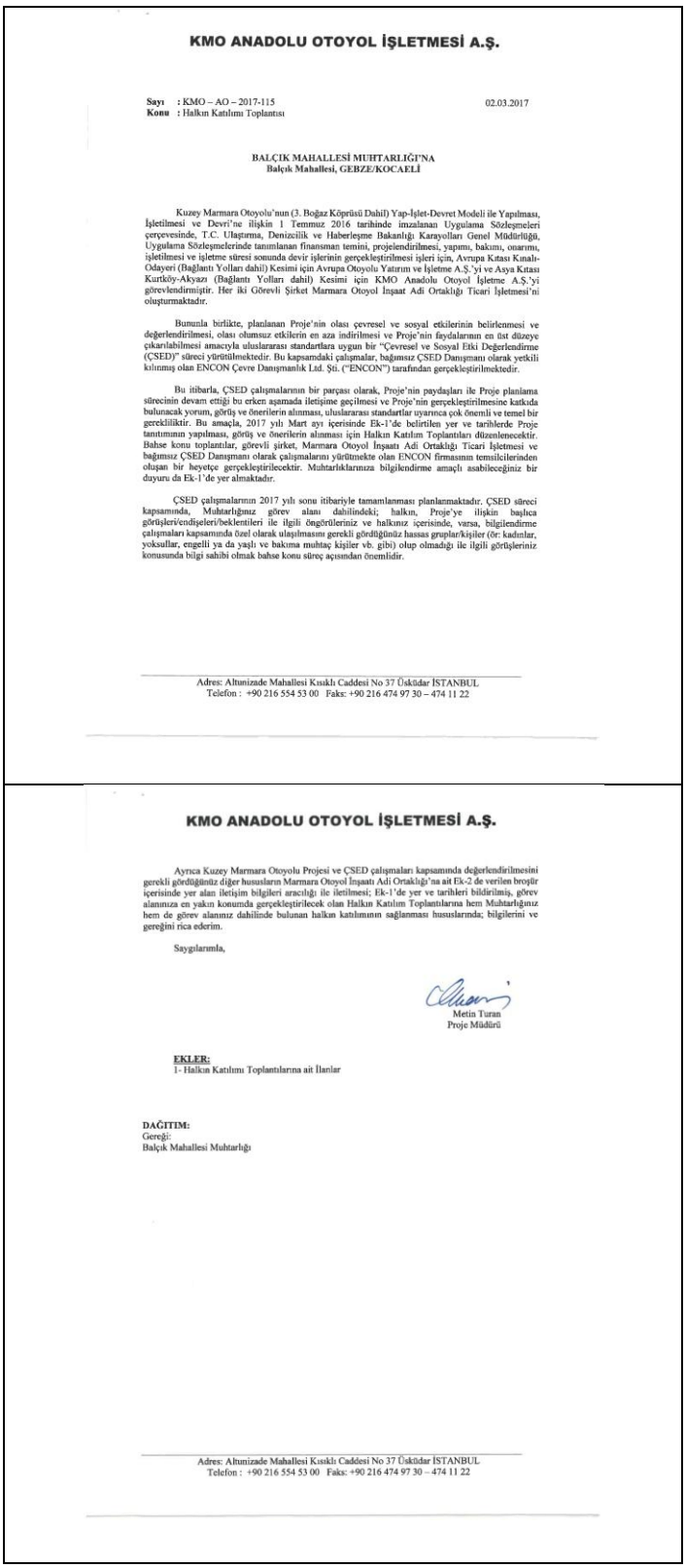
Metin TURAN
Proje Müdürü

DAĞITIM:
Gereği:
Sakarya Valiliği

Bilgi:
Adapazarı Kaymakamlığı
Akyazı Kaymakamlığı

Adres: Altunizade Mahallesi Kısıklı Caddesi No 37 Üsküdar İSTANBUL
Telefon : +90 216 554 53 00 Faks: +90 216 474 97 30 – 474 11 22

Figure 19.6. Official Letter Sent to Sakarya Government



KMO ANADOLU OTOYOL İŞLETMESİ A.Ş.

Sayı : KMO – AO – 2017-115 02.03.2017
Konu : Halkın Katılımı Toplantısı

BALÇIK MAHALLESİ MUHTARLIĞI'NA
Balçık Mahallesi, GEBZE/KOCAELİ

Kuzey Marmara Otoyolu'nun (3. Boğaz Köprüsü Dahil) Yap-İşlet-Devret Modeli ile Yapılması, İşletilmesi ve Devri'ne ilişkin 1 Temmuz 2016 tarihinde imzalanan Uygulama Sözleşmeleri çerçevesinde, T.C. Ulaştırma, Denizcilik ve Haberleşme Bakanlığı Karayolları Genel Müdürlüğü, Uygulama Sözleşmelerinde tanımlanan finansman temini, projelendirilmesi, yapımı, bakımı, onarımı, işletilmesi ve işletme süresi sonunda devir işlerinin gerçekleştirilmesi işleri için, Avrupa Kıtası Kınalı-Odayeri (Bağlantı Yolları dahil) Kesimi için Avrupa Otoyolu Yatırım ve İşletme A.Ş.'yi ve Asya Kıtası Kurtköy-Akyazı (Bağlantı Yolları dahil) Kesimi için KMO Anadolu Otoyol İşletme A.Ş.'yi görevlendirmiştir. Her iki Görevli Şirket Marmara Otoyol İnşaat Adi Ortaklığı Ticari İşletmesi'ni oluşturmaktadır.

Bununla birlikte, planlanan Proje'nin olası çevresel ve sosyal etkilerinin belirlenmesi ve değerlendirilmesi, olası olumsuz etkilerin en aza indirilmesi ve Proje'nin faydalarının en üst düzeye çıkarılabilmesi amacıyla uluslararası standartlara uygun bir "Çevresel ve Sosyal Etki Değerlendirme (ÇSED)" süreci yürütülmektedir. Bu kapsamdaki çalışmalar, bağımsız ÇSED Danışmanı olarak yetkili kılınmış olan ENCON Çevre Danışmanlık Ltd. Şti. ("ENCON") tarafından gerçekleştirilmektedir.

Bu itibarla, ÇSED çalışmalarının bir parçası olarak, Proje'nin paydaşları ile Proje planlama sürecinin devam ettiği bu erken aşamada iletişime geçilmesi ve Proje'nin gerçekleştirilmesine katkıda bulunacak yorum, görüş ve önerilerin alınması, uluslararası standartlar uyarınca çok önemli ve temel bir gerekliliktir. Bu amaçla, 2017 yılı Mart ayı içerisinde Ek-1'de belirtilen yer ve tarihlerde Proje tanıtımının yapılması, görüş ve önerilerin alınması için Halkın Katılım Toplantıları düzenlenecektir. Bahse konu toplantılar, görevli şirket, Marmara Otoyol İnşaatı Adi Ortaklığı Ticari İşletmesi ve bağımsız ÇSED Danışmanı olarak çalışmalarını yürütmekte olan ENCON firmasının temsilcilerinden oluşan bir heyetçe gerçekleştirilecektir. Muhtarlıklarınıza bilgilendirme amaçlı asabileceğiniz bir duyuru da Ek-1'de yer almaktadır.

ÇSED çalışmalarının 2017 yılı sonu itibariyle tamamlanması planlanmaktadır. ÇSED süreci kapsamında, Muhtarlığınız görev alanı dahilindeki; halkın, Proje'ye ilişkin başlıca görüşleri/endişeleri/beklentileri ile ilgili öngörüleriniz ve halkınız içerisinde, varsa, bilgilendirme çalışmaları kapsamında özel olarak ulaşılmasını gerekli gördüğünüz hassas gruplar/kişiler (ör: kadınlar, yoksullar, engelli ya da yaşlı ve bakıma muhtaç kişiler vb. gibi) olup olmadığı ile ilgili görüşleriniz konusunda bilgi sahibi olmak bahse konu süreç açısından önemlidir.

Adres: Altunizade Mahallesi Kısıklı Caddesi No 37 Üsküdar İSTANBUL
Telefon : +90 216 554 53 00 Faks: +90 216 474 97 30 – 474 11 22

KMO ANADOLU OTOYOL İŞLETMESİ A.Ş.

Ayrıca Kuzey Marmara Otoyolu Projesi ve ÇSED çalışmaları kapsamında değerlendirilmesini gerekli gördüğünüz diğer hususların Marmara Otoyol İnşaatı Adi Ortaklığı'na ait Ek-2 de verilen broşür içerisinde yer alan iletişim bilgileri aracılığı ile iletilmesi; Ek-1'de yer ve tarihleri bildirilmiş, görev alanınıza en yakın konumda gerçekleştirilecek olan Halkın Katılım Toplantılarına hem Muhtarlığınız hem de görev alanınız dahilinde bulunan halkın katılımının sağlanması hususlarında; bilgilerini ve gereğini rica ederim.

Saygılarımla,

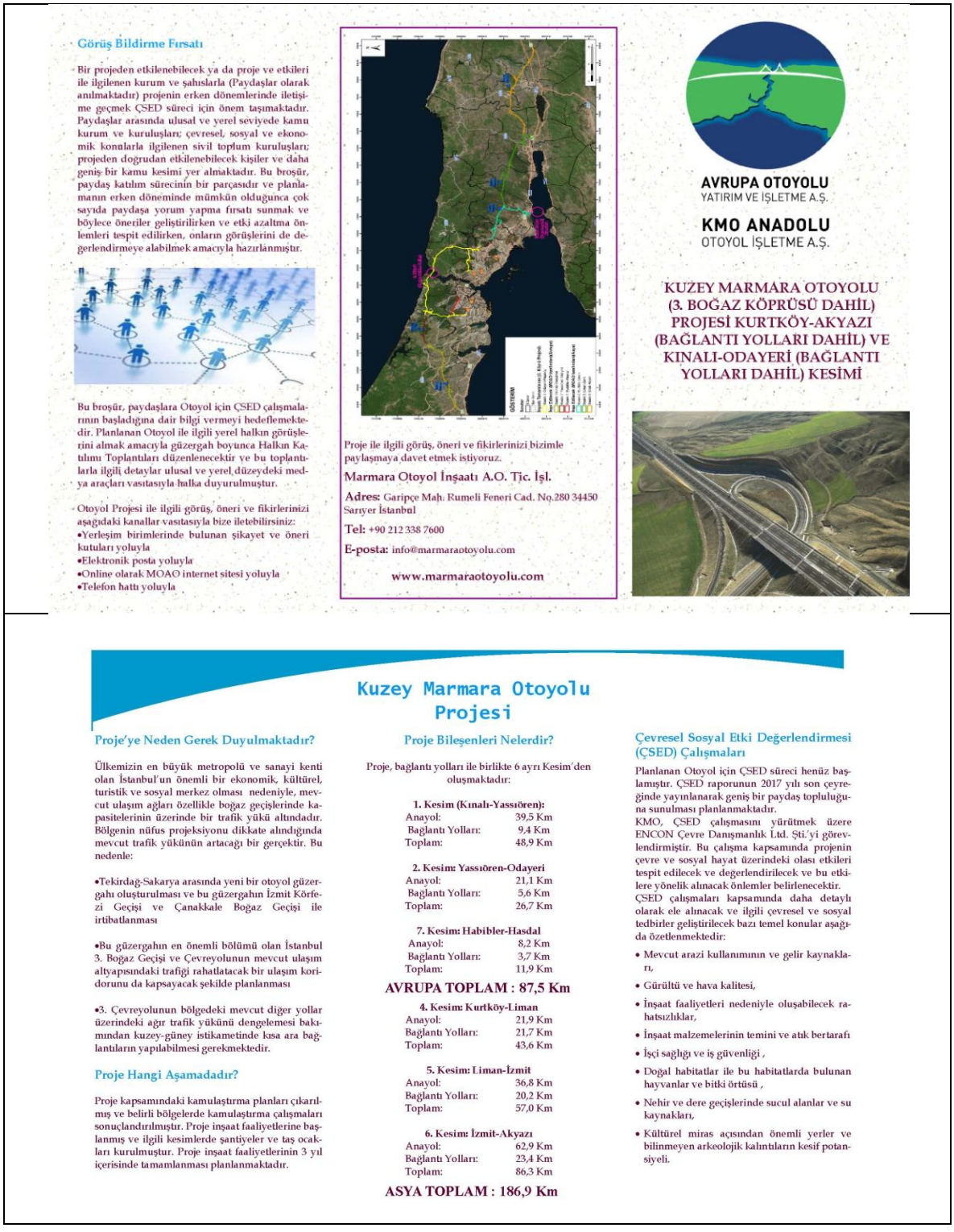
Metin Turan
Proje Müdürü

EKLER:
1- Halkın Katılımı Toplantılarına ait İlanlar

DAĞITIM:
Gereği:
Balçık Mahallesi Muhtarlığı

Adres: Altunizade Mahallesi Kısıklı Caddesi No 37 Üsküdar İSTANBUL
Telefon : +90 216 554 53 00 Faks: +90 216 474 97 30 – 474 11 22

Figure 19.7. Sample Official Letter sent to Neighborhood Headmen



Görüş Bildirme Fırsatı

Bir projeden etkilenebilecek ya da proje ve etkileri ile ilgilenen kurum ve şahıslarla (Paydaşlar olarak anılmaktadır) projenin erken dönemlerinde iletişime geçmek ÇSED süreci için önem taşımaktadır. Paydaşlar arasında ulusal ve yerel seviyede kamu kurum ve kuruluşları; çevresel, sosyal ve ekonomik konularla ilgilenen sivil toplum kuruluşları; projeden doğrudan etkilenebilecek kişiler ve daha geniş bir kamu kesimi yer almaktadır. Bu broşür, paydaş katılım sürecinin bir parçasıdır ve planlamanın erken döneminde mümkün olduğunca çok sayıda paydaşa yorum yapma fırsatı sunmak ve böylece öneriler geliştirilirken ve etki azaltma önlemleri tespit edilirken, onların görüşlerini de değerlendirmeye alabilmek amacıyla hazırlanmıştır.

Bu broşür, paydaşlara Otoyol için ÇSED çalışmalarının başladığına dair bilgi vermeyi hedeflemektedir. Planlanan Otoyol ile ilgili yerel halkın görüşlerini almak amacıyla güzergah boyunca Halkın Katılımı Toplantıları düzenlenecektir ve bu toplantılarla ilgili detaylar ulusal ve yerel düzeydeki medya araçları vasıtasıyla halka duyurulmuştur.

Otoyol Projesi ile ilgili görüş, öneri ve fikirlerinizi aşağıdaki kanallar vasıtasıyla bize iletebilirsiniz:
•Yerleşim birimlerinde bulunan şikayet ve öneri kutuları yoluyla
•Elektronik posta yoluyla
•Online olarak MOAO internet sitesi yoluyla
•Telefon hattı yoluyla

Proje ile ilgili görüş, öneri ve fikirlerinizi bizimle paylaşmaya davet etmek istiyoruz.

Marmara Otoyol İnşaatı A.O. Tic. İşl.

Adres: Garipçe Mah. Rumeli Feneri Cad. No.280 34450 Sarıyer İstanbul

Tel: +90 212 338 7600

E-posta: info@marmaraotoyolu.com

www.marmaraotoyolu.com

AVRUPA OTOYOLU
YATIRIM VE İŞLETME A.Ş.

KMO ANADOLU
OTOYOL İŞLETME A.Ş.

KUZEY MARMARA OTOYOLU (3. BOĞAZ KÖPRÜSÜ DAHİL) PROJESİ KURTKÖY-AKYAZI (BAĞLANTI YOLLARI DAHİL) VE KINALI-ODAYERİ (BAĞLANTI YOLLARI DAHİL) KESİMİ

Kuzey Marmara Otoyolu Projesi

Proje'ye Neden Gerek Duyulmaktadır?

Ülkemizin en büyük metropolü ve sanayi kenti olan İstanbul'un önemli bir ekonomik, kültürel, turistik ve sosyal merkez olması nedeniyle, mevcut ulaşım ağları özellikle boğaz geçişlerinde kapasitelerinin üzerinde bir trafik yükü altındadır. Bölgenin nüfus projeksiyonu dikkate alındığında mevcut trafik yükünün artacağı bir gerçektir. Bu nedenle:

•Tekirdağ-Sakarya arasında yeni bir otoyol güzergahı oluşturulması ve bu güzergahın İzmit Körfezi Geçişi ve Çanakkale Boğaz Geçişi ile irtibatlanması

•Bu güzergahın en önemli bölümü olan İstanbul 3. Boğaz Geçişi ve Çevreyolunun mevcut ulaşım altyapısındaki trafiği rahatlatacak bir ulaşım koridorunu da kapsayacak şekilde planlanması

•3. Çevreyolunun bölgedeki mevcut diğer yollar üzerindeki ağır trafik yükünü dengelemesi bakımından kuzey-güney istikametinde kısa ara bağlantıların yapılabilmesi gerekmektedir.

Proje Hangi Aşamadadır?

Proje kapsamındaki kamulaştırma planları çıkarılmış ve belirli bölgelerde kamulaştırma çalışmaları sonuçlandırılmıştır. Proje inşaat faaliyetlerine başlanmış ve ilgili kesimlerde şantiyeler ve taş ocakları kurulmuştur. Proje inşaat faaliyetlerinin 3 yıl içerisinde tamamlanması planlanmaktadır.

Proje Bileşenleri Nelerdir?

Proje, bağlantı yolları ile birlikte 6 ayrı Kesim'den oluşmaktadır:

1. Kesim (Kınalı-Yassıören):

Anayol:	39,5 Km
Bağlantı Yolları:	9,4 Km
Toplam:	48,9 Km

2. Kesim: Yassıören-Odayeri

Anayol:	21,1 Km
Bağlantı Yolları:	5,6 Km
Toplam:	26,7 Km

7. Kesim: Habibler-Hasdal

Anayol:	8,2 Km
Bağlantı Yolları:	3,7 Km
Toplam:	11,9 Km

AVRUPA TOPLAM : 87,5 Km

4. Kesim: Kurtköy-Liman

Anayol:	21,9 Km
Bağlantı Yolları:	21,7 Km
Toplam:	43,6 Km

5. Kesim: Liman-İzmit

Anayol:	36,8 Km
Bağlantı Yolları:	20,2 Km
Toplam:	57,0 Km

6. Kesim: İzmit-Akyazı

Anayol:	62,9 Km
Bağlantı Yolları:	23,4 Km
Toplam:	86,3 Km

ASYA TOPLAM : 186,9 Km

Çevresel Sosyal Etki Değerlendirmesi (ÇSED) Çalışmaları

Planlanan Otoyol için ÇSED süreci henüz başlamıştır. ÇSED raporunun 2017 yılı son çeyreğinde yayınlanarak geniş bir paydaş topluluğuna sunulması planlanmaktadır.
KMO, ÇSED çalışmasını yürütmek üzere ENCON Çevre Danışmanlık Ltd. Şti.'yi görevlendirmiştir. Bu çalışma kapsamında projenin çevre ve sosyal hayat üzerindeki olası etkileri tespit edilecek ve değerlendirilecek ve bu etkilere yönelik alınacak önlemler belirlenecektir.
ÇSED çalışmaları kapsamında daha detaylı olarak ele alınacak ve ilgili çevresel ve sosyal tedbirler geliştirilecek bazı temel konular aşağıda özetlenmektedir:

- Mevcut arazi kullanımının ve gelir kaynakları,
- Gürültü ve hava kalitesi,
- İnşaat faaliyetleri nedeniyle oluşabilecek rahatsızlıklar,
- İnşaat malzemelerinin temini ve atık bertarafı
- İşçi sağlığı ve iş güvenliği ,
- Doğal habitatlar ile bu habitatlarda bulunan hayvanlar ve bitki örtüsü ,
- Nehir ve dere geçişlerinde sucul alanlar ve su kaynakları,
- Kültürel miras açısından önemli yerler ve bilinmeyen arkeolojik kalıntıların kesif potansiyeli.

Figure 19.8. Brochure distributed during PCMs

KUZEY MARMARA OTOYOLU PROJESİ KURTKÖY-AKYAZI KESİMİ
(BAĞLANTI YOLLARI DAHİL)
HALKIN BİLGİLENDİRİLMESİ TOPLANTILARINA DAVET

KMO Anadolu Otoyol İşletme A.Ş. tarafından, İstanbul, Kocaeli, Sakarya İl sınırları içerisinde Yap-İşlet-Devret (YİD) modeli ile yapılması ve işletilmesi planlanan Kuzey Marmara Otoyolu Projesi Kurtköy-Akyazı Kesimi'ne (Bağlantı Yolları Dahil) ait proje finansmanı şartı olarak yürütülen Çevresel ve Sosyal Etki Değerlendirmesi (ÇSED) çalışmaları kapsamında halkı bilgilendirmek, halkın görüş ve önerilerini almak, yatırım ve işletme dönemlerinde halk ile işbirliği tesis etmek üzere İdare tarafından planlanan otoyol güzergahı üzerinde aşağıda detayları verilen **"Halkın Katılımı Toplantıları"** düzenlenecektir.

Halkımıza saygı ile duyurulur.

Toplantı Tarih ve Yerleri

13.03.2017 Pazartesi; Saat 16:00	Demirciler Mahalle Kahvehanesi
14.03.2017 Salı; Saat 11:00	Sevindikli Mahalle Kahvehanesi
15.03.2017 Çarşamba; Saat 11:00	Çayırköy Mahalle Kahvehanesi
15.03.2017 Çarşamba; Saat 16:00	Korucuk Ulubey Tesisleri
16.03.2017 Perşembe; Saat 11:00	Osmanbey Mahalle Kahvehanesi

Proje Sahibi : KMO Anadolu Otoyol İşletme A.Ş.
Tel : 0 (212) 338 76 00
GSM : 0 (533) 722 19 08
Faks : 0 (212) 338 76 99

ÇSED Raporunu
Hazırlayan Kuruluş : ENCON Çevre Danışmanlık Ltd. Şti.
Tel : (0312) 447 71 22
Faks : (0312) 447 69 88

Figure 19.9. Invitation Letters announced in the Neighborhoods

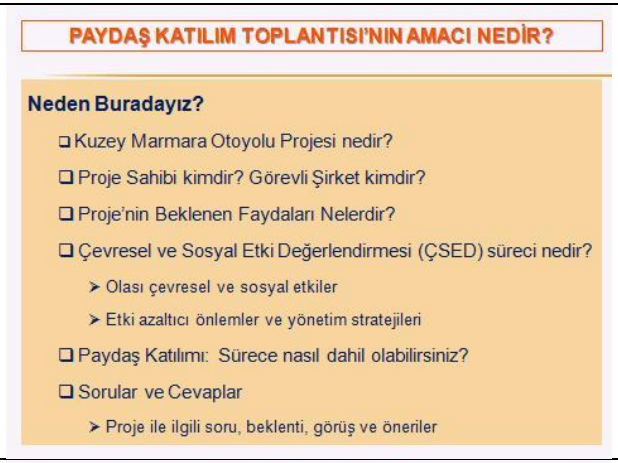


Figure 19.10. Project Information Presentation that presented to the PCM Participants-1-

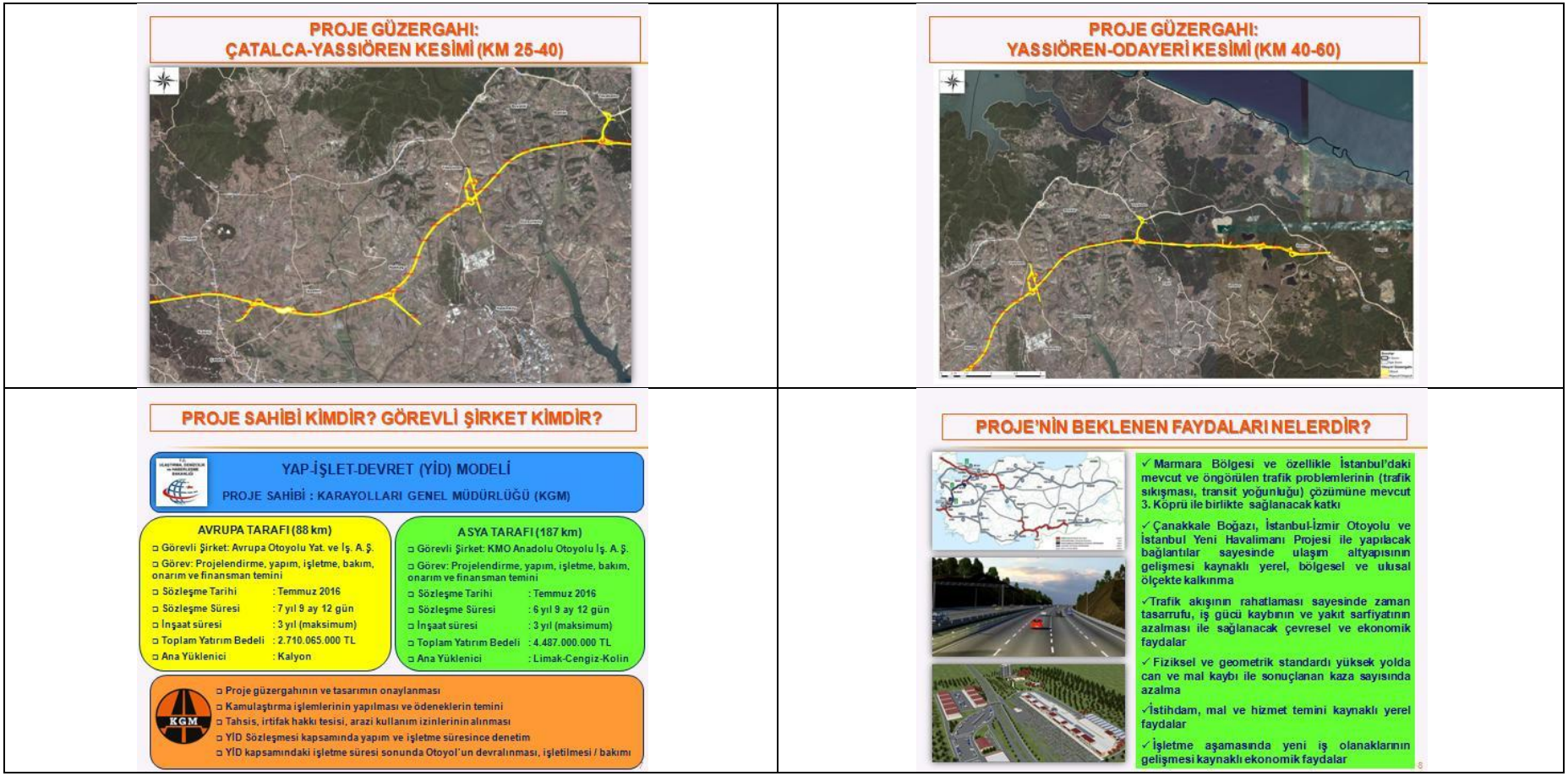
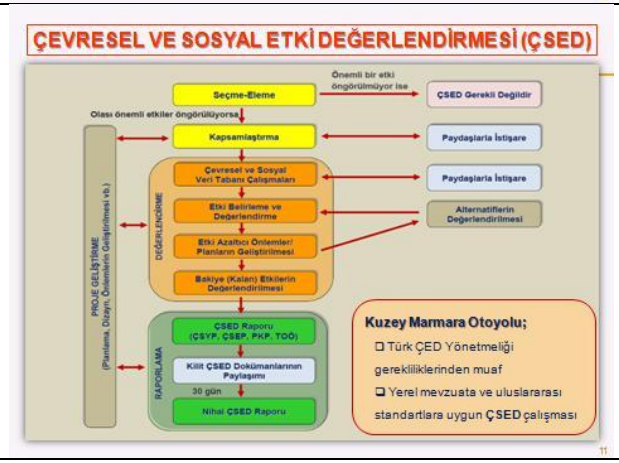


Figure 19.10. Project Information Presentation that presented to the PCM Participants-2-



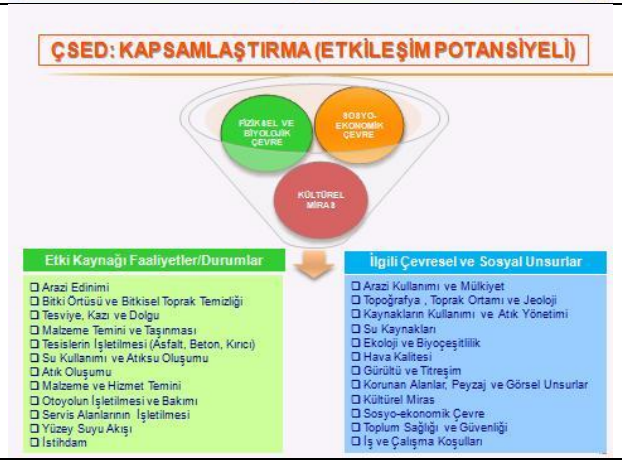


Figure 19.10. Project Information Presentation that presented to the PCM Participants-3-

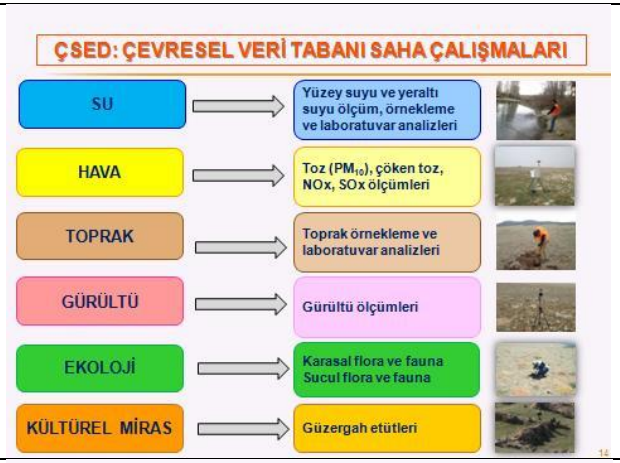


Figure 19.10. Project Information Presentation that presented to the PCM Participants-4-

Figure 19.10. Project Information Presentation that presented to the PCM Participants-5-

Figure 19.10. Project Information Presentation that presented to the PCM Participants-6-

19.4.2. Pictures from Public Consultation Meetings

Photographs from PCM are presented below:

PCM 1: Demirciler Neighborhood (Kocaeli, Dilovasi)

Photograph 19.1. Introduction

Photograph 19.2. Participants

Photograph 19.3. Women Participants from Yagcilar Neighborhood

Photograph 19.4. Questions and Answers Session (Speech of Demirciler Neighborhood Headman)

Photograph 19.5. Discussions on the Map o Relevant Route Section

PCM 2: Sevindikli Neighborhood (Kocaeli, Korfez)

Photograph 19.6. Participants Outside the Teahouse

Photograph 19.7. Introduction

Photograph 19.8. Presentation

Photograph 19.9. Questions and Answers Section (Speech of Korfez Municipality's Vice Mayor)

Photograph 19.10. Questions and Answers Session (Questions Received From Outside of the Teahouse)

Photograph 19.11. Questions and Answers Session (Reply Given to Participants who are Outside of the Teahouse)

PCM 3: Cayirkoy Neighborhood (Kocaeli, Izmit)

Photograph 19.12 Map of Relevant Route Section Posted at the Meeting Room

Photograph 19.13. Participants Outside the Teahouse

Photograph 19.14. Presentation

Photograph 19.15. Questions and Answers Session (Speech of Cayirkoy Neighborhood Headman)

Photograph 19.16. Questions and Answers Session

Photograph 19.17. Questions and Answers Session

PCM 4: Korucuk Neighborhood (Sakarya, Adapazari)

Photograph 19.18. Introduction

Photograph 19.19. Presentation

Photograph 19.20. Participants

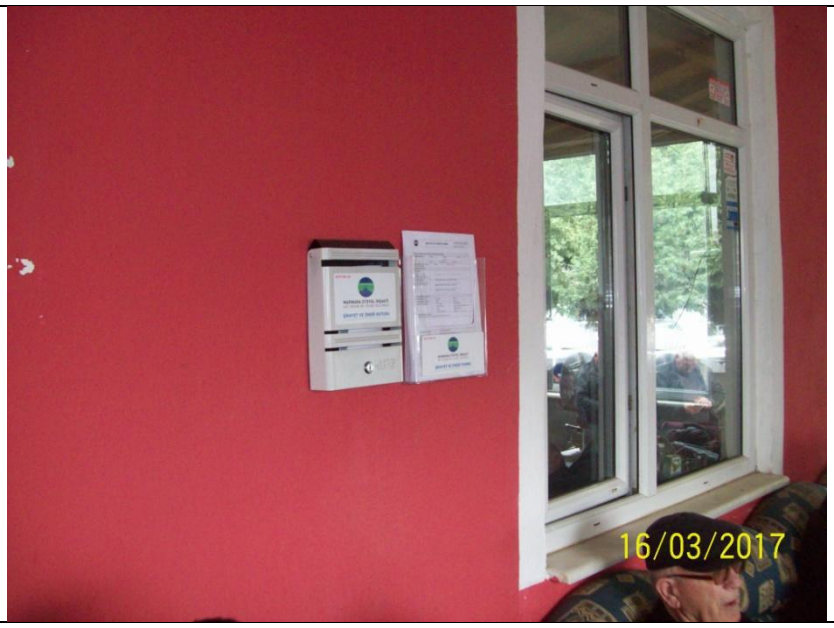
Photograph 19.21. Questions and Answers Session

Photograph 19.22. Questions and Answers Session

Photograph 19.23. Participants Reviewing the Route After the Meeting

PCM 5: Osmanbey Neighborhood (Sakarya, Akyazi)

Photograph 19.24. Participants Outside the Teahouse



Photograph 19.25. Comment and Grievance Box and Forms

Photograph 19.26. Presentation

Photograph 19.27. Questions and Answers Session

Photograph 19.28. Participants

Photograph 19.29. Map of Relevant Route Section Posted at the Meeting Room

CHAPTER 20

ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

CHAPTER 20. ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

In accordance with KGM's Technical Specifications, Project Sponsor will establish certified (ISO 14001 and OHSAS 18001) Quality Management Systems. These systems will aim to ensure that all the construction activities and the services to be provided would cover quality assurance aspects. In addition to providing quality assurance, the Project will be implemented in accordance with national environmental and health and safety legislation and also IFC requirements on subject matter. This "Environmental and Social Management System" (ESMS) has been developed as a part of the Project's ESIA process in order to generate a systematic approach for daily implementations within the North Marmara Motorway Project.

This ESMS consists of the following elements:

(i) Project's policies on environmental, health, safety and labor aspects;
(ii) Organizational structure of the Project;
(iii) An integrated Environmental and Social Management Plan (ESMP) defining the main management approaches and mitigation measures for relevant environmental and social subjects;
(iv) Framework for the monitoring and review of the ESMP

In addition, the Emergency Preparedness and Response Plan (see Annex-3) and the Stakeholder Engagement Plan (see Annex-11) prepared as a part of the ESIA Report will be complementary parts of the Project's ESMS. Besides, a Cultural Heritage Management Plan and a Chance Finds Procedure have been prepared as a part of the studies conducted on the archaeology and immovable cultural heritage (see Annex-10 for the Study Report on the Archaeology and Immovable Cultural Heritage).

The Project ESMS has been established to ensure that all the implementations within the Project will be carried out in an environmentally sound manner. The system will also provide the main framework for implementation of health and safety measures for the employees and the affected communities.

As a part of the ESMS, the ESMP will be consisting of procedures indicating the good practices, mitigation measures and monitoring. However the system will not be limited with the provisions laid out in the document since continual improvement will be carried out through an ongoing process of reviewing, correcting and improving it. The ESMS will be implemented by the Project Sponsors and all the contractors and contractors and contractors and subcontractors involved. With effective implementation of the ESMS, compliance with the applicable national and international legislation and standards will be guaranteed.

20.1. Environmental and Social Policy Framework

Marmara Otoyolu Joint Venture (MOJV) is committed to implement the Project in line with the commitments and measures contained in this ESIA, which have been developed and proposed on the basis of the Equator Principles and the relevant requirements of the IFC performance standards and EHS Guidelines. In this context, the Project will follow the principles defined in this ESMS (including the ESMP) and establish ISO 14001 and OHSAS 18001 Quality Management Systems. Based on the framework provided in this ESMS, a Project-specific Environmental and Social Policy will be developed and implemented by the MOJV including but not limited to the main principles defined below.

20.1.1. Environmental Policy

The objective for setting out an environmental policy is to follow sustainability principle by implementing all the Project activities in accordance with national and international environmental requirements. Environmental compliance will be taken into account in all Project phases.

The potential impacts of the Project and the mitigation measures to be taken are defined in the ESIA Report and the ESMP. MOJV will be the responsible party for taking all necessary measures for avoiding/minimizing these impacts to environment. Key areas of impact have been identified as; air quality, water quality and wastewater, solid and hazardous waste, noise and habitat fragmentation. The following environmental principles will be followed by the project owner for developing an environmental policy:

- An environmental responsible/officer will be in charge in all phases of the Project.
- Environmental protection measures will be integrated in planning and design phases of the Project.
- The environmental friendly technologies will be preferred for construction and operation processes in order to minimize the impacts.
- All the activities will be carried out in accordance with national environmental legislation and international standards.
- Necessary trainings will be provided for all the employees and subcontractors to be working on site.
- Affected community will be informed about the environmental policy and implementations on site.
- All necessary measures will be taken in order to avoid any pollutant releases in environmental receiving media.
- Minimization of waste generation will be promoted through raising awareness via visual aid and trainings. Reusing and recycling methods will be placed for solid waste.
- The “Emergency Preparedness and Response Plan” will be implemented in order to minimize reaction time and adverse effects in cases of environmental accidents/incidents

- Conservation of the biodiversity elements within the Project area, minimizing the impacts on ecology, biodiversity and habitats will be taken into consideration during policy development.

20.1.2. Health and Safety Policy

The working environment should be healthy and safe for employees and also the local communities with which the Project will be in interaction. Thus, the Project Sponsors will develop and implement a Policy for occupational and community health and safety in order to ensure that the risks of accidents/incidents will be reduced to a minimum or more preferably to zero and all Project activities are undertaken in accordance with the requirements of relevant national and international regulations on health and safety aspects.

Project's Policy will address the importance of health and safety in construction works and also during operation. Through this Policy, Project Sponsors will be committing that all legislative requirements will be met with best practices and international standards and also convention provisions will be acknowledged, integrated into the policy and implemented. The Policy will be implemented by the employees and also the contractors/subcontractors to be employed by the MOJV during construction and operation activities. Commitment will be the main principle in implementing health and safety policies and be accepted by all employees at all levels.

MOJV will be the responsible party for taking all necessary measures for avoiding/minimizing health and safety impacts/risks. Key areas of impact/risk have been identified as; physical hazards, chemical hazards, training needs, noise exposure, usage of personal protective equipments (PPEs) under the occupational health and safety subject and traffic and fire safety under the community health and safety aspect. The following principles will be followed by the Project Sponsors for developing an occupational health and safety policy:

- All necessary measures will be taken in order to avoiding any hazards to employees caused by the working environment, working equipment or to local communities or wider public due to the construction or operation activities planned in the scope of the Project.
- A risk assessment will be realized including all areas of work. The risk assessment will be a living document and will be updated as required by the legislation.
- Necessary action will be carried out in order to reduce risks to a minimum.
- Certain procedures will be developed, periodically updated, maintained on an easily accessible media and communicating certain procedures for health and safety based on the requirements of working environment and the nature of the job.
- The Project Sponsors will promote PPE usage and supply all necessary equipment to all employees.
- The Project Sponsors will provide all necessary information, training and direction to all employees.
- The Project Sponsors will establish communication lines with the Project personnel and local communities for emergency response.

- The Project Sponsors will evaluate the risks and impacts of the Project to the health and safety of local communities, and take preventive measures to eliminate the identified risks and impacts.

- The Project Sponsors will avoid polluting environmental media and causing any hazard to community.
- The Project Sponsors will inform the close community of health and safety policies and potential risks.
- The Project Sponsors will take all necessary measures to reduce or eliminate the risks arising from the traffic load generated by the project.
- A Project-specific “Emergency Preparedness and Response Plan” will be prepared based on the framework provided in the ESIA Report (see Annex-3) in order to minimize reaction time and adverse effects in cases of health and safety accidents/incidents.

20.1.3. Labor and Employment Policy

Project Sponsors will take all necessary actions and measures for labor and employment in order to be in compliance with Turkish legislation and international standards. For this purpose, a Labor and Employment Policy will be developed by the Project Sponsors.

National labor law and related regulations covers the basic principles of international labor standards and the IFC Performance Standard 2 in the issues of equal treatment of employees, restrictions on the working age and employment of children, avoidance of forced labor and ensuring occupational health and safety at the workplaces. In this regard, the following measures to be taken by the Project Sponsor will underlie the Labor and Employment Policy of the Project, while all other requirements of the national legislation will be strictly fulfilled.

- No discrimination based on language, race, sex, political opinion, philosophical belief, religion and sex or similar reasons will be permitted by the Project Sponsors in the employment relationship.
- Working age restrictions of the Turkish Labor Law will be complied with.
- The employee’s consent will be taken for overtime work and the overtime work arrangements will be done in accordance with the Turkish Labor Law.
- The Project Sponsors will take all the necessary measures and maintain all the needed means and tools in full; and ensure that those measures taken in the field of occupational health and safety are strictly obeyed by all employees.
- Retrenchment of the construction workforce following the completion of construction activities will be done in compliance with all legal and contractual requirements. Retrenchment activities will be conducted under a plan that will be in compliance with IFC PS2.

20.2. Organization Capacity and Competency

The North Marmara Motorway is a Project planned by the Turkish Ministry of Transport, Maritime Affairs and Communications (MoTMAC), General Directorate of Highways ("KGM") in accordance with the Law on Implementation of Some of the Investments and Services in the Framework of Build, Operate and Transfer Model (Law No: 3996). KGM, as the Project's owner and administrative authority, has commissioned two different special purpose entities (SPV) for the implementation of the European and Asian sections of the North Marmara Motorway Project under the related Build, Operate and Transfer (BOT) contracts. In this regard, Avrupa Otoyolu Yatirim ve Isletme A.S. (Avrupa OYIAS) has been awarded with a BOT Contract for the implementation of the European part (European sections: Kinali-Yassioren, Yassioren-Odayeri and Habibler-Hasdal sections) of the Project and KMO Anadolu Otoyol Isletme A.S. (Anadolu OIAS) has been awarded with a BOT Contract for the implementation of the Asian part (Asian sections: Kurtkoy-Liman; Liman-Izmit and Izmit-Akyazi sections) of the Project. These two entities together form the Marmara Otoyolu Joint Venture (MOJV) and referred as the Project Sponsors within the ESIA process.

Under the MoTMAC, GD of KGM, Istanbul 1st Regional Directorate is the related local authority responsible from the implementation of the Project. The SPVs (Avrupa OYIAS and KMO Anadolu OIAS) established for the Project and a private consulting company act under the KGM's 1st Regional Directorate, as depicted in the organizational chart presented in Figure 20.1. MOJV will be the main contractor of the Project. All the commitments presented in this report will be owned by the MOJV.

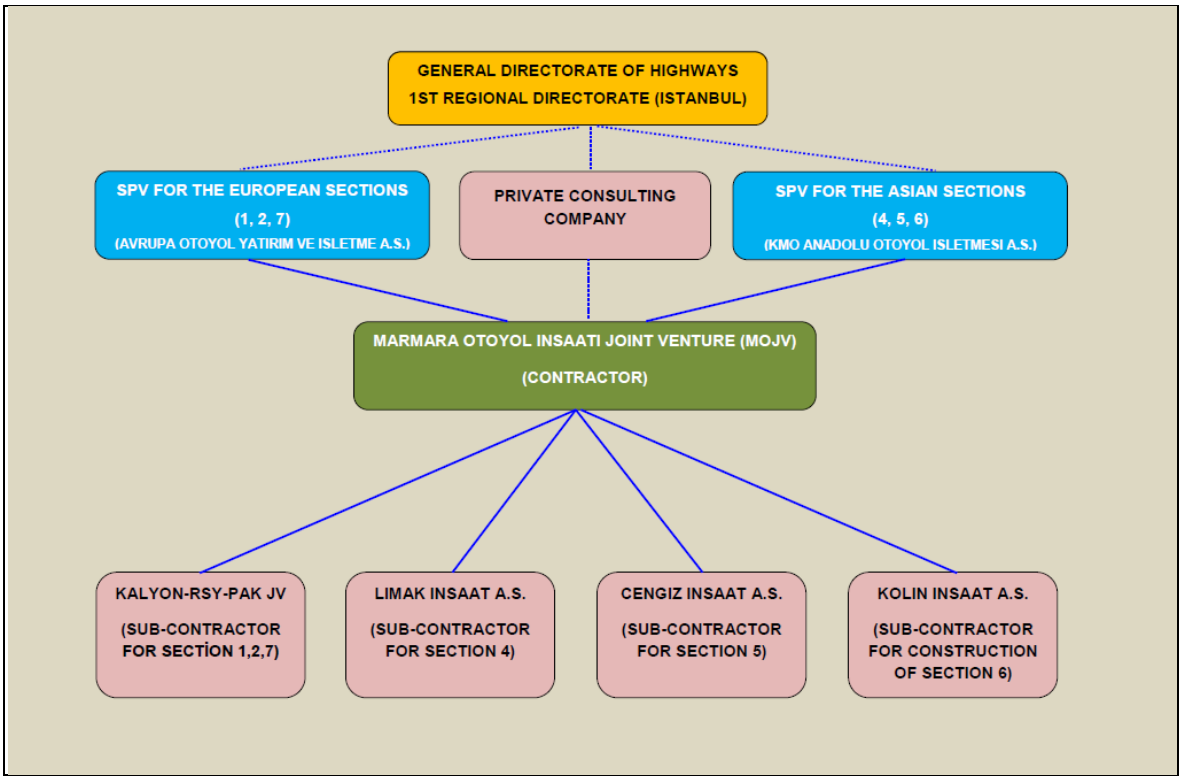


Figure 20.1. Organizational Structure of the Project

As the Project Owner, key responsibilities of KGM will include the approval of Motorway route and design; execution of the expropriation works (according to Article 13 of the BOT Contract) in line with the relevant provisions of the Expropriation Law, acquisition of other land use (forestry, agricultural, pasture, etc.) permits, easement rights, etc. in accordance with relevant Turkish legislation and ensuring minimum traffic guarantee. Technical and legal supervision and control of the construction and operation works will also be executed by the personnel or independent consulting firms to be assigned by the KGM.

Project Sponsors will be the main responsible party for the implementation of the ESMS including the ESMP, while it will also have a coordinating role in the actions to be undertaken by the third parties (i.e. contractors/sub-contractors Provincial Directorate of Environment and Urbanization, other related authorities), as required. Project Sponsors does not have any responsibility or authority regarding the execution of expropriation works but they are liable to provide up to 500 million TL for the expropriation costs in each section. The costs exceeding this amount will be provided by the KGM. The costs related with the procurement of services for the valuation works and others will be separately covered by the Project Sponsors.

The detailed organizational structure to be developed by the Project Sponsors for the construction and operation phases of the Project will assign specific personnel(s) (e.g. environmental officer/expert, Environmental and OHS expert) who has the required knowledge, skills and experience for the environmental and health and safety tasks (i.e. compliance with legislative environmental requirements, taking mitigation/corrective actions, monitoring, etc.) to be conducted under this ESMS. Mechanisms will be established to inform the top management about the environmental and social performance of the Project.

20.2.1. Construction Phase

During the construction phase, workforce requirements of the Project will be large-scale (including the contractors and sub-contractors, anticipated to reach up to a few thousands during the peak phase of the activities). According to the BOT Contract, Contract Duration covers both the construction and operation phases. Contract Duration for the Asian sections has been specified as 6 years 9 months 12 days, within which construction phase will be completed in maximum 3 years. Though the construction phase will be temporary, the Project Sponsors will ensure that an organizational capacity sufficient for the implementation of the ESMS is established and maintained throughout the construction period.

Within the organizational structure, several directorates serve for the execution of works. An Environmental Department, which is responsible from the performance of environmental and social tasks, has already been established by the MOJV under the Management Systems Directorate. The Environmental Department is lead by an Environmental Manager and supported by a Community Liaison Officer, an Environmental Permitting Officer and a Cultural Heritage/Archaeology Expert hired for the Project. Contractor's environmental and health and safety departments are also reporting to Project's environmental and health and safety departments. Separate Health and Safety and Public Relations Departments are also serving under the Management Systems Directorate. The current organizational structure is presented in Figure 20.2.

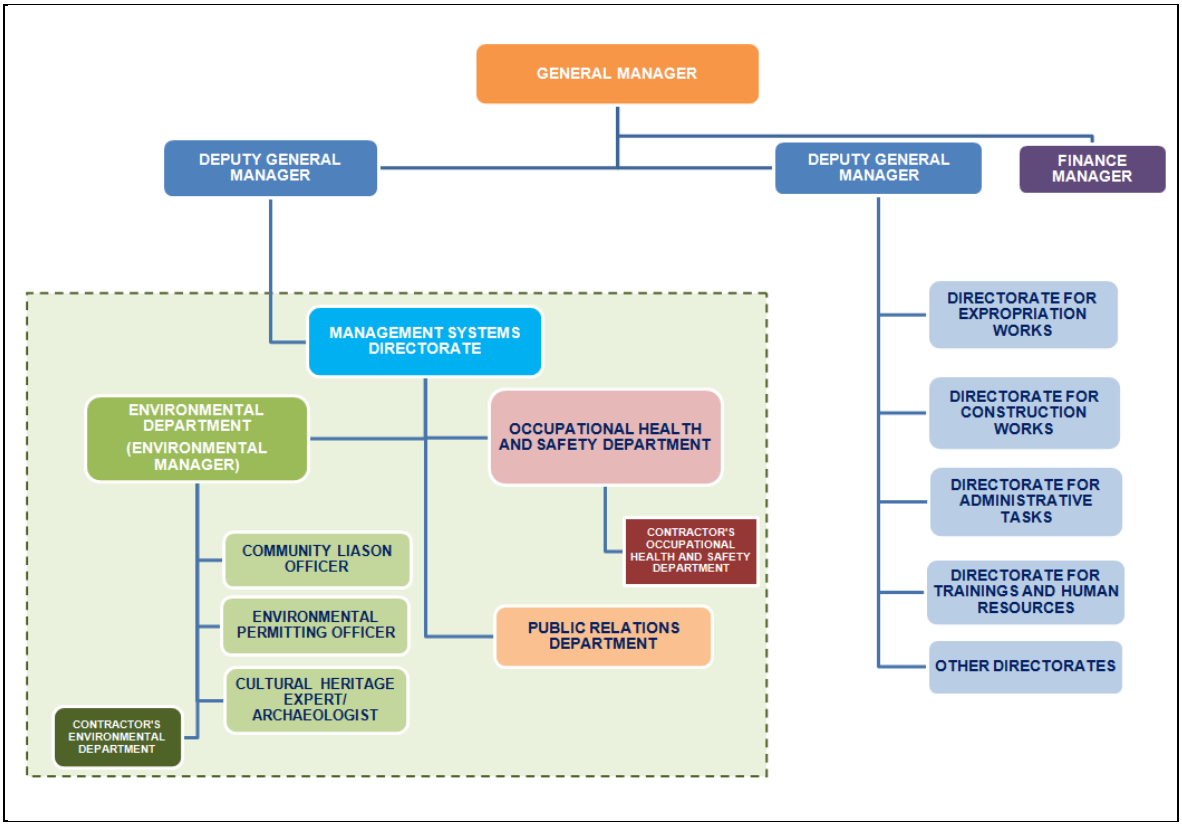


Figure 20.2. Organizational Structure of the MOJV for the Construction Phase

Relevant procedures of the ESMP will be implemented throughout the construction phase under the direction of the Environmental Department. The Environmental Manager will clearly define the responsibilities in the scope of the ESMS and communicate these responsibilities to the relevant personnel. Provision of sufficient human and financial resources required for the effective implementation of the ESMS will be ensured by the Project Sponsor through the Directorate for Trainings and Human Resources established under the existing organizational structure. Key responsibilities of the Environmental Manager cover the following. These responsibilities will be expanded throughout the Project, as needed:

- Supervising the proper fulfillment of all environmental measures as set out in the ESMP or which may further be added.
- Liaison with regulatory government agencies and communicating with local communities and responding to any complaints that may arise, as required.
- Delivering environmental training and awareness programs to Project personnel prior to and during on-site works.
- Providing technical assistance on environmental subjects to Project personnel and government auditing officers.
- Carrying out monitoring activities as required and preparing reports at regular frequencies which summarize activities and actions taken, and submitting these reports to the appropriate organizations.
- Supervising implementation of general good environmental practice.

The Environmental Manager will identify requirements for the ESMP changes (i.e. may be due to certain changes in the Project, technology, legislation, etc.) and make the relevant revisions in the ESMS and the ESMP accordingly. In case of a need for such a change or revision, related authorities will be informed by the Environmental Manager on behalf of the Project Sponsors, in a written format regarding the changes/revisions to be made and their reasons. The environmental responsibilities and the relevant ESMP requirements will also be included in the contracts that will be signed with the contractors, if there is any.

20.2.2. Operation Phase

Following the completion of construction, the operation phase of the Contract Duration will start. If the construction period, which is specified as maximum 3 years, exceeds 3 years, the delay time (the time after 3 years) will be deducted from the operation period. If the construction of the Motorway is completed before the end of foreseen construction period (3 years), the remaining time will be added to operation period. In the operation phase, relevant personnel will be directly and indirectly employed at the operation and maintenance buildings/facilities as well as the service areas. Project Sponsors will continue to ensure that an organizational capacity sufficient for the implementation of the ESMS is maintained throughout the operation period under the BOT Contract Duration. At the end of the contract Duration, the motorway will be transferred to the KGM.

The organizational structure of the MOJV will be adapted to the requirements of the operation phase prior to start of Motorway's operation. To ensure competency, Project Sponsors will ensure that the operation and maintenance personnel are properly trained in their specialty and successfully completed the necessary security investigations in accordance with the related terms of the BOT contract. For the same purpose, trainings on the aspects related with the operation and maintenance of Motorway will be provided by Project Sponsors to KGM's designated operation and maintenance personnel one year ahead of the end of the contract duration,.

The Project/Operating Manager on behalf of the Project Sponsor will coordinate the relations with the Provincial Directorate of Environment and Urbanization and other related authorities.

20.3. Environmental and Social Management Plan (ESMP)

Environmental and Social Management Plans (ESMP) are set forward to implement principles that are required to prevent, control and minimize potential impacts of the project on the natural environment, wildlife and local communities. The idea is to apply environmentally sound management strategies in line with related Turkish and international regulations to carry out project activities conserving the integrity of natural systems without changing air, water and soil qualities. As a part of the ESMS, an ESMP, consisting of sub-procedures on the management of environmental (e.g. water and wastewater, waste, hazardous materials, wildlife, etc.) and health and safety (occupational and community related) aspects of the Project has been prepared.

Under the ESMP, several subject specific procedures, laying out the main management approaches and mitigation measures together with a monitoring scheme in order to assess the effectiveness of mitigation measures to be implemented, have been developed. The Project ESMP including those procedures, as listed below, is presented in Annex-6 of the ESIA Report.

- Environmental Management Plan
  - Air Quality and Emissions Management Procedure
  - Water Quality, Wastewater and Stormwater Management Procedure
  - Solid Waste Management Procedure
  - Hazardous Waste Management Procedure
  - Noise Management Procedure
  - Habitat Alteration, Fragmentation and Wildlife Management Procedure
  - Quarry Management Procedure
  -
- Occupational Health and Safety Management Plan
  - Physical Hazards Management Procedure
  - Chemical Hazards Management Procedure
  - Noise Management Procedure
  - Personal Protective Equipment (PPE) Management Procedure
  - Communication and Training Management Procedure
  -
- Community Health and Safety Plan
  - Fire Management Procedure
  - Traffic Management Procedure

20.4. Monitoring and Review

The effective implementation of the ESMS/ESMP will be monitored through appropriate tools such as site audits, environmental monitoring efforts, checking of related documents, etc. In this regard, an Environmental and Social Monitoring Plan has been developed for the Project as presented in Table 20.1. This program will be used as a tool to support the ESMP monitoring. Project Sponsors will conduct internal inspections and audits to verify compliance with the desired ESMS/ESMP outcomes. Where necessary, external/independent experts would be commissioned by lenders to verify environmental and social monitoring information and/or perform monitoring services. Costs associated with the environmental monitoring will be supplied by Project Sponsors, as it is usually done for lenders' experts/consultants, from the Project Budget. The frequency of the monitoring will be as follows:

- Quarterly during the construction phase;
- Annually during the operation phase throughout the BOT Contract Duration.

The results of the environmental and social monitoring activities will be compiled in "ESMP Performance Review and Monitoring Reports (Monitoring Reports)" to be prepared in line with the frequency of the monitoring studies. The Monitoring Reports will include documentation of Project's compliance against ESIA, ESMP and ESAP commitments. Based on the monitoring results, necessary corrective and preventive actions will be indentified and amendments will be made on the ESMS and the ESMP accordingly. Such amendments will be included in the monitoring program and followed up in the upcoming monitoring studies to ensure effective implementation. If requested the monitoring reports will also be shared with the governmental authorities.

The Environmental Manager will share the key monitoring results and performance review of the ESMS with the senior management (i.e. Management System Director, Deputy General Manager) and plan the necessary measures to be taken to ensure effective implementation of environmental and social measures.

In addition to the monitoring to be conducted by independent experts, the Environmental Department will establish a system for internal inspections/audits to be done for monitoring of environmental and social performance of the Project. Besides, local authorities and the Ministry of Environment and Urbanization (MoEU) has the authority to execute monitoring and inspection activities to follow-up the conformity of the Project activities with the environmental requirements as per the relevant legislation.

Table 20.1. Environment and Social Monitoring Plan for the Project

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
Land Preparation and Construction							
C1	Environmental and Social Management System (ESMS)	C1.1. Policy and ESMP	-Project-specific Environment and Social Policy -Organizational Structure (number and CVs of the personnel employed under the Environmental Department) -Periodical ESMP Performance Review and Monitoring Reports -Number of non-compliant situations -Project-specific Emergency Preparedness and Response Plan -Existence and validity of the legal environmental and health and safety permits -Budget allocated/spent for ESMP implementation -Number and scope of trainings, number of participants, training hours per employee, training materials, trainings provided to contractors/sub-contractors, etc. -Measures taken to ensure compliance of contractors/sub-contracts with ESMP measures	Project office	Document review	Quarterly	-MOJV -Independent experts
C2	Land Use and Property	C2.1. Forest lands	-Forestry permits/applications -Afforestation protocols made with the Ministry of Forestry and Water Affairs -Area of lost forestland (in hectare) -Number of the trees cut -Records on forest fires (if any)	Project office	Document review	Quarterly	-MOJV -Independent experts
			-Locations and length of viaducts and tunnels	Locations of viaducts and tunnels	Site audit Document review	Quarterly	-MOJV -Independent experts
		C2.2. Agricultural lands	-List of expropriated agricultural parcels (inc. information on area and characteristics of the land plot) - Site allocation documents for expropriated lands; bilateral agreements, commitment and consent letters for non-expropriated lands	Project office	Document review	Quarterly	-MOJV -Independent experts
			-Grievances received in the subjects of crossing of the expropriation borders, start of activities on non-expropriated lands, etc.)	Project office	Review of grievance logs	Quarterly	-MOJV -Independent experts

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
		C2.3.Pasturelands	-Area and number of pasturelands for which land use permits taken	Project office	Document review	Quarterly	-MOJV -Independent experts
C3	Topography and Soils	C3.1. Top soil management	-Stripped/stored top soil volumes (m^3) -Reinstated top soil volumes (m^3) and locations -Conditions of the top soil storage sites (height, side slopes, drainage, etc.)	-Top soil storage sites -Rehabilitated areas	Site audit	Quarterly	-MOJV -Independent experts
		C3.2.Earthworks	-Excavation and fill volumes (m^3) -Volume of reused materials (m^3) -Conditions at the storage sites	Excavated material storage sites	Site audit	Quarterly	-MOJV -Independent experts
		C3.3. Erosion	-Erosion control measures taken (drainage channels, barriers, settling structures, etc.) -Area of exposed lands at each work sites (m^2)	Locations of exposed lands within the expropriation corridor	Site audit	Quarterly	-MOJV -Independent experts
		C3.4. Quarry	-Operation licenses -Mining method applied -Production amount (m^3/day) -Slope stability -Borders of the work sites -Management of waste rock	Location of quarries	Site audit	Quarterly	-MOJV -Independent experts
		C3.5. Soil quality	-Number of spill/leakage incidents and corrective measures taken	Contaminated lands/sites	Site audit	Quarterly	-MOJV -Independent experts
C4	Wastes	C4.1. Waste management	-List of hazardous materials/chemicals supplied, stored and used (inc. information on type and amount/volume) -Type (i.e. municipal, packaging, waste oil, etc.) and amount of wastes produced/disposed of -Waste management/disposal agreements done with licensed companies -Waste Management Plans -Temporary Waste Storage Areas	-Camp Sites -Road construction sites -Quarries	-Site audit -Document review	Quarterly	-MOJV -Independent experts
			-Site practices on waste management (e.g. general housekeeping rules, source separation practice, containers, containment structures, etc.)		Visual inspection	Daily	-MOJV/Contractor's personnel

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
C5	Water Resources	C5.1. Water quality	-Annex-2, Table 2 of the Regulation on the Surface Water Quality Regulation	-Kurtdere Dam -Bickidere Pond -Denizli Pond -Poyrazlar Lake -River/Creek Crossings: Gedikli, Sakarya, Mudurnu, Buyukgol -Receiving water bodies for treated wastewater discharges (if any) -Groundwater resources used for water supply	-Water quality sampling, in-situ measurement, laboratory analyses	Quarterly	-MOJV -Independent experts (environmental) -Accredited laboratories
		C5.2. Water supply	-Sources and amount of water supply -Water supply permits	-Project office -Camp Sites	-Document review	Quarterly	-MOJV -Independent experts (environmental)
		C5.3. Wastewater management	-Environmental permits for package domestic wastewater treatment plant discharges -Wastewater disposal agreements/channel connection permits to be done with municipalities -Capacity of package domestic wastewater treatment plant -Discharge/disposal volumes	-Package domestic wastewater treatment plants	-Document review	Quarterly	-MOJV -Independent experts (environmental)
			-Quality of treated wastewater from the discharge of package domestic wastewater treatment plants (Water Pollution Control Regulation (Table 21.1))	-Camp Sites	-Treated wastewater quality sampling, in-situ measurement, laboratory analyses	Quarterly	-MOJV -Independent experts (environmental) -Accredited laboratories
			Wastewater management practices at concrete plants	-Camp Sites -Concrete Plant locations	-Site audit -Document review	Quarterly	-MOJV -Independent experts (environmental)

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
C6	Ecology	C6.1.Terrestrial Flora	-*Cirsium polycephalum* -*Galanthus plicatus subsp. byzantinus* -*Ornithogalum paschaenum* -*Crocus pestalozzae* -*Hypericum aviculariifolium subsp. byzantinum* -*Campanula lyrata subsp. lyrata* -*Leucıjum aestivum* -*Cyclamen coum var. coum*	-Section 4: km 137+300; 1+300 -Section 5: km 162+500, km 164+700, km 175+700 -Section 6: km 217+500, km 251+111	-Site survey	One-off	Flora experts
		C.6.2. Terrestrial Fauna	-Culverts for fauna species (locations, dimensions, etc.)	Culvert locations at sensitive habitats (see Chapter 9)	-Site survey	One-off	Fauna experts
			-Ecological Bridge	Section 5: KM 161+870	-Site survey (via phototrap to be installed on both ways)	One-off	Fauna experts
C7	Air Quality	C7.1. Dust	-PM10	Kurnakoy, Kadilli, Demirciler, Tepecik, Sipahiler, Cayirkoy, Karaabdulbaki, Suleymaniye, Korucuk, Evrenkoy, Ikızce Osmaniye, Budaklar, Osmanbey, Kutluca, Taskisigi, Durhasan	-Site measurements	Quarterly or Upon Complaint	-MOJV -Independent experts (environmental) -Accredited laboratories
			-Number of water trucks -Frequency of road watering	-Camp Sites -Road construction sites -Quarries	-Document review	Quarterly	-MOJV -Independent experts (environmental)
			-Statistics on the grievances received on impacts related with dust, air emissions	-Project office	-Review of grievance logs	Quarterly	-MOJV -Independent experts
			-Environmental permits for concrete plants, asphalt plants	-Project office	-Document review	Quarterly	-MOJV -Independent experts

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
C8	Environmental Noise and Vibration	C8.1. Environmental Noise	-Environmental Noise (dBA)	- Tavsanli, Sevindikli, Sepetci, Cayirkoy, Tepekoy, Durhasan, Gedikli, Bayraktar, Sapakpinar, Karaabdulbaki, Suleymaniye, Camyolu, Karaman, Abali, Haciramazanlar, Budaklar, Kasimlar, Cerciler, Celebiler	-Site measurements (24 hour)	Quarterly or Upon Complaint	-MOJV -Independent experts (environmental) -Accredited laboratories
			-Statistics on the grievances received on impacts related with noise generation	-Project office	-Review of grievance logs	Quarterly	-MOJV -Independent experts
		C8.2. Vibration	-Ground vibration value	- Taskisigi, Kutluca	-Measurement with vibrometer	Quarterly	-Independent experts -Accredited laboratories
			-Statistics on the grievances received on impacts related with blasting operations	-Project office	-Review of grievance logs	Quarterly	-MOJV -Independent experts
C9	Cultural Heritage	C9.1. Chance finds	-Employment data on cultural heritage expert/archaeologist -Number of chance finds procedure operated	-Road construction sites	-Document review -Site audit	Quarterly	-MOJV -Independent experts (environmental/ cultural heritage)
		C9.2. Protected sites	-Actions taken in accordance with the decisions of Conservations Boards (e.g. planning of bridges, embankments, etc.; number of georadar studies conducted, test or salvage excavations conducted, etc.)	-Road construction sites	-Document review -Site audit	Quarterly	-MOJV -Independent experts (environmental/ cultural heritage)
C10	Socio-economy	C10.1. Employment	-Employment statistics (direct and contracted workers, local/non-local/foreign)	-Project office	-Document review	Quarterly	-MOJV -Independent experts (environmental/social)
		C10.2. Expropriation	-Agreement level for expropriation works -Number of court cases	-Project office	-Document review	Quarterly	-MOJV -Independent experts (environmental/social)
		C10.3. Social responsibility/volunteer activities	-Number and scope of social responsibility/volunteer projects/activities conducted	-Project office	-Document review	Quarterly	-MOJV -Independent experts (environmental/social)

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
		C10.4. Local Infrastructure	-Local infrastructure (e.g. roads) relocated/maintained/improved	-Project office	-Document review	Quarterly	-MOJV -Independent experts (environmental/social)
		C10.5. Land use restrictions	-Locations and dimensions for culverts and underpasses that provide access to agricultural and/or pasturelands	-Project office	-Document review -Site audit	Quarterly	-MOJV -Independent experts (environmental/social)
C11	Health and Safety/ Labor and Working Conditions	C11.1. Occupational Health and Safety/Labor and Working Conditions	-Employment agreements -Number of work accidents -Source and quality of drinking water	-Project office -Camp Sites	-Document review	-Quarterly	-MOJV -Independent expert (environmental /health and safety)
			-Use of PPEs -Health and safety signs -Fire safety equipments/systems -Accommodation conditions	-Camp Sites -Road construction sites -Quarries	-Site audit -Visual observation	-Quarterly	-MOJV -Independent expert (environmental /health and safety)
			-Number of health and safety trainings provided	-Project office -Camp Sites	-Document review	-Quarterly	-MOJV -Independent experts (environmental /health and safety)
			-Emergency Preparedness and Action Plan -Number of drills conducted	-Project office	-Document review	-Quarterly	-MOJV -Independent experts (environmental /health and safety)
			-Grievance mechanisms for Project personnel -Grievances received from Project personnel	-Project office	-Document review	-Quarterly	-MOJV -Independent experts
		C11.2. Community Health and Safety	-Employment data on the security personnel -Trainings provided to security personnel -Grievances received and replied to regarding the acts of security personnel	-Project office -Camp Sites	-Document review	-Quarterly	-MOJV -Independent experts
C12	Public Consultation	C12.1. Stakeholder Engagement	-Implementation of Stakeholder Engagement Plan -Number of stakeholder engagement activities/events conducted -Presence and functionality of Project web-site	-Project office	-Document review	-Quarterly	-MOJV -Independent experts
		C12.2. Grievance Mechanism	-Statistics on the grievances received and replied to	-Project office	-Document review -Media screen	-Quarterly	-MOJV -Independent experts

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
Operation							
O1	Environmental and Social Management System (ESMS)	O1.1. Policy and ESMP	-Project-specific Environment and Social Policy -Organizational Structure (number and CVs of the personnel employed under the Environmental Department) -Periodical ESMP Performance Review and Monitoring Reports -Number of non-compliant situations -Project-specific Emergency Preparedness and Response Plan -Existence and validity of the legal environmental and health and safety permits -Budget allocated/spent for ESMP implementation -Number and scope of trainings, number of participants, training hours per employee, training materials, trainings provided to contractors/sub-contractors, etc. -Measures taken to ensure compliance of contractors/sub-contracts with ESMP measures	Project office	Document review	Annual	-MOJV -Independent experts
				-Project office	Document review	Annual	-MOJV -Independent experts
O2	Land Use and Property	O2.1. Afforestation	-Implementation of afforestation (area afforestated, number of trees planted, etc.), success of planting	-Project office	-Document review -Site audit	Annual	-MOJV -Independent experts
O3	Topography and Soils	O3.1. Erosion	-Erosion control measures taken (drainage channels, barriers, settling structures, etc.)	-Embankment locations -Motorway surroundings	Site audit	Annual	-MOJV -Independent experts
		O3.2. Quarry	-Rehabilitated area	-Location of quarries	Site audit	Annual	-MOJV -Independent experts
		O3.3. Geotechnics	-Structural motion, undermining, maintenance requirement of engineering structures	-Foundations and legs of viaducts, bridges, other structural elements	Site audit	Annual	-MOJV/Project (technical) experts -Independent experts

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
O4	Wastes	O4.1. Waste management	-List of hazardous materials/chemicals supplied, stored and used (inc. information on type and amount/volume) -Type (i.e. municipal, packaging, waste oil, etc.) and amount of wastes produced/disposed of -Waste management/disposal agreements done with licensed companies -Waste Management Plans -Temporary Waste Storage Areas -Site practices on waste management (e.g. general housekeeping rules, source separation practice, containers, containment structures, etc.)	-Operation facilities/buildings -Service areas	-Site audit -Document review	Annual	-MOJV -Independent experts
O5	Water Resources	O5.1. Drainage	-Presence and functionality of drainage system	-Motorway route	-Site audit	Annual	-MOJV -Independent experts
		O5.2. Water supply	-Sources and amount of water supply -Water supply permits	-Operation facilities/buildings -Service areas	-Site audit -Document review	Annual	-MOJV -Independent experts
		O5.3. Wastewater management	-Environmental permits for package domestic wastewater treatment plant discharges -Wastewater disposal agreements/channel connection permits to be done with municipalities -Capacity of package domestic wastewater treatment plant -Discharge/disposal volumes	-Package domestic wastewater treatment plants	-Document review	Annual	-MOJV -Independent experts (environmental)
O6	Ecology	C6.1.Terrestrial Flora	-*Cirsium polycephalum* -*Galanthus plicatus subsp. byzantinus* -*Ornithogalum paschaenum* -*Crocus pestalozzae* -*Hypericum avicullariifolium subsp. byzantinum* -*Campanula lyrata subsp. lyrata* -*Leucıjum aestivum* -*Cyclamen coum var. coum*	-Section 4: km 137+300; 1+300 -Section 5: km 162+500, km 164+700, km 175+700 -Section 6: km 217+500, km 251+111	-Site survey	One-off	Flora experts
		C.6.2. Terrestrial Fauna	-Fauna species (inc. suitability of culverts, population of sensitive species, etc.)	Sensitive and/or alternative habitats	-Site survey	One-off	Fauna experts

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
			-Ecological Bridge	Section 5: KM 161+870	-Site survey (via phototrap to be installed on both ways)	One-off	Fauna experts
O7	Air Quality	O7.1. Gaseous Pollutants	-NOx	- Demirciler, Tavsanli, Sepetci, Cayirkoy, Eseler, Karapinar, Karaman, Evrenkoy, Durhasan, Kadilli, Kurnakoy, Korucuk	-Site measurements	Annual or Upon Complaint	-MOJV -Independent experts (environmental) -Accredited laboratories
			-Grievances received on impacts related with gaseous emissions	-Project office	-Review of grievance logs	Annual	-MOJV -Independent experts
O8	Environmental Noise and Vibration	O8.1. Environmental Noise	-Environmental Noise (dBA)	- Durhasan, Karaabdulbaki, Korucuk, Kurnakoy, Sipahiler, Akfirat-1, Akfirat-2, Eseler	-Site measurements	Annual	-MOJV -Independent experts (environmental) -Accredited laboratories
			-Statistics on the grievances received on impacts related with traffic noise	-Project office	-Review of grievance logs	Annual	-MOJV -Independent experts
O9	Cultural Heritage	O9.1. Newly registered sites	-Number of sites, which have been registered as a result of Project's cultural heritage studies	-Project office -Databases of Cultural Heritage authorities	-Document review	One-off at the beginning of operation phase	-MOJV -Independent experts (environmental/ cultural heritage)
O10	Socio-economy	O10.1. Employment	-Employment statistics (direct and contracted workers, local/non-local/foreign)	-Project office	-Document review	Annual	-MOJV -Independent experts (environmental/social)
		O10.2. Social responsibility/volunteer activities	-Number and scope of social responsibility/volunteer projects/activities conducted	-Project office	-Document review	Annual	-MOJV -Independent experts (environmental/social)
O11	Health and Safety/Labor and Working Conditions	O11.1. Occupational Health and Safety/Labor and Working Conditions	-Employment agreements -Number of work accidents during operation and maintenance works	-Project office -Operation facilities/buildings -Service areas	-Document review	Annual	-MOJV -Independent experts (environmental /health and safety)

No	Subject	Sub-topic	Monitoring Parameter	Monitoring Station/Location	Monitoring Method	Monitoring Frequency	Responsibility*
			-Emergency Preparedness and Action Plan -Number of drills conducted	-Project office	-Document review	Annual	-MOJV -Independent experts (environmental /health and safety)
			-Grievance mechanisms for Project personnel -Grievances received from Project personnel	-Project office	-Document review	Annual	-MOJV -Independent experts
		O11.2. Community Health and Safety	-Traffic safety measures taken (safety systems established, traffic signs, etc.) -Traffic accident records on the Motorway	-Motorway -Project office	-Site audit -Document review	Annual	-MOJV -Independent experts (environmental /health and safety)
O12	Public Consultation	O13.1. Stakeholder Engagement	-Implementation of Stakeholder Engagement Plan -Number of stakeholder engagement activities/events conducted -Presence and functionality of Project web-site	-Project office	-Document review	Annual	-MOJV -Independent experts
		O13.2. Grievance Mechanism	-Grievances received and replied to	-Project office	-Document review -Media screen	Annual	-MOJV -Independent experts

** Where necessary, external/independent experts would be commissioned by lenders to verify environmental and social monitoring information and/or perform monitoring services.*

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