# *CHAPTER 2*

# *STUDY AREA*

## *2.1*

## *PHYSICAL CONDITIONS*

# CHAPTER 2 STUDY AREA

## 2.1 Physical Conditions

Physical conditions of the study area such as topography, river system, geology and hydrogeology are described in this sub-section.

### 2.1.1 Topography

(1) Topography of Bulgaria

Fig. 2.1.1 shows the Maritza River with surrounding river basins. Topography of Bulgaria is characterized by the major mountain chains with wide plains between them. In the central part, Balkan Mountains (highest peek: El. 2376 m) exist from west to east direction, which separates the northern half from the southern half of the country. Also in the central part, Sredna Gora Mountains (highest peak: El. 1604m) is lying just south of the Balkan Mountains. In south-western part, there are Rila Mountains (highest peek: El. 2925m), Rodope Mountains (highest peek: El. 2191m) and Pilin Mountains (highest peek: El. 2914m).

To the northern side of the Balkan Mountains, there is a wide flat plain called Danube Plain. Elevation of the Danube Plain is El. 400m to less than 100m with gradually decreasing the elevation to east direction. The Danube River is flowing from west to east in the center of the Danube Plain.

To the south of the Balkan Mountains, there is also a wide flat plain called upper part of Trakia Plain (Upper Trakia Plain). Elevation of the Upper Trakia Plain is from El. 400m to less than 100m, gradually decreasing elevation to the east and southeastern direction.

In the westernmost side of the country, Struma Valley exists between the Pilin Mountains and the country border. The Struma River is flowing along this valley to the south. Between the Pilin Mountains and the Rodopi Mountains, lies also a long valley called Mesta Valley. The Mesta River is flowing along this valley to the east-south directions.

(2) Topography of the Maritza River Basin

Topography of the Maritza River Basin was studied based on the 1/100,000 topographic maps. Catchment area of the Maritza River was measured by GIS and it was 21,314 $km^2$. Fig. 2.1.2 shows elevation analysis by GIS. Average slope of the plain is about 1/900 to 1/1000 from west to east direction along the Maritza Main Stream and 1/500 to 1/600 from north to south direction along the Sazliyka River.

### 2.1.2 River System

The Maritza River originates in the Rila Mountain and flows to east direction in the center of Trakia Plain. It joins with several major tributaries including one of the major left tributaries called Sazliyka River and flows to east-south direction up to the country border of Bulgaria and Turkey. After the country border, the Maritza River flows to south direction, joins the Tundza River from left side, flows along the country border of Greece and Turkey and finally flows into the Aegean Sea.

Fig. 2.1.3 shows the river systems of the Maritza River Basin. The Maritza River Basin is sub-divided into 16 sub-basins, which is composed of 6 sub-basins of the Maritza Main Stream and 10 major tributaries. Their catchment area and river length measured by using 1/100,000 topographic maps are shown in Table 2.1.1.

Slope in the downstream and mid-stream reaches of the Maritza Main Stream is almost less than 1/1000 with some reaches with 1/500-1/1000. Slope of upstream reaches of the Maritza Main Stream and tributaries except the Sazliyka River are steeper than 1/500 or

1/200. Slope of the Sazliyka River is rather gentle with less than 1/500 in the middle to downstream reaches.

### 2.1.3 Geology

The Maritza River basin is situated at the northern edge of the Alpine orogenic belt, which is the latest major tectonic event (throughout Tertiary) of the earth's history.

Fig. 2.1.4 shows the geological map of the Maritza River Basin. Precambrian and Paleozoic plutonic and metamorphic rocks outcrop exclusively in the mountainous area. These highly consolidated rocks form a solid basement (hereafter called bedrock) in the study area providing sedimentary basins for overlying younger formations. Mesozoic formations are exposed typically in the northern part, in small areas in the form of narrow strips along major faults. Tertiary sedimentary rocks cover the most part of topographically flat areas. They are considered to fill the depression in the bedrock. Sedimentary formations of the uppermost part of this sequence are unconsolidated. Quaternary deposits are distributed along the river courses, flood plains, and terraces among them. They overlie the tertiary formations as a thin and flat depositional cover.

A complicated set of faults called the Maritza Deep Fault runs through the study area from west to east, which is seismically active nowadays. The study area is divided into two structural zones by the fault zone. The two zones are called Srednogorie Structural Zone (northwestern to eastern areas) and the Rhodopes Crystalline Massif (southern area). Since the fault zone is very active, it is considered to affect even the youngest Quaternary deposits in some parts.

(1) Srednogorie Structural Zone

Granites in south Bulgaria (Carboniferous), biotite and two-mica gneisses etc. (Precambrian) accompanied by small portion of lower Paleozoic metamorphic rocks are

widely distributed along the northwestern border of the study area. These rocks form the bedrock for overlying Tertiary and Quaternary sequences. A group of faults trending from northwest to southeast with synclinorium are clearly observed in the northwestern plutonic bedrock. They expose formations of cretaceous limestone and volcano-sedimentary rocks called Panagyurishte strip between them. This synclinorium is considered to be the most specific feature of this structural zone. This structure obviously extends to the east and its eastern end is exposed along the northeastern border of the study area. Another conspicuous structure is observed to its west. Ihtiman-Horst block which is composed of sets of horst and graben filled mainly with Pliocene and Quaternary sediments. In the whole study area, Neogene terrigenous sediments are observed in the depression of the northwest to southeast. They are composed of conglomerate, sand and clay. In the eastern part, coal layers are observed in the Marica Formation (Plaeogene-Neogene) along the Sazliyka River.

(2) Rodopes Crystalline Massif

Rodopes Crystalline Massif is regarded as a part of the larger and older lithosperic block which is known as the Tracian Crystalline Massif. Biotite granite and two mica granites etc. (Precambrian), granite in southern Bulgaria (Carboniferous) and gneiss-schists (Precambrian) are dominant in the most part of the Rodope Mountains. The total thickness of the apparent outcrop is 20km. In its center, acid and intermediate volcanic and volcaniclastic rocks (Oligocene) are observed to fill the structural depression. Marbles and schists of Assenovgrad Group (Precambrian) outcrop in smaller scale in the eastern part of the Rodope Mountains intermediate volcanics (andesites in Eocene) and complex of dominantly intermediate tuffs, tuffaceous sandstones and reef limestone (Oligocene) also outcrop on smaller scale in the east. Neogene terrigenous sediments composed of conglomerate, sand and clay can be observed in the northeastern part with minor amount of intermediate pyroclastics and limestone (Oligocene).

(3) Quaternary Deposits

Relatively younger and unconsolidated deposits cover most of the topographically even areas. Among them, the distribution of recent river deposits and flood plain deposit are confined to a narrow area along the river course in the east. On the other hand, their distribution is wider in the west.

In addition, quaternary alluvial terrace deposits lie in slightly higher plains between the major tributaries especially in the upper reach of the Sazliyka River and in the middle reach of the Maritza River.

Remarkable development of alluvial fans composed of drift deposits is observed along the northern edge of Rodope Mountains where the mountain slope suddenly levels off into the flood plain.

(4) Others

In relation to the various faults and volcanic activities, there are several mineral resources such as copper, lead, zinc and uranium in the study area. There are also many thermal and mineral water sources in the study area. The distribution of volcanic activities and serpentinized ultrabasic rock bodies appears to be related to the orientation and distribution of faults in the area. It leads to the localization of most of ore minerals- lead-zinc and fluorite deposits are controlled by the northwest-southeast striking fault sets. The localization of the thermal mineral waters is also dependent on the fault orientation.

### 2.1.4 Hydrogeology

(1) Hydrogeological Classification

Hydrogeological classification in the Study Area is composed of four units as bedrocks, Quaternary deposits, Neogene deposits, carbonate rocks, and fractured zones.

Bedrocks:

Precambrian rocks, Ordovician, Silurian, Carboniferous, Permian rocks in Paleozoic, Triassic, Jurassic, Cretaceous rocks in Mesozoic, and Tertiary rocks are widely distributed in the study area. Those are practically impermeable with low porosity and considered to be the bedrocks from the hydrogeological point of view.

Quaternary deposits:

Quaternary deposits are distributed in the mountain foot and along Maritza river and its tributaries. The results of previous exploration boreholes show that the depth to the basement rocks ranges from 5 meters at small tributaries to more than 100 meters at the downstream of Maritza river. The thickness of Quaternary deposits tends to increase toward the downstream. It is roughly divided into five different deposits from the topographical point of view as follows.

| | |
|---|---|
| Flood plain deposit | : recent and modern river bed deposit |
| Talus deposit | : distributed at the mountain foot |
| Fan deposit | : distributed at mouths of valleys |
| Drift deposit | : bad sorted glacial deposit |
| Terrace deposit | : distributed on the terrace along rivers |

These deposits are mainly composed of sand and gravel with clay and considered to be aquifer. Those are most interesting and can be divided into the following three groups from a viewpoint of groundwater development.

1) Flood plain deposit

Recent flood plain deposit is widely distributed along Maritza river and its tributaries which have a thickness of over 100 meters in an area. It mainly consists of gravel, sand with clay. Permeability of this deposit may be the highest comparing with another Quaternary deposits.

2) Talus and drift deposits

Talus deposit is distributed at the mountain foot and drift deposit is distributed on the hilly region. Those are composed of gravel, sand, and clay and poorly sorted. Clay contents of talus and drift deposits may be the highest comparing with other deposits.

3) Fan and terrace deposits

Fan deposit is distributed at valley mouths in the mountain foot and terrace deposit is distributed in the hilly region continuing from mountain foot or flood plain. Those are composed of gravel, sand, and clay. Clay contents may be higher than those of flood plain deposit.

Neogene deposits:

Neogene deposits are mainly composed of sand and gravel with clay. It is reported that maximum thickness is about 150 meters in the northern part of Plovdiv and 250 to 300 meters in Karlovo.

Carbonate rocks:

Basement rocks are basically impervious, but there are some pervious zones due to solution cavities in Mesozoic carbonate rocks. Carbonate rocks of dolomite, limestone are distributed in the upstream of Topolnitza river, near Brezovo, Stara Zagora, Devin, and Lakki. Those are considered to be aquifers because of many solution cavities and solution openings.

Fractured zones:

Basement rocks are basically impervious, but there are some pervious zones due to fractures in the bedrocks. According to the interpretation of topographical and geological maps, some fractured zones are distributed in the study area. Those may form either

pervious or impervious zones which control groundwater flow and are expected to be fissure aquifers. Pumping yield of production wells range widely depending on characteristics of faults and fractured zone.

(2) Aquifer Type

Quaternary aquifer:

Quaternary deposits distributed along Maritza River and its tributaries are considered to be unconfined aquifers having the water table. The maximum pumping yield of production wells in the study area was 15 liters/second (1,296$m^3$/day) in the past study. Neogene unconfined aquifer is partly included in this aquifer.

Confined aquifer lies under the confining layer that is an impervious clay layer in Alluvial deposit. This aquifer is utilized as the source of artesian well or flowing well.

Almost Neogene aquifer lies under the Alluvial deposit. Some part of this aquifer is combined with Alluvial confined aquifer. This is not interesting for the groundwater development because of a few potential of groundwater comparing with another Quaternary aquifer.

Karst aquifer:

The acidic rainwater enters joints and beddings in carbonate rocks and it may dissolve small volumes of rocks causing an enlargement of crevices and voids. As a cavern system develops, surface stream flow is diverted to underground flow. If these voids are close to the land surface, the roofs of resulting caverns may cave in and thus produce sink holes. Lakes in this type of terrain, which is called " karst topography ", are intimately connected to the groundwater system. Maximum pumping yield was 70 liters/second (6,048 $m^3$/day in the past data.

Fissure aquifer:

Fractured zones may form either pervious or impervious zones which control groundwater flow. If a fractured zone is large enough without clay fill, water can be stored in the fractured zone. This is called "fissure aquifer". Pumping yield of production wells ranged widely due to diverse characteristics of faults and fractured zone. Maximum one was 20 liters/second (1,728 $m^3$/day) near Plovdiv.

TABLE 2.1.1 CATCHMENT AREA AND RIVER LENGTH OF THE BASINS

| Number | River | Catchment area ($km^2$) | River length (km) |
|---|---|---|---|
| **1.** | **MARITZA MAIN STREAM** | **8323** | **305** |
| MU | Upstream Basin of the Main Stream | 1602 | 103 |
| MU1 | Upper sub-basin | 1173 | 30 |
| MU2 | Lower sub-basin | 429 | 73 |
| MM | Mid-stream Basin of the Main Stream | 5087 | 136 |
| MM1 | Upper Sub-basin | 1518 | 40 |
| MM2 | Middle sub-basin | 1993 | 47 |
| MM3 | Lower sub-basin | 1576 | 49 |
| MD | Downstream Basin of the Main Stream | 1634 | 66 |
| **2.** | **MAJOR TRIBUTARIES** | **12991** | **873** |
| TOP | Topolnitza River (left tributary) | 1857 | 129 |
| LUD | Luda Yana River (left tributary) | 739 | 73 |
| PYA | Pyassachnik River (left tributary) | 419 | 65 |
| STR | Stryama River (left tributary) | 1694 | 101 |
| CPI | Chepinska River (right tributary) | 919 | 75 |
| STA | Stara River (right tributary) | 366 | 54 |
| VAC | Vacha River (right tributary) | 1689 | 101 |
| CPE | Chepelarska River (right tributary) | 979 | 75 |
| HAR | Harmanliyska River (right tributary) | 986 | 81 |
| SAZ | Sazliyka River (left tributary) | 3343 | 119 |
| | **Total** | **21314** | **1178** |

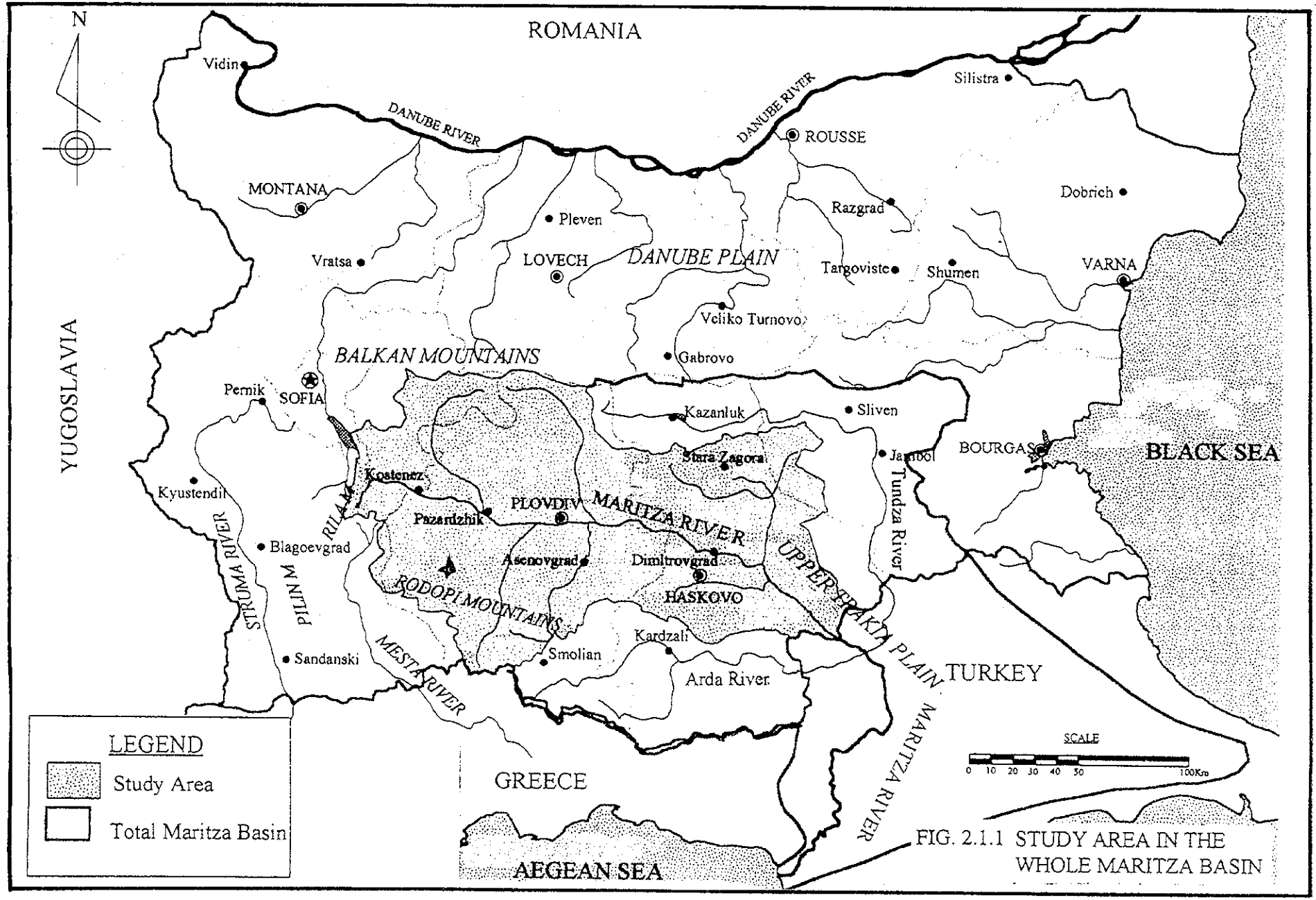
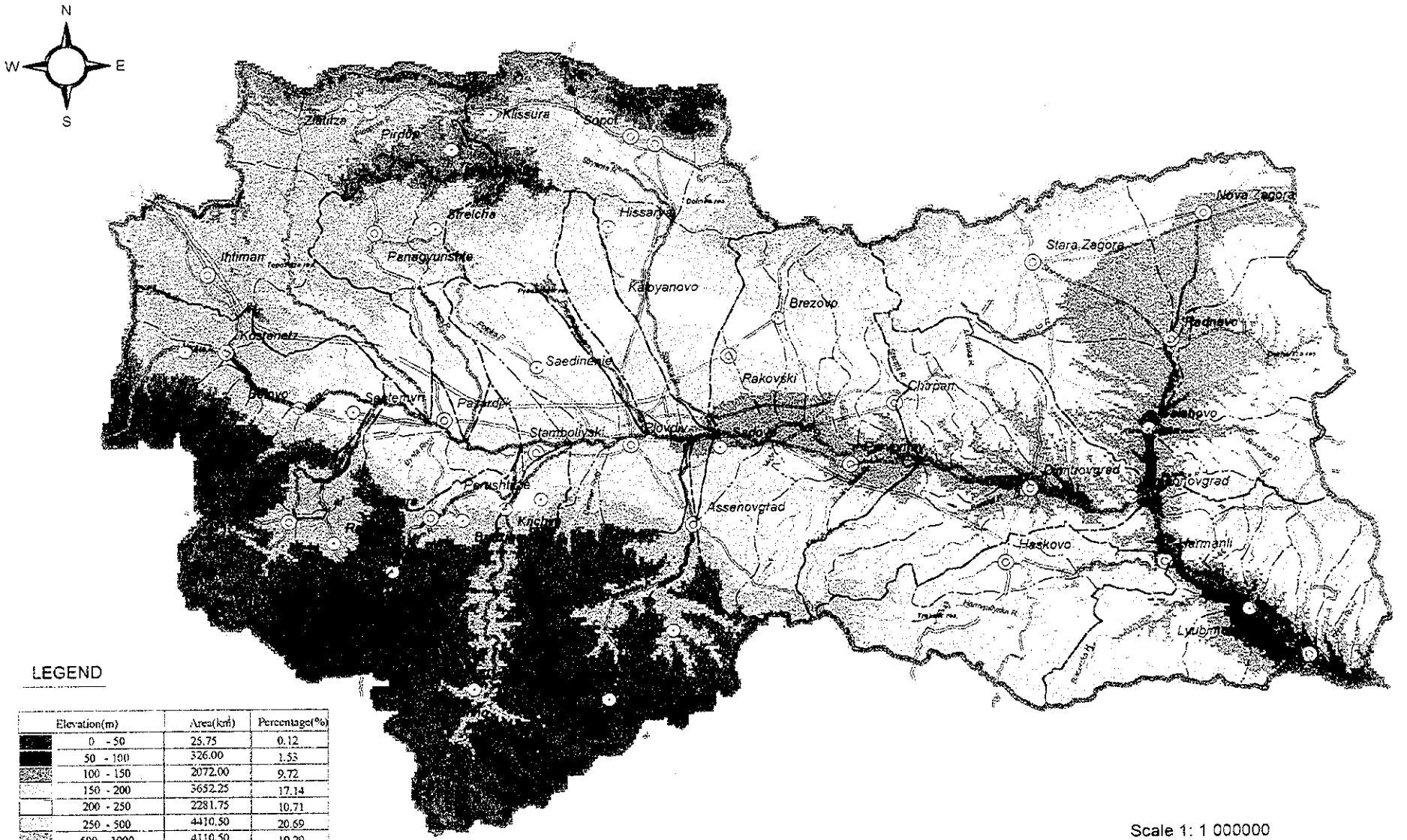



FIG. 2.1.1 STUDY AREA IN THE WHOLE MARITZA BASIN




| Elevation(m) | Area(km²) | Percentage(%) |
|---|---|---|
| 0 - 50 | 25.75 | 0.12 |
| 50 - 100 | 326.00 | 1.55 |
| 100 - 150 | 2072.00 | 9.72 |
| 150 - 200 | 3652.25 | 17.14 |
| 200 - 250 | 2281.75 | 10.71 |
| 250 - 500 | 4410.50 | 20.69 |
| 500 - 1000 | 4110.50 | 19.29 |
| 1000 - 1500 | 2962.75 | 13.90 |
| 1500 - 2000 | 1346.25 | 6.32 |
| 2000 - 2500 | 114.25 | 0.54 |
| 2500 - 3000 | 12.00 | 0.06 |

FIG 2. 1. 2 DISTRIBUTION OF ELEVATION IN THE STUDY AREA

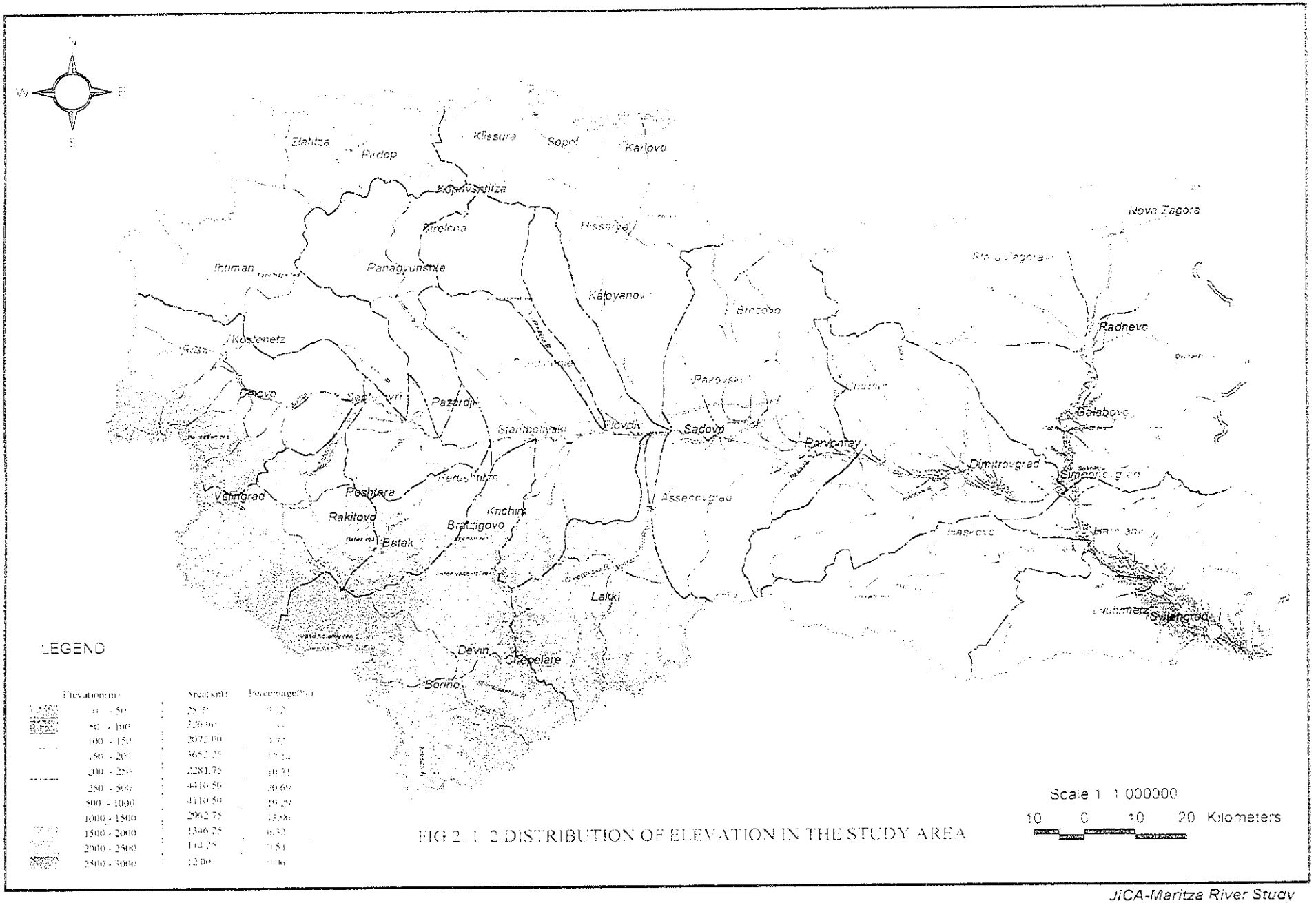



FIG 2. 1. 2 DISTRIBUTION OF ELEVATION IN THE STUDY AREA

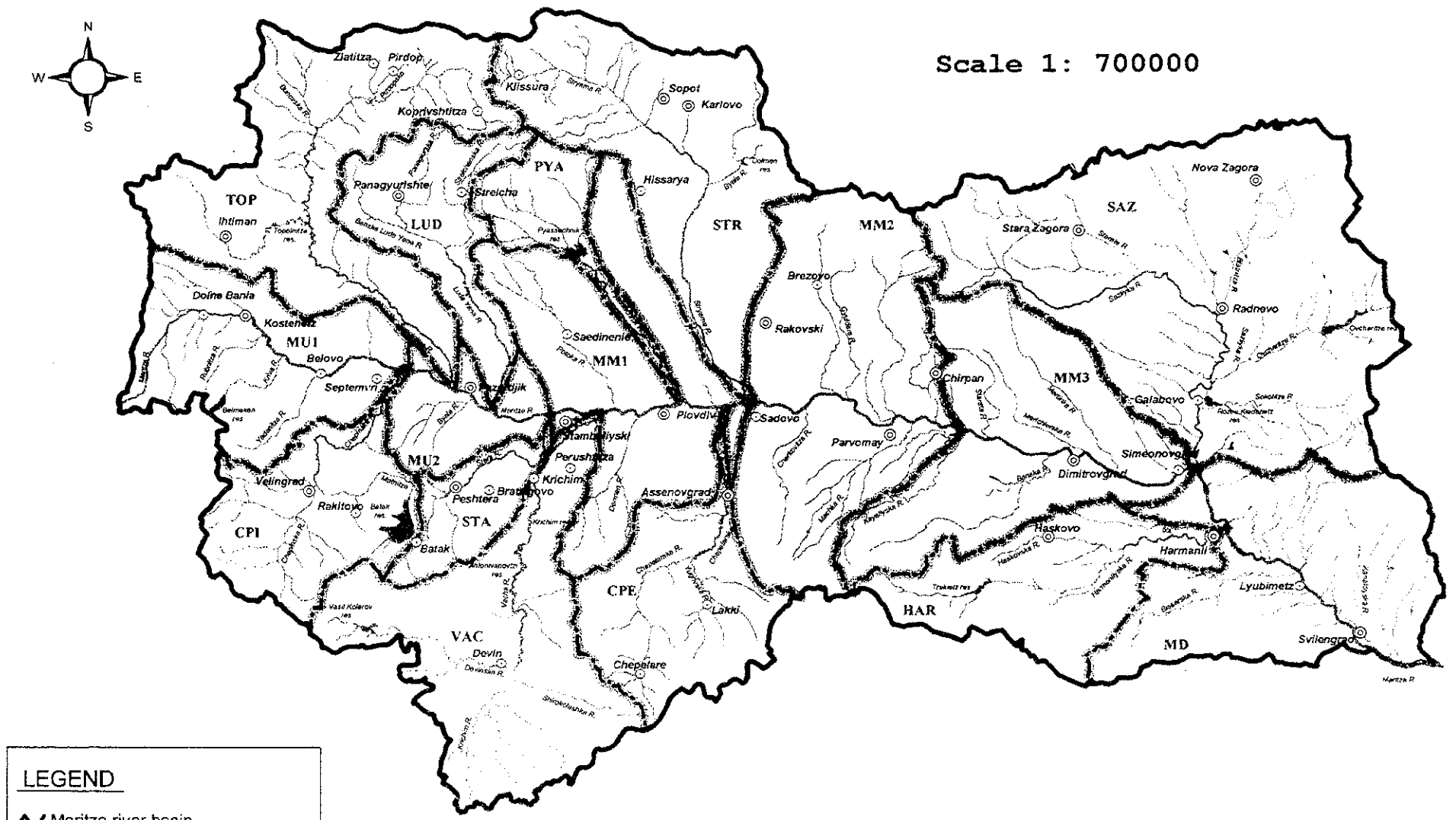



FIG. 2.1.3 RIVER SYSTEM IN THE MARITZA RIVER BASIN

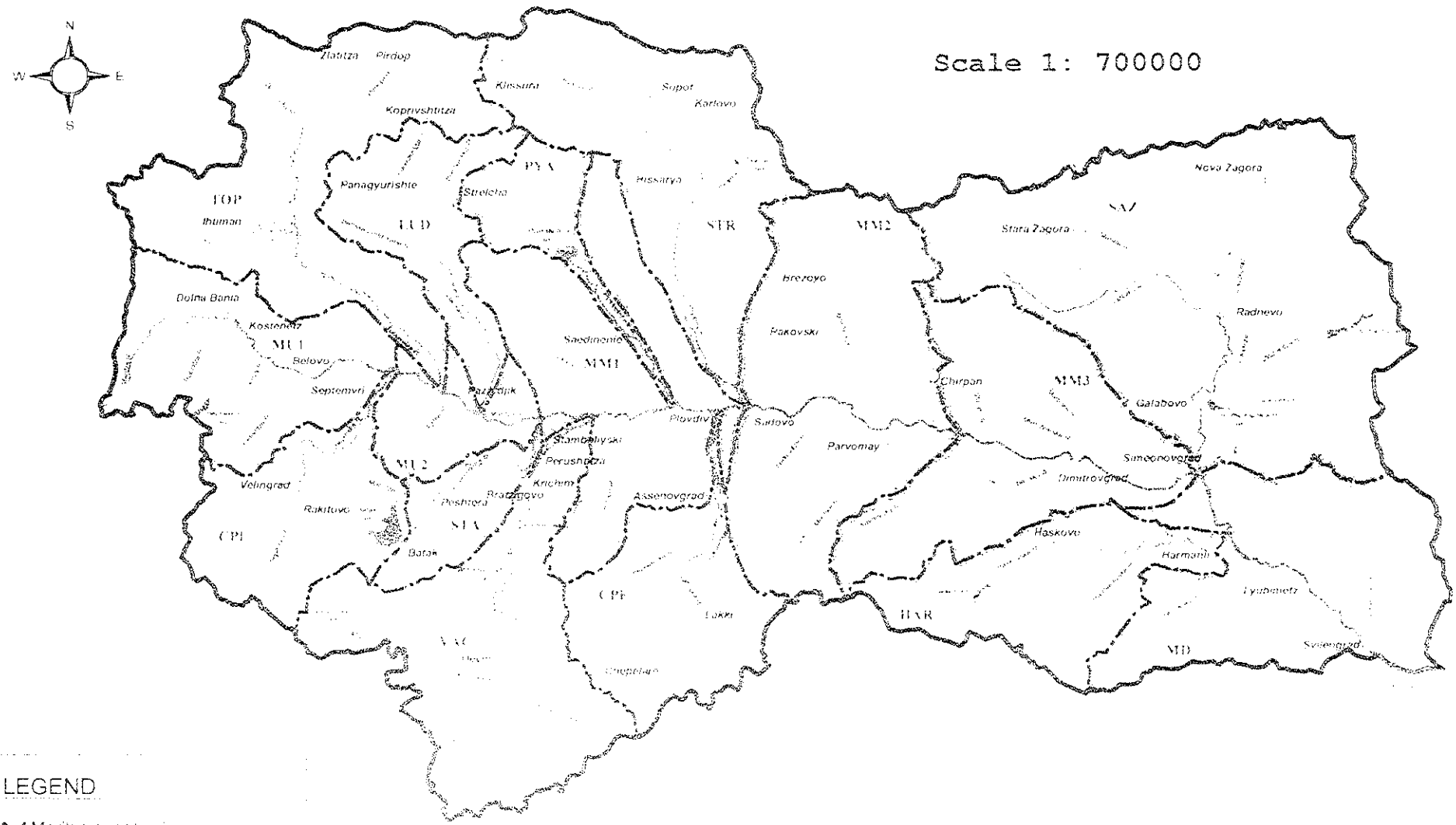
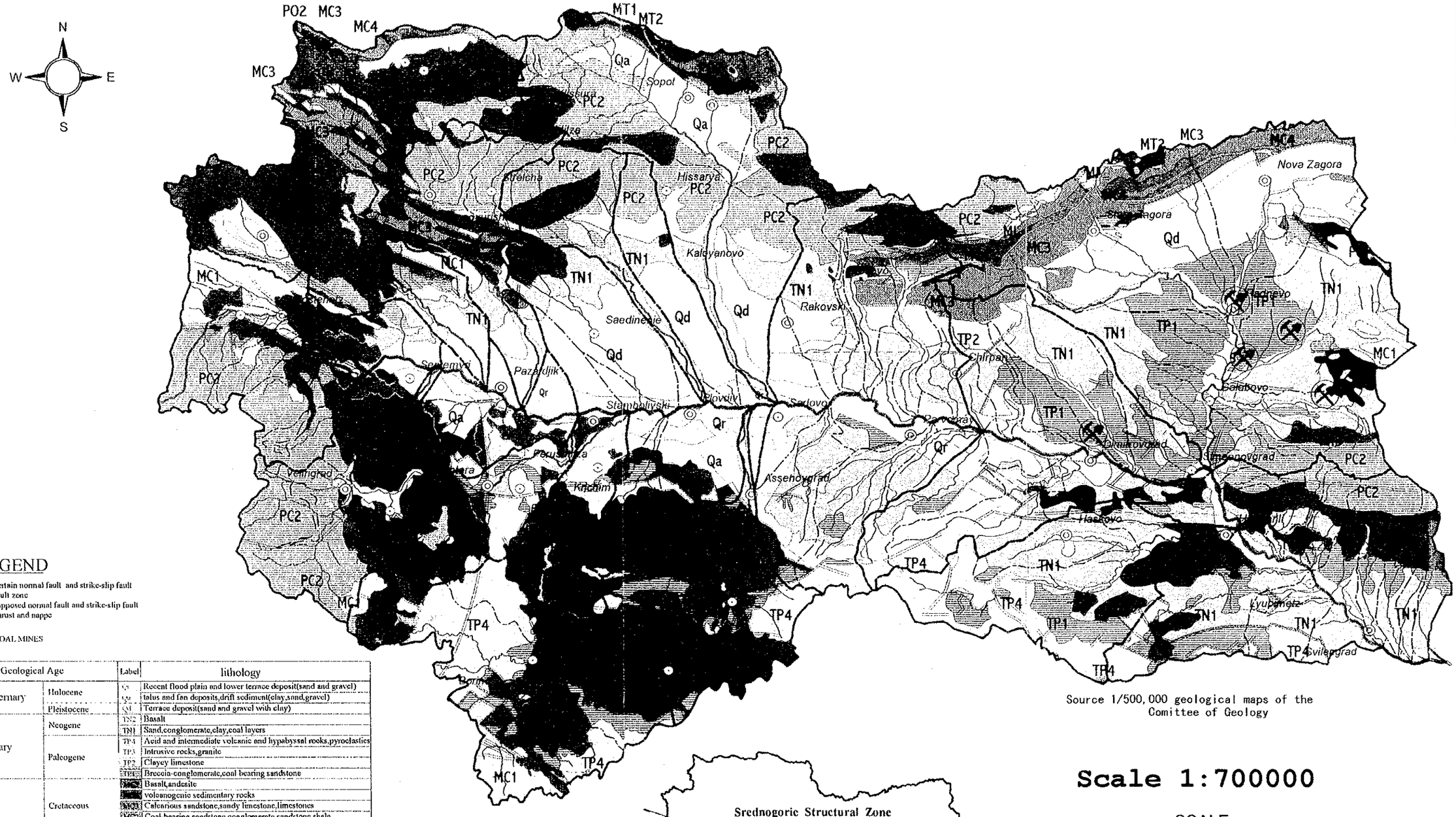



FIG. 2.1.3 RIVER SYSTEM IN THE MARITZA RIVER BASIN

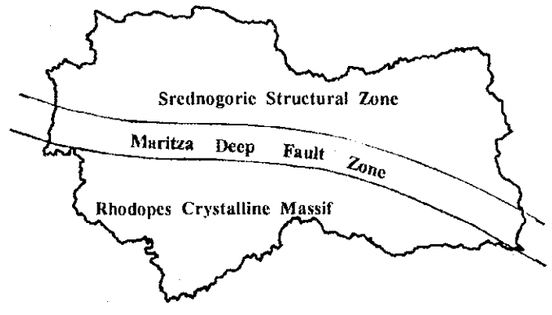
2 - 1 - 13




## LEGEND

- Certain normal fault and strike-slip fault
- Fault zone
- Supposed normal fault and strike-slip fault
- Thrust and nappe
- COAL MINES

| Geological Age | | Label | lithology |
|---|---|---|---|
| Quaternary | Holocene | Qr | Recent flood plain and lower terrace deposit(sand and gravel) |
| | | Qa | talus and fan deposits,drift sediment(clay,sand,gravel) |
| | Pleistocene | Q1 | Terrace deposit(sand and gravel with clay) |
| Tertiary | Neogene | TP2 | Basalt |
| | | TN1 | Sand,conglomerate,clay,coal layers |
| | Paleogene | TP4 | Acid and intermediate volcanic and hypabyssal rocks,pyroclastics |
| | | TP3 | Introsive rocks,granite |
| | | TP2 | Clayey limestone |
| | | TP1 | Breccia-conglomerate,coal bearing sandstone |
| Mesozoic | Cretaceous | MC4 | Basalt,andesite |
| | | | volcanogenic sedimentary rocks |
| | | MC3 | Calcarious sandstone,sandy limestone,limestones |
| | | MC2 | Coal-bearing sandstone,conglomerate,sandstone,shale |
| | | MC1 | Granite,granodiorite,dioritporphyry |
| | Jurassic | | Terrigenous carbonate rocks |
| | Triassic | | Metasandstone,schists,dolomite marbles |
| | | | Conglomenate,sandstone,silistone,shale |
| | | MT1 | Limestone,dolomite |
| Paleozoic | Permian | | Volcanic and hypabyssal rock bodies,quartzporphylites |
| | Carboniferous | PO2 | Granite,granodiorite |
| | | | Coal-bearing terrestrial rocks,metabreccia-conglomerate |
| | Silurian | | Sandstone,lidite |
| | Ordovician | PO2 | Metashale,metsandstone,quartzite |
| Precambrian | | | Gneiss-granite,migmatite |
| | | | Gneiss,migmatite,amphybolite,schist |
| | | | Marble,dolomitic marble,schist |
| | | | Metamorphosed basic and ultrabasic rocks |

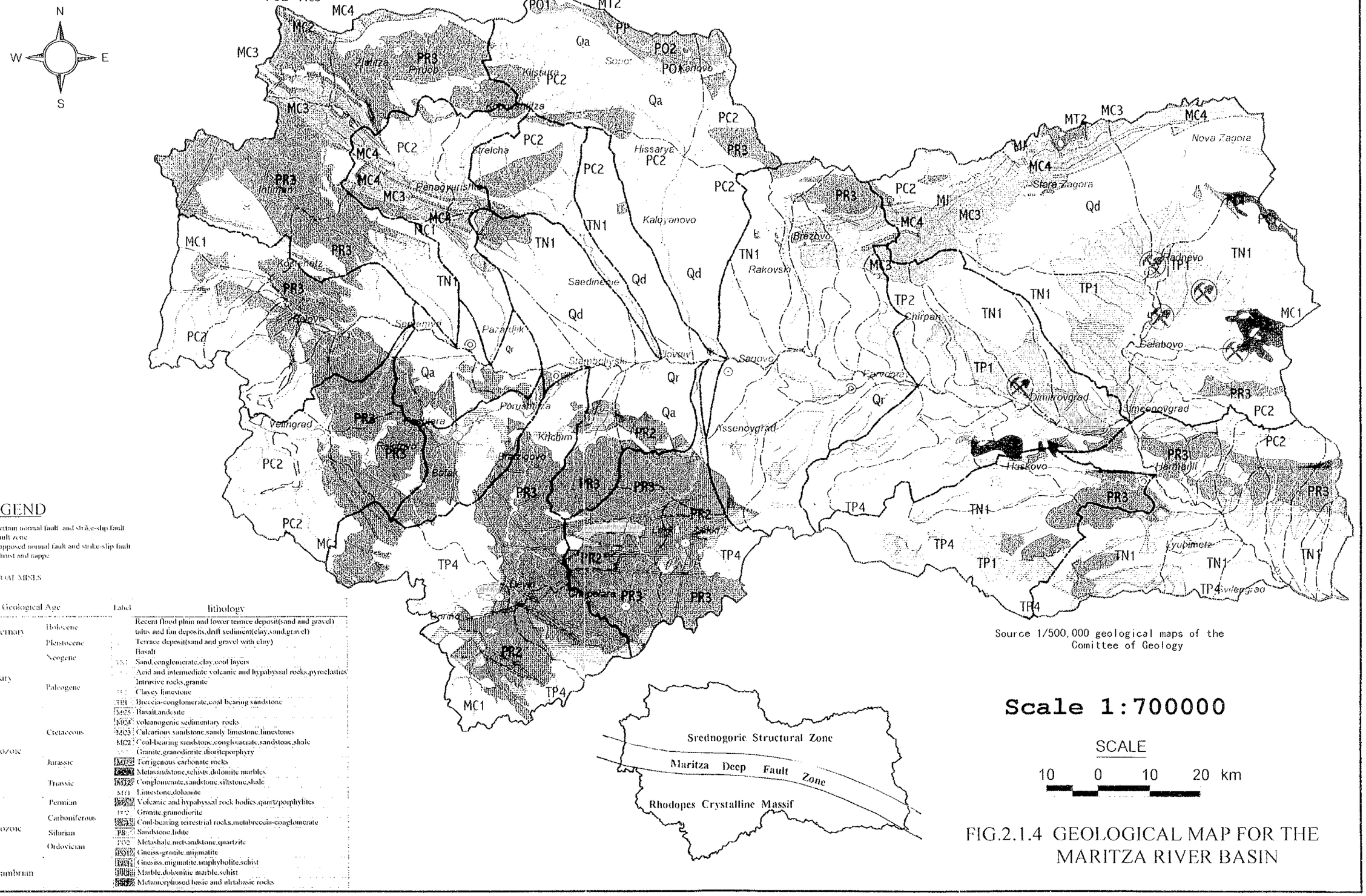



Source 1/500,000 geological maps of the Comittee of Geology

**Scale 1:700000**

SCALE
10 0 10 20 km

FIG.2.1.4 GEOLOGICAL MAP FOR THE MARITZA RIVER BASIN




## LEGEND

- Certain normal fault and strike-slip fault
- Fault zone
- Supposed normal fault and strike-slip fault
- Thrust and nappe
- COAL MINES

| Geological Age | | Label | lithology |
|---|---|---|---|
| Quaternary | Holocene | | Recent flood plain and lower terrace deposit(sand and gravel) |
| | | | talus and fan deposits,drift sediment(clay,sand,gravel) |
| | Pleistocene | | Terrace deposit(sand and gravel with clay) |
| | Neogene | | Basalt |
| | | TN1 | Sand conglomerate,clay,coal layers |
| Tertiary | | | Acid and intermediate volcanic and hypabyssal rocks,pyroclastics |
| | Paleogene | | Intrusive rocks,granite |
| | | TP1 | Clayey limestone |
| | | TP2 | Breccia-conglomerate,coal bearing sandstone |
| | | MC4 | Basalt,andesite |
| | | MC3 | volcanogenic sedimentary rocks |
| | Cretaceous | MC2 | Calcarious sandstone,sandy limestone,limestones |
| Mesozoic | | MC1 | Coal-bearing sandstone,conglomerate,sandstone,shale |
| | | | Granite,granodiorite,dioriteporphyry |
| | Jurassic | MJ | Terrigenous carbonate rocks |
| | | | Metasandstone,schists,dolomite marbles |
| | Triassic | MT2 | Conglomerate,sandstone,siltstone,shale |
| | | MT1 | Limestone,dolomite |
| | Permian | | Volcanic and hypabyssal rock bodies,quartzporphylites |
| | Carboniferous | PO2 | Granite,granodiorite |
| | | | Coal-bearing terrestrial rocks,metabreccia-conglomerate |
| Paleozoic | Silurian | PS | Sandstone,lidite |
| | Ordovician | PO2 | Metashale,metsandstone,quartzite |
| | | | Gneiss-granite,migmatite |
| | | | Gneisss,migmatite,amphybolite,schist |
| Precambrian | | | Marble,dolomitic marble,schist |
| | | | Metamorphosed basic and ultrabasic rocks |

Source 1/500,000 geological maps of the Comittee of Geology

**Scale 1:700000**

SCALE

10 0 10 20 km

FIG.2.1.4 GEOLOGICAL MAP FOR THE MARITZA RIVER BASIN

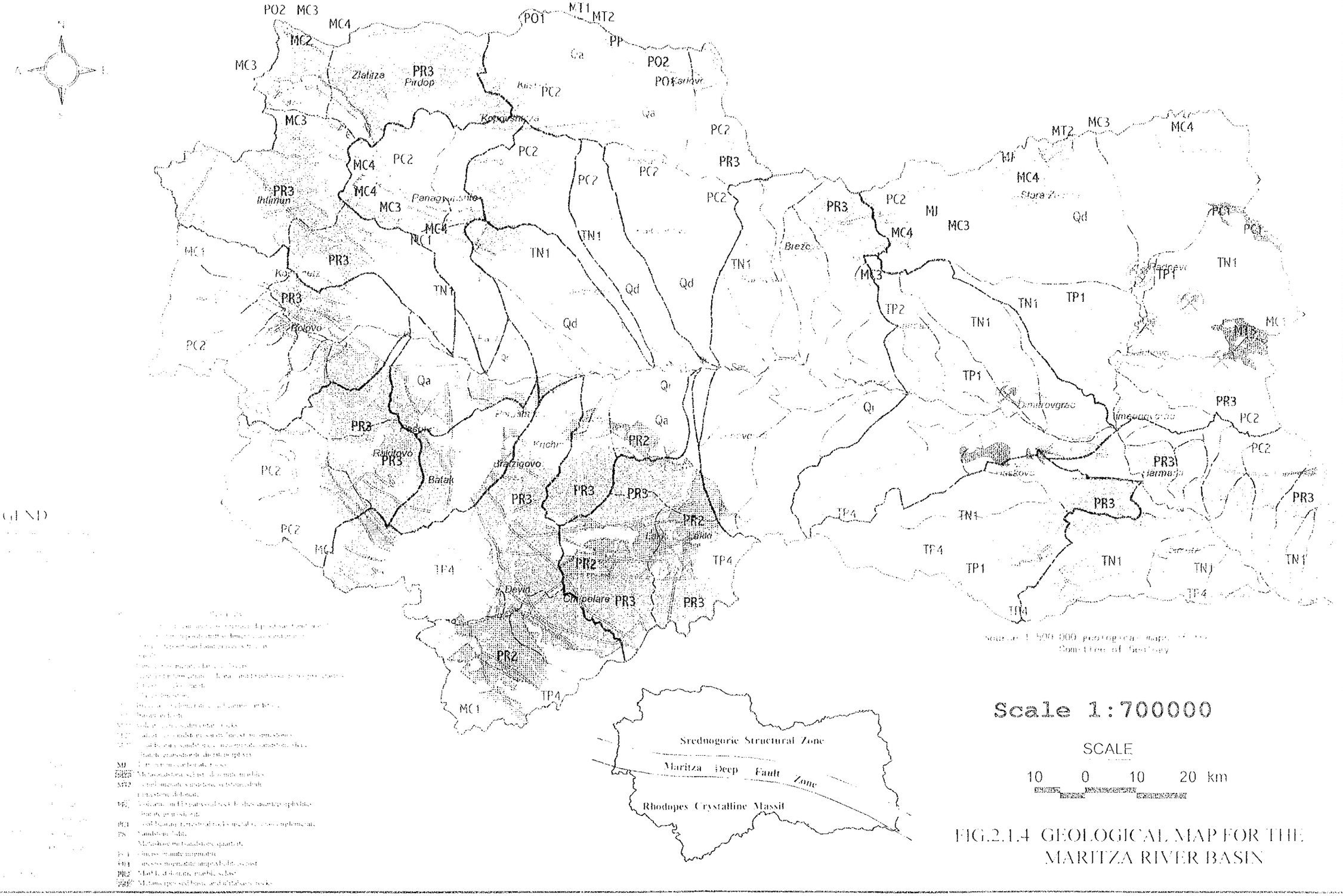



FIG.2.1.4 GEOLOGICAL MAP FOR THE MARITZA RIVER BASIN

## *2.2*

# *SOCIO-ECONOMY*

## 2.2 Socio-Economy

### 2.2.1 Administration Boundary and Population

Fig. 2.2.1 shows the administration boundary in the study area. The study area is divided into 3 regions of Plovdiv, Haskovo and Burgas Regions composed of 54 municipalities. Table 2.2.1 shows population in the study area for each region and municipalities. Total population in 1992 census for the study area was 1,747,334 persons, which is composed of 1,177,038 persons (67 %) in urban areas and 570,296 persons (33 %) in rural areas as shown in Table 2.2.2. Table 2.2.3 shows the basin-wise population in the study area.

### 2.2.2 National Socio-Economic Performance and Projections

Gross Domestic Product

To compare the economic performance of Bulgaria in different years, a deflator is derived from available statistics. Applying the deflator, it is shown that the Bulgarian economy had grown in real terms continuously from 1980 through 1988. The growth varied among broad economic sectors. The average annual growth during this period was 1.4% for agriculture, 6.0% for industry, and 2.5% for services. The gross domestic product (GDP) had grown at 4.3% per annum during 1980-88.

Since 1989, the GDP decreased in real terms consistently to reach the lowest level in 1993 (Table 2.2.4). The GDP in 1993 was only 62% of the maximum attained in 1988. The GDP recovered slightly in 1994. During this latter period, the industrial GDP decreased consistently. The agricultural GDP also declined generally up to 1993, except a short boom in 1990. It started to recover since 1993. The services sector, after a small setback during 1990-92, has been generally expanding. As a result, the economic structure of Bulgaria has changed as shown below.

Changes in Economic Structure of Bulgaria

(Unit: %)

| | 1980 | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| Agriculture | 14.4 | 11.9 | 17.7 | 14.1 |
| Industry | 53.8 | 62.5 | 51.3 | 34.7 |
| Services | 31.8 | 25.6 | 31.0 | 51.1 |

### 2.2.3 Value-Added Per Employee

Value-added per employee in different sectors is calculated from the GDP and the employment data in Tables 2.2.5 for the period 1989-95. Results are shown below.

Changes in Value-Added per Employee by Economic Sectors

(Unit: thousand leva in 1995 prices)

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|
| Agriculture | 176.0 | 260.8 | 194.7 | 141.9 | 116.4 | 130.4 | 140.9 |
| Industry | 382.7 | 306.2 | 280.3 | 254.8 | 223.9 | 219.1 | 243.0 |
| Services | 255.9 | 233.8 | 238.5 | 303.2 | 328.3 | 328.0 | 286.5 |
| Total | 300.0 | 271.7 | 247.7 | 249.8 | 241.9 | 243.0 | 237.1 |

The value-added per employee in agriculture attained the maximum level in the boom year of 1990, but decreased rapidly since then. This labor productivity, as crudely called here, reached a minimum in 1993 when it was only 45% of the productivity attained in 1990. The value-added per employee in industry declined consistently to reach the level in 1994 lower than 60% of the productivity in 1989. The services sector is the only sector where the productivity started to increase already in 1991, although it has declined slightly in the latest years.

Contribution of the private sector in GDP and employment is summarized in Tables 2.2.6 and 2.2.7, respectively. Value-added per employee in the private sector is calculated by economic sector for the period 1993-95, for which consistent data are available.

Value-Added per Employee in the Private Sector

(Unit: thousand leva in 1995 prices)

| | 1993 | 1994 | 1995 |
|---|---|---|---|
| Agriculture | 128.6 | 140.4 | 140.4 |
| Industry | 303.3 | 259.1 | 305.6 |
| Services | 655.6 | 542.1 | 512.7 |
| Total | 323.5 | 290.0 | 292.3 |

Comparison between the two tables above reveals the following. The value-added per employee is larger in the private sector in 1993 for all the economic sectors. The performance of the private sector thereafter has been unstable, but the productivity is generally higher in the private sector. The divergence of productivity between the public and the private sectors is the largest in the services sector, which has undergone the privatization from the earliest time. The productivity in agriculture is mixed outcome of the privatization and the land restitution. The privatization in industry was the slowest and the least attained during this period (Table 2.2.6)

### 2.2.4 Socio–Economy of Maritza River Basin

(1) Basin Sub–Division for Socio–Economic Analysis

Maritza river basin is sub–divided into the five sub–regions for socio-economic analysis in the study: Upstream, Mid-central, Mid–lower, Sazliyka, and Downstream sub–regions (Fig. 2.2.2).

Upstream sub–region consists of four major tributaries, viz. Topolnitza, Chepinska, Luda Yana and Stara rivers, as well as the Maritza main stream. Mid-central sub–region contains four major tributaries, viz. Pyassachnik, Vacha, Chepelarska and Stryama rivers. Mid–lower sub–region is composed of many smaller tributary basins. Sazliyka sub–region corresponds to the Sazliyka river basin. Downstream sub–region has the Harmanliyska river basin and several small tributaries. Socio-economic characteristics of the Study Area are summarized in Table 2.2.7 to Table 2.2.9.

(2) Existing Socio–Economic Conditions

1) Population and urbanization

The total population of the Maritza river basin decreased from 1.93 million in 1989 to 1.75 million in 1995, which accounts for 21% of the national population or 8.41 million in 1995. Urbanization ratio in the basin is about the same (67.4% in 1995) as the national average (67.7% in 1994), but the basin contains the most populated area in the Country outside the capital region. Mid-central sub-region has the largest urban population of the entire sub–regions in the basin, and Plovdiv, the largest urban center in the basin, has the highest density of all the urban centers in the Country. Both total and urban population decreased slightly between 1985 and 1995. Of 24 major urban centers in the Country having population over 500,000 only seven gained urban population during 1985-95. Assenovgrad in Mid-central sub–region recorded the highest growth of urban population, 2.6% over 1985–95.

2) Land cover

A map showing the existing land cover in the Study Area has been produced, extracted from the CORINE database (see Fig. 2.2.3). Of the 32 land use categories identified in the map, nine correspond to agricultural land use covering in total 10.2 thousand $km^2$ (48% of the basin), including agro-forestry as well but not grassland and pasture, and three correspond to forest land covering 7.0 thousand $km^2$ (33%) consisting of broad-leaved, coniferous and mixed forests, but not transitional woodland/shrub not agro-forestry. Forest coverage varies among the sub-regions, ranging from 48.9% in Upstream sub-region to 13.2% in Sazliyka sub-region. Agricultural land varies between 68.2% in Mid-lower sub region and 32.7% in Upstream sub-region. Settlements and urbanized area occupy only 4.6% of the basin.

3) Agriculture

Wheat is by far the most important crop in the entire sub–regions. Upstream and Mid-central sub–regions, coinciding largely with Plovdiv district, are exclusive producers of rice in the country. These sub–regions have comparative advantages in various vegetables, apple, plum and potatoes production as indicated by higher yields than respective national averages.

Grapes are produced widely in Mid-central, Mid–lower, Sazliyka and Downstream sub–regions, especially on skirts of mountains and hill slopes. Other important industrial crops are tobaccos produced mainly in Mid-central, Sazliyka and Downstream sub–regions, sunflower in Sazliyka sub–region, and cotton in Downstream sub–region. Distribution of cereals production depends on altitude and soil conditions. Wheat is more dominant in Upstream, Mid-central and Mid–lower sub–regions, rye is produced mainly in Mid-central sub–region, and barley is more widespread in Mid–lower and Sazliyka sub–regions.

The Maritza river basin is also an important livestock-producing region. There exist a few big farms for pigs in the basin, but much larger livestock and poultry population is raised by individual farmers.

4) Industry

The Maritza river basin has both indigenous resources–based industries and some of those strategic industries allocated to the country under the division of work system during the COMECON regime. Most important resources-based industries in the basin are coal mining and metallurgy. Coal production in Radnevo, Galabovo and Dimitrovgrad contributes some 75% to the national production value. Non–ferrous metallurgy in Upstream and Mid-central sub–regions contribute significantly (about 30%) to the national production. Other resources–based industries are pulp and paper,

and wood products in Upstream and Mid-central sub–regions, textile in Downstream sub–region, and tobacco mainly in Sazliyka and Downstream sub– regions as well as food processing.

Machinery and chemicals represent the strategic industries in the basin. These industries as well as building materials and food processing industries are widespread in the basin. The basin is also a significant producer of electricity with both thermal power plants based on local coal production and hydro power plants, contributing some 30% to the national production.

5) Social indices

Only limited data on social indices have been obtained. Birth and death rates may reflect not only health but also broader social conditions of people, which may in turn due to their economic status. Both birth and death rates are slightly better in the Study Area than the respective national averages.

Death rates vary more widely among the sub-regions between 9.7 per 1,000 in the Mid-central sub-region and 16.0 pre 1,000 in the Mid-lower sub-region. Infant mortality rate in the Study Area is higher than the national average. Within the Study Area, the rate is again the highest in the Mid-lower sub-region and the lowest in the Mid-central sub-region.

# TABLE 2.2.1 POPULATION IN THE STUDY AREA

| Region | Municipality | Population | | |
|---|---|---|---|---|
| | | Urban | Rural | Total |
| | | **1 177 038** | **570296** | **1 747 334** |
| **Plovdiv** | Assenovgrad | 52 360 | 15513 | 67 873 |
| | Brezovo | 2 280 | 8 103 | 10 383 |
| | Kaloyanovo | | 15144 | 15 144 |
| | Karlovo | 45243 | 31126 | 76 369 |
| | Maritza | | 32130 | 32130 |
| | Plovdiv | 341 058 | | 341058 |
| | Parvomay | 16 809 | 18762 | 35 571 |
| | Rakovski | 15 799 | 12723 | 28 522 |
| | Rodoppi | 27362 | 51440 | 78 802 |
| | Sadovo | 2 647 | 14360 | 17 007 |
| | Saedinenie | 6 801 | 6547 | 13 348 |
| | Hisarya | 9 149 | 8811 | 17960 |
| | Borino | | 4329 | 4329 |
| | Devin | 6 411 | 10164 | 16575 |
| | Lakki | 3 461 | 1738 | 5199 |
| | Chepelare | 6 264 | 4291 | 10555 |
| | Smolyan | | 2153 | 2153 |
| | Batak | 4 468 | 3 062 | 7530 |
| | Belovo | 5 016 | 6 406 | 11422 |
| | Bratzigovo | 5 022 | 7 160 | 12182 |
| | Velingrad | 26 020 | 17 629 | 43649 |
| | Lessichevo | | 7 042 | 7042 |
| | Pazardjik | 80 921 | 51 471 | 132392 |
| | Panagyurishte | 20 944 | 11 057 | 32001 |
| | Peshtera | 20 002 | 2 785 | 22787 |
| | Rakitovo | 8 672 | 7 616 | 16288 |
| | Septemvri | 9 365 | 23 600 | 32965 |
| | Strelcha | 5 063 | 1 362 | 6425 |
| | **Sub-total** | **721 137** | **376 524** | **1097661** |
| **Haskovo** | Dimitrovgrad | 53 579 | 19 239 | 72818 |
| | Lyubimetz | 8 499 | 3567 | 12066 |
| | Mineralniv.Bani | | 7583 | 7583 |
| | Svilengrad | 18 643 | 6343 | 24986 |
| | Simeonovgrad | 8 294 | 3655 | 11949 |
| | Stambolovo | | 5409 | 5409 |
| | Topolovgrad | | 2666 | 2666 |
| | Harmanli | 21 349 | 9680 | 31029 |
| | Haskovo | 80 700 | 21301 | 102001 |
| | Bratya Daskalovi | | 11 707 | 11707 |
| | Galabovo | 9 473 | 7 800 | 17273 |
| | Opan | | 4 425 | 4425 |
| | Radnevo | 14 203 | 11 885 | 26088 |
| | Stara Zagora | 149 666 | 25 022 | 174688 |
| | Chirpan | 19 694 | 9 140 | 28834 |
| | **Sub-total** | **384 100** | **149 422** | **533522** |
| **Burgas** | Nova Zagora | 26 260 | 23 306 | 49566 |
| **Sofia** | Anton | | 1 768 | 1768 |
| | Zlatitza | 5 635 | 955 | 6590 |
| | Ihtiman | 12 860 | 5 578 | 18438 |
| | Koprivshtitza | 3 006 | | 3006 |
| | Kostenetz | 10 641 | 5 365 | 16006 |
| | Mirkovo | | 3 293 | 3293 |
| | Pirdop | 8 373 | 947 | 9320 |
| | Samokov | 5 026 | | 5026 |
| | Chavdar | | 1 504 | 1504 |
| | Chelopech | | 1 634 | 1634 |
| | **Sub-total** | **45 541** | **21 044** | **66585** |

Source: National Statistical Institute
Note: The population is calculated according census 1992

TABLE 2.2.2 URBAN POPULATION IN THE STUDY AREA

| Region | Municipality | Populated place | Urban Population |
|---|---|---|---|
| Burgas | Nova Zagora | Nova Zagora | 26 260 |
| Haskovo | Chirpan | Chirpan | 19 694 |
| Haskovo | Dimitrovgrad | Dimitrovgrad | 50 977 |
| Haskovo | Galabovo | Galabovo | 9 473 |
| Haskovo | Harmanli | Harmanli | 21 349 |
| Haskovo | Haskovo | Haskovo | 80 700 |
| Haskovo | Lyubimetz | Lyubimetz | 8 499 |
| Haskovo | Dimitrovgrad | Merichleri | 2 602 |
| Haskovo | Radnevo | Radnevo | 14 203 |
| Haskovo | Simeonovgrad | Simeonovgrad | 8 294 |
| Haskovo | Stara Zagora | Stara Zagora | 149 666 |
| Haskovo | Svilengrad | Svilengrad | 18 643 |
| Plovdiv | Assenovgrad | Assenovgrad | 52 360 |
| Plovdiv | Batak | Batak | 4 468 |
| Plovdiv | Belovo | Belovo | 5 016 |
| Plovdiv | Bratzigovo | Bratzigovo | 5 022 |
| Plovdiv | Brezovo | Brezovo | 2 280 |
| Plovdiv | Chepelare | Chepelare | 6 264 |
| Plovdiv | Devin | Devin | 6 411 |
| Plovdiv | Hisarya | Hisarya | 9 149 |
| Plovdiv | Karlovo | Kalofer | 4 273 |
| Plovdiv | Karlovo | Karlovo | 27 291 |
| Plovdiv | Karlovo | Klilsura | 1 905 |
| Plovdiv | Rodoppi | Krichim | 8 761 |
| Plovdiv | Lakki | Lakki | 3 461 |
| Plovdiv | Panagyurishte | Panagyurishte | 20 944 |
| Plovdiv | Parvomay | Parvomay | 16 809 |
| Plovdiv | Pazardjik | Pazardjik | 80 921 |
| Plovdiv | Rodoppi | Perushtitza | 5 586 |
| Plovdiv | Peshtera | Peshtera | 20 002 |
| Plovdiv | Plovdiv | Plovdiv | 341 058 |
| Plovdiv | Rakitovo | Rakitovo | 8 672 |
| Plovdiv | Rakovski | Rakovski | 15 799 |
| Plovdiv | Sadovo | Sadovo | 2 647 |
| Plovdiv | Saedinenie | Saedinenie | 6 801 |
| Plovdiv | Septemvri | Septemvri | 9 365 |
| Plovdiv | Karlovo | Sopot | 11 774 |
| Plovdiv | Rodoppi | Stamboliyski | 13 015 |
| Plovdiv | Strelcha | Strelcha | 5 063 |
| Plovdiv | Velingrad | Velingrad | 26 020 |
| Sofia | Samokov | Dolna Banya | 5 026 |
| Sofia | Ihtiman | Ihtiman | 12 860 |
| Sofia | Koprivshtitza | Koprivshtitza | 3 006 |
| Sofia | Kostenetz | Kostenetz | 10 641 |
| Sofia | Pirdop | Pirdop | 8 373 |
| Sofia | Zlatitza | Zlatitza | 5 635 |
| | | **TOTAL** | **1 177 038** |

Source: National Statistical Institute
Note: The population is calculated according census 1992

TABLE 2.2.3 BASIN-WISE POPULATION IN THE STUDY AREA

| Major tributary basin | Sub-basin | Urban | Rural | Total |
|---|---|---|---|---|
| **Chepelarska R.** | CPE-1 | 52 360 | 19 391 | 71 751 |
| | CPE-2 | 3461 | 1738 | 5 199 |
| | CPE-3 | 6264 | 4291 | 10555 |
| Total | | 62 085 | 25 420 | **87 505** |
| **Chepinska R.** | CPI-2 | 8672 | 7 616 | 16288 |
| | CPI-3 | 26 020 | 17 629 | 43 649 |
| Total | | 34692 | 25 245 | **59937** |
| **Harmanliyska R.** | HAR-1 | 21 349 | 3 650 | 24 999 |
| | HAR-2 | 80 700 | 18053 | 98 753 |
| | HAR-3 | | 8340 | 8340 |
| Total | | 102 049 | 30 043 | **132 092** |
| **Luda Yana R.** | LUD-2 | 20 944 | 11 057 | 32 001 |
| | LUD-3 | 5 063 | 1 362 | 6 425 |
| Total | | 26 007 | 12 419 | **38 426** |
| **Maritza R.** | MD | 27142 | 23488 | 50630 |
| | MM | 479976 | 168353 | 648329 |
| | MU | 110969 | 89837 | 200806 |
| | | 618087 | 281678 | **899765** |
| **Pyassachnik R.** | PYA | | 16393 | 16393 |
| Total | | | 16393 | **16393** |
| **Sazliyka R.** | SAZ-2 | | 2 666 | 2 666 |
| | SAZ-3 | | 1647 | 1647 |
| | SAZ-4 | 9 473 | 11062 | 20 535 |
| | SAZ-6 | 40463 | 21659 | 62122 |
| | SAZ-7 | 149 666 | 36907 | 186 573 |
| Total | | 199 602 | 73 941 | **273 543** |
| **Stara R.** | STA | 29 492 | 15504 | 44 996 |
| Total | | 29 492 | 15504 | **44 996** |
| **Striyama R.** | STR-1 | 9 149 | 19 021 | 28 170 |
| | STR-2 | 4 273 | 6196 | 10 469 |
| | STR-3 | 40970 | 24930 | 65900 |
| Total | | 54 392 | 50 147 | **104 539** |
| **Topolnitza R.** | TOP-2 | 12860 | 8871 | 21731 |
| | TOP-3 | 17014 | 5040 | 22054 |
| Total | | 29874 | 13911 | **43785** |
| **Vacha R.** | VAC-1 | 14347 | 9937 | 24284 |
| | VAC-2 | | 2957 | 2957 |
| | VAC-3 | 6411 | 12701 | 19112 |
| Total | | 20758 | 25595 | **46353** |

| TOTAL | **1 177 038** | **570 296** | **1 747 334** |
|---|---|---|---|

TABLE 2.2.4 GROSS DOMESTIC PRODUCT BY ECONOMIC SECTOR, 1989-95

(Unit: million leva in 1995 prices)

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|
| Agriculture | 143,304 | 197,555 | 135,630 | 98,470 | 82,915 | 97,968 | 111,041 |
| Industry | 777,852 | 570,832 | 423,228 | 330,993 | 272,831 | 255,832 | 272,699 |
| Services | 388,529 | 344,889 | 323,777 | 388,347 | 423,691 | 433,829 | 401,262 |
| GDP | 1,309,685 | 1,113,277 | 882,636 | 817,809 | 779,436 | 787,629 | 785,002 |

Sources: Statistical Yearbook 1996 (1991-95)
Statistical Reference Book, Economics of Bulgaria,1993

TABLE 2.2.5 EMPLOYMENT BY ECONOMIC SECTOR

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|
| Agriculture | 814,246 | 757,527 | 696,454 | 694,007 | 712,575 | 751,503 | 782,918 |
| Industry | 2,032,306 | 1,864,016 | 1,510,133 | 1,298,869 | 1,218,696 | 1,167,564 | 1,144,164 |
| Services | 1,518,482 | 1,475,305 | 1,357,450 | 1,280,869 | 1,290,567 | 1,322,534 | 1,355,101 |
| Total | 4,365,034 | 4,096,848 | 3,564,037 | 3,273,661 | 3,221,838 | 3,241,601 | 3,282,183 |

Source: Statistical Yearbook 1994,1996

TABLE 2.2.6 CONTRIBUTION OF PRIVATE SECTOR IN GDP BY SECTOR

(Private sector share in parenthesis) (Unit: million leva in current prices)

| | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Private sector | Total | Private sector | Total | Private sector | Total | Private sector | Total | Private sector |
| Agriculture | 20,139 | 7,272 (36.1) | 23,329 | 13,384 (57.2) | 29,694 | 21,414 (72.1) | 60,184 | 49,956 (83.0) | 111,041 | 90,297 (81.3) |
| Industry | 62,843 | 3,495 (5.6) | 78,417 | 8,376 (10.7) | 97,708 | 17,891 (18.3) | 180,790 | 34,546 (19.1) | 272,699 | 80,042 (29.4) |
| Services | 48,076 | 25,202 (30.0) | 92,005 | 29,647 (32.2) | 151,735 | 66,361 (43.7) | 268,668 | 123,452 (45.9) | 401,262 | 219,268 (54.6) |
| Total | 131,058 | 25,202 (17.5) | 193,751 | 51,407 (26.5) | 279,137 | 105,666 (37.9) | 509,642 | 207,954 (40.8) | 785,002 | 389,607 (49.6) |

Source: NSI, Macro-Economic Indicators 1995.

# TABLE 2.2.7 SOCIO-ECONOMIC CHARACTERISTICS OF THE STUDY AREA

| | Unit | Upstream | Mid-central | Mid-lower | Sazliika | Downstream | Study Area | Bulgaria |
|---|---|---|---|---|---|---|---|---|
| ***1.Area*** | | | | | | | | |
| Total land area | $km^2$ | 5,482 | 6,299 | 3,569 | 3,343 | 2,620 | 21,314 | 111,011 |
| ***2.Population (1995)*** | | | | | | | | |
| Total population | | 378,950 | 689,119 | 214,000 | 273,543 | 182,722 | 1,747,334 | 8,384,715 |
| Population density | $km^2$ | 70,8 | 109,0 | 60,3 | 81,8 | 69,7 | 82,0 | 75,5 |
| Urbanization ratio | % | 59.6 | 72.3 | 55.7 | 73.0 | 70.7 | 67.4 | 67.8 |
| ***3.Land use*** | | | | | | | | |
| Agricultural land | $km^2$ | 1,801 | 2,344 | 2,412 | 2,292 | 1,448 | 10,296 | 62,786 |
| Arable land | % | 84.4 | 75.9 | 92.3 | 51.4 | 94.9 | 78.5 | 74.8 |
| Irrigation land | % | 15.6 | 24.1 | 7.7 | 48.6 | 5.1 | 21.5 | 16.2 |
| Forest land | $km^2$ | 2,669 | 2,715 | 539 | 440 | 528 | 6,891 | 38,107 |
| ***4.Economic structure (1995)*** | | | | | | | | |
| Agriculture | % | | | | | | 13.0 | 14.1 |
| Industry | % | | | | | | 40.3 | 34.7 |
| Services | % | | | | | | 46.8 | 51.1 |
| ***5.Employment structure (1995)*** | | | | | | | | |
| Agriculture | % | | | | | | 22.8 | 23.8 |
| Industry | % | | | | | | 39.5 | 33.9 |
| Services | % | | | | | | 37.8 | 42.3 |
| ***6.Main crops*** | | Wheat, Vegetables, Rice, Fruits, Potatoes | Wheat, Vegetables, Rye, Tobacco | Wheat, Cotton, Grapes, Barley | Grapes, Barley, Sunflower, Tobacco | Cotton, Tobacco, Grapes, Vegetables | | |
| ***7.Characteristic industries*** | | Mining, Metallurgy, Pharmaceuticals Pulp & paper, Wood processing, Wines | Textile, Dairy, Cosmet.&perfum, Electric device, Pharmaceuticals, Tobacco, Agric.mashinery, Pulp & paper | Textile, Electricity, Cement, Fertilizer, Coal mining, Cosmet.&perfum, Dairy, Meat products | Vegetable oils, Fertilizer &agro Chemicals, Coal mining, Briquetts, Electricity, Tobacco | Textile, Tobacco, Dairy, Wines | | |
| ***8.Municipal water supply*** | | | | | | | | |
| Unit domestic water use | l/cap/day | 186 | 165 | 208 | 126 | 119 | 160 | |
| Loss ratio | % | 42.7 | 41.4 | 33.3 | 51.5 | 32.4 | 42.7 | |
| ***9.Urban sewerage systems*** | | | | | | | | |
| Service ratio | % | 77.9 | 88.3 | 88.3 | 88.7 | 80.0 | 85.3 | |
| ***10.Municipal account*** | | | | | | | | |
| Per capita revenue | Lev. | 4,137 | 5,076 | 3,255 | 5,125 | 4,332 | 4,587 | 4,553 |
| Per capita expenditure | Lev. | 7,977 | 8,811 | 7,683 | 8,184 | 8,411 | 8,350 | 8,114 |

Source: *1, 4, 5, 6, 7* – JICA Study Team; *2, 3, 8, 9, 10* - NSI

TABLE 2.2.8 SHARES OF DISTRICT POPULATION WITHIN MARITZA RIVER BASIN, 1995

(Unit: 1,000)

| Chapter 3 District | Total population | Population in Maritza River Basin | Share (%) |
|---|---|---|---|
| Plovdiv | 1,214.0 | 1,092.9 | 90.0 |
| Haskovo | 897.9 | 549.9 | 61.2 |
| Sofia | 966.5 | 66.6 | 6.9 |
| Bourgas | 846.5 | 48.7 | 5.8 |
| Maritza river basin | | 1,758.0 | 20.9 % of total national population |

TABLE 2.2.9 SHARES OF MARITZA RIVER BASIN BY VARIOUS INDICES

| Index | Unit | Bulgaria | Maritza river basin | Share (%) |
|---|---|---|---|---|
| Land area | $km^2$ | 110,994 | 21,084 | 19.0 |
| Population, 1995 | 1.000 | 8,406.1 | 1,758.0 | 20.9 |
| Arable land | $km^2$ | 4,693 | 823.9 | 17.6 |
| Livestock population* | | | | |
| Cattle | | 631,739 | 160,300 | 25.4 |
| Pigs | | 2,140,011 | 378,200 | 17.7 |
| Sheep | | 2,386,451 | 575,000 | 24.1 |
| Livestock products* | | | | |
| Milk | $10^3$ l | 1,404,221 | 327,500 | 23.3 |
| Eggs | $10^3$ | 1,954,955 | 313,300 | 16.0 |

* District statistics allocated to Maritza river basin by population share

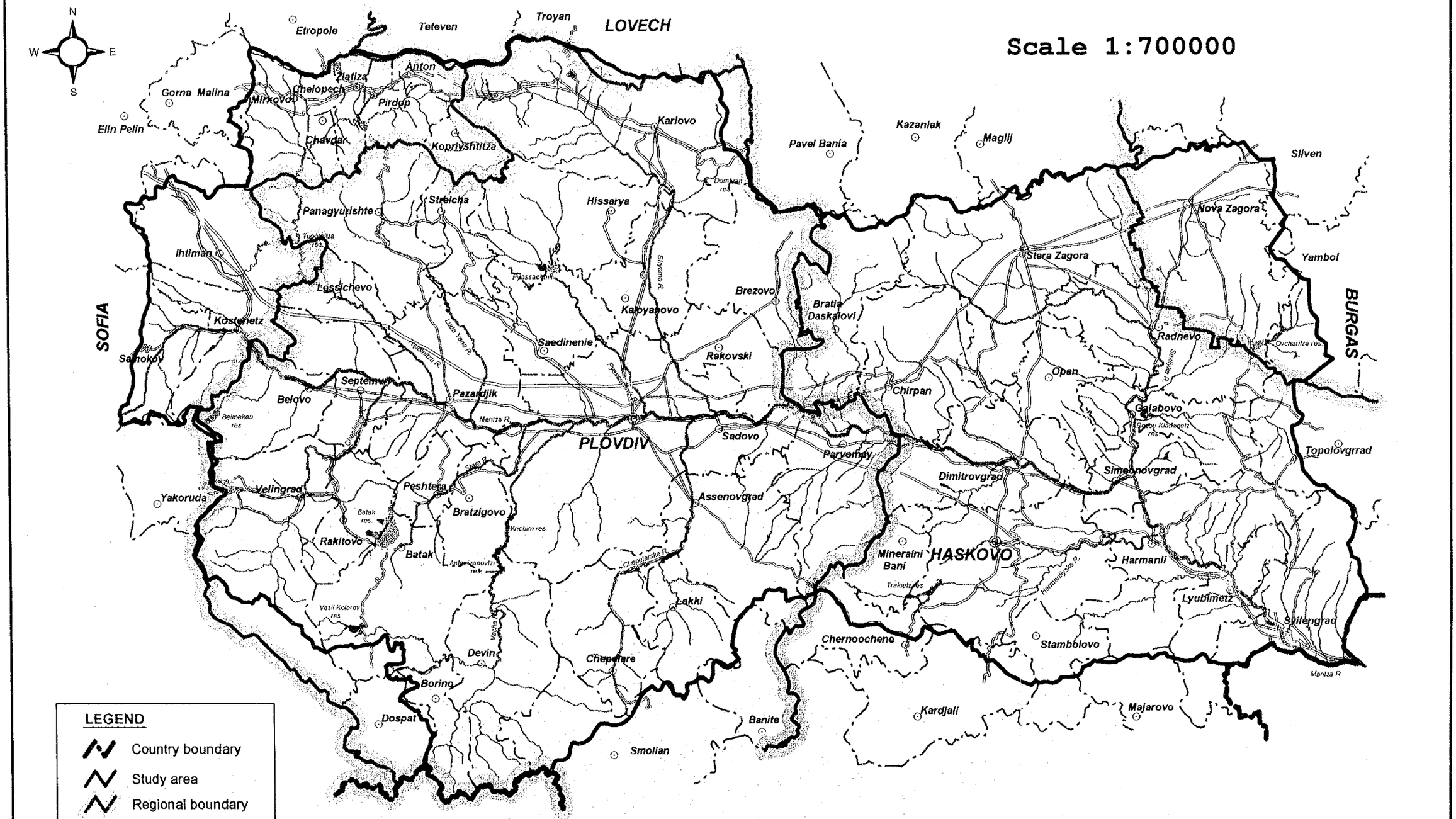



FIG. 2.2.1 ADMINISTRATION BOUNDARY IN THE STUDY AREA

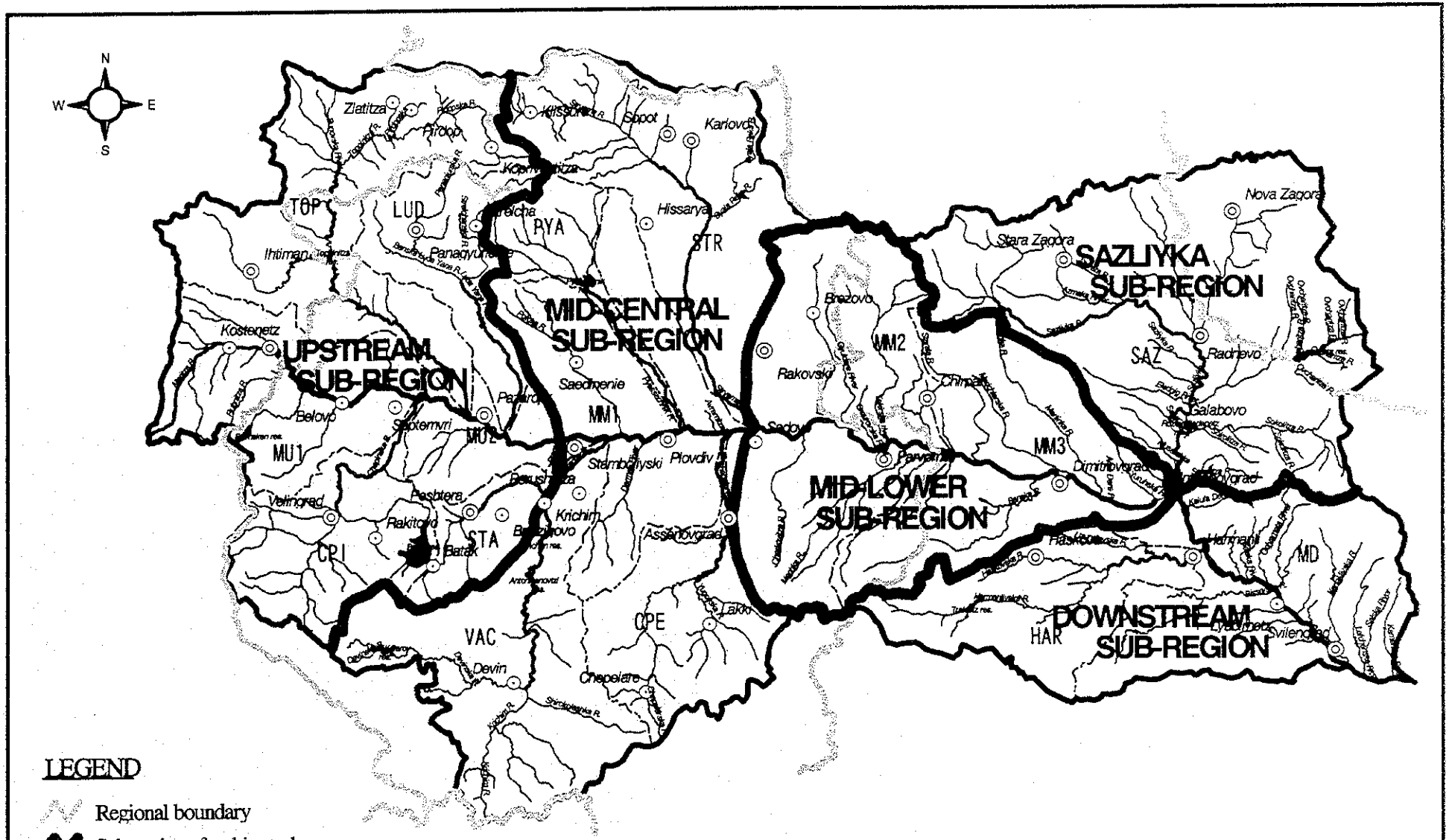
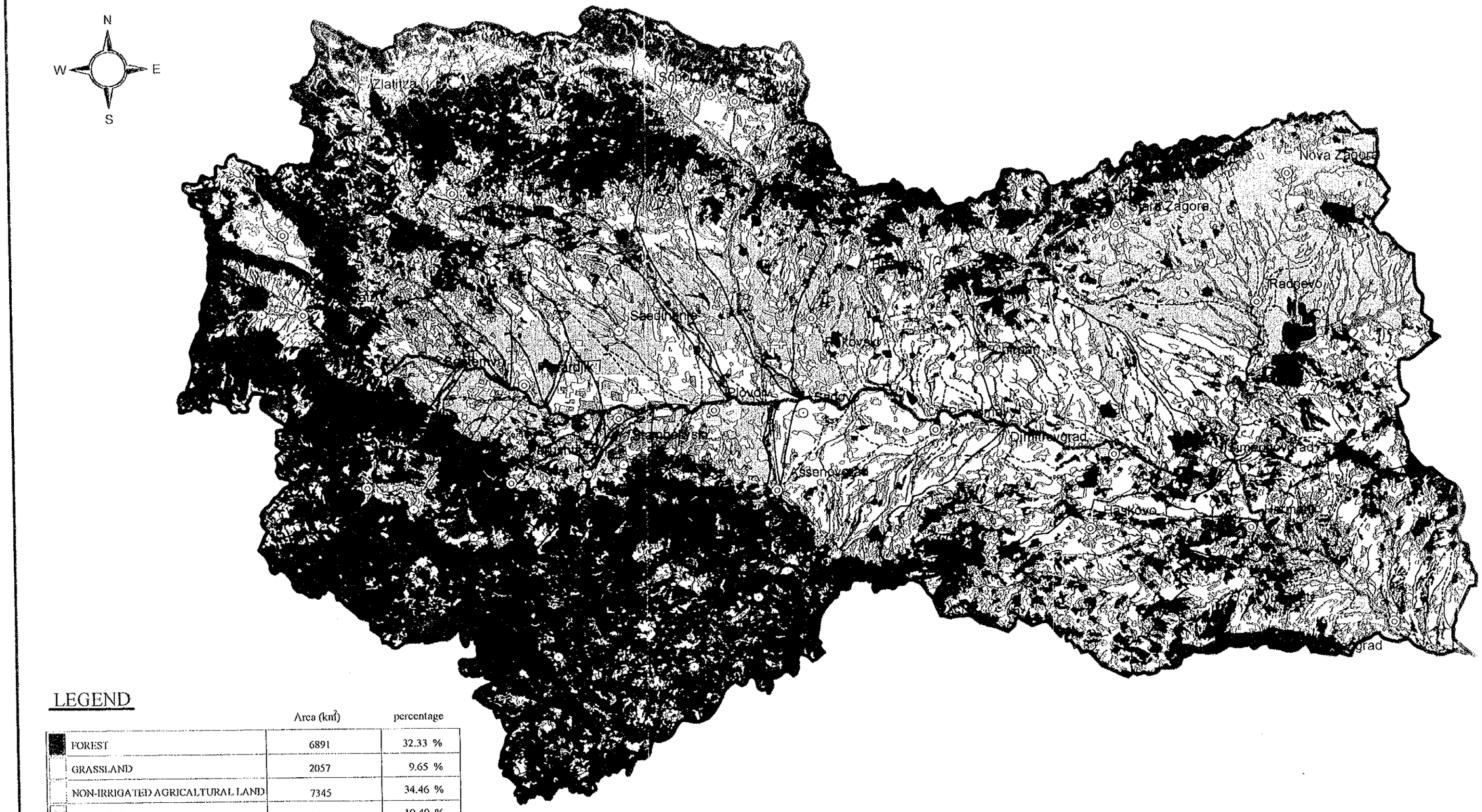



FIG. 2.2.2 FIVE SUB-REGIONS IN THE MARITZA RIVER BASIN




LEGEND

| | Area (km²) | percentage |
|---|---|---|
| FOREST | 6891 | 32.33 % |
| GRASSLAND | 2057 | 9.65 % |
| NON-IRRIGATED AGRICALTURAL LAND | 7345 | 34.46 % |
| IRRIGATED LAND | 2216 | 10.40 % |
| FRUIT TREES/VINEYARDS | 735 | 3.45 % |
| URBAN AREA | 948 | 4.45 % |
| WATER BODIES | 139 | 0.65 % |
| BARE LANDS | 982 | 4.61 % |

FIG. 2.2.3 PRESENT LAND COVER MAP DERIVED FROM CORINE DATABASE

Scale 1:700000

10 0 10 20 km


FIG. 2.2.3 PRESENT LAND COVER MAP DERIVED FROM CORINE DATABASE

Scale 1:700000

10 0 10 20 km