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JAPAN INTERNATIONAL COOPERATION AGENCY

THE SOFIA GREATER MUNICIPALITY, THE REPUBLIC OF BULGARIA

THE STUDY ON THE SOLID WASTE MANAGEMENT FOR THE TERRITORY OF THE SOFIA GREATER MUNICIPALITY

SUPPORTING REPORT I

July 1994

Yachiyo Engineering Co., Ltd.
Tokyo, Japan

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INTRODUCTION

INTRODUCTION

The Study on the Solid Waste Management for the Territory of the Sofia Greater Municipality extended from April 1993 to July 1994. During that period the JICA Study Team spent two extended periods in Sofia for a total of about 7 months.

During the Study course, and with the valuable cooperation of the SGM Counterpart team, and representative from the various related government ministries in Bulgaria numerous surveys were conducted and extensive data collected. The analysis of these data assisted in the formation of the master plan and preliminary designs for the priority projects.

Unfortunately it is not possible to enclose all the data collected in the main reports of this study, and indeed even in this Supporting Report. However data which has close relevancy to the Study master plan and case study on feasibility of the priority projects has been incorporated in this Supporting Report I.

It should be noted that the contents of this report contain information and data but in many cases no analysis or conclusions. These are dealt with in Main Reports I and II.

Chapter 1 and 2 contain information on existing conditions in SGM. Information on the current SWM practice in the municipality is found in Chapter 3. Chapter 4 provided additional analysis on the Collection and Haulage component of the Master Plan.

Background for calculation of priority project costs are included in Chapter 5. Chapter 6 contains a review of related studies conducted an a listing of the surveys executed during this Study.

CHAPTER 1

NATURAL CONDITIONS IN SGM

1. NATURAL CONDITIONS IN SGM

1.1 Geological and Lithological Structure

The geological structure of the Sofia plain and surrounding mountains is complex and diverse. It is particularly relevant to the Sofia solid waste landfill appraisal work and hence is reviewed here.

The oldest geological forms which are to be found near the surface date from the Paleozoic era and the most recent ones are the Quarternery deposits. Figure 1-1 presents a geological map of the region.

Paleozoic rocks are present mostly in the form of metamorphic shales, quartzited sandstone and conglomerates. Their outcrop is to be found in the north and east slopes of the plain - Kremikovtsi, Buhovo, Stolnik, Aprilovo and Dolna Malina.

Triassic formations are mainly from the lower and middle Triassic period. Lower Triassic forms are mainly the red sands whose outcrop is to be found on the north slopes of Lozen mountain (Dolni Lozen, Novi Han) and the southern slopes of Stara Planina (Kremikovtsi, Lokorsko, Podgumer, Kurillo and others). Middle Triassic formations are mainly dolomite and limestone at the villages of Kremikovtsi, Sesslavtsi, Buhovo.

Triassic formations have been found in some parts of the Sofia basin under the Neozoic sediments.

Jurassic sediments are present in the form of different sandstones, limestone, clay shales and marls. They are to be found on the slopes of the Stara Planina in the western part of the basin as well as at several points around German (a village 2 km east of Sofia), Dolni Lozen and Dolna Malina.

Sediments from the Cretaceous period are turonian, senonian and magmatic rocks of upper Cretaceous eruptions.

Turonian sands, conglomerates and gray-green shales are found around Dolni Lozen and Gorna Malina.

Senonian sediments are represented by marls and limestone and are widely distributed in the north eastern plain at Buhovo and Gorna Malina.

Figure 1-1

GEOLOGICAL MAP OF THE REGION - SHEET 1

N

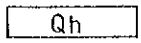
Scale 0 5 10 km

Figure 1-1

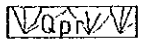
GEOLOGICAL MAP OF THE REGION - SHEET 1

N

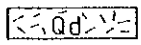
Scale 0 5 10 km



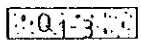
HOLOCENE AND QUATERNARY RIVER TERRACES



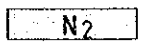
QUARTERNERY SUPERFICIAL CONES



SLOPE EMBANKMENTS

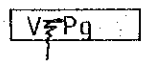


ALLUVIAL, PROLUVIAL AND LAKE SEDIMENTS

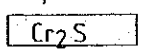


PLIOCENE

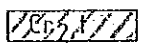
UPPER EOCENE II



MIDDLE NEOINTRUSIONS

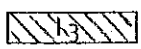


SENONIAN - MAASTRICHT

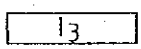

TURON - TETHYSSIAN TYPE

UPPER CRETACEOUS TUFFS - MIDDLE

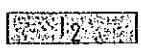
LIMESTONE TYPE TITHON



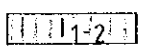
FLYSCH LIKE TYTHON



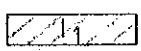
CLAY MALM, OXFORD, KIMERIGE



DOGGER



LIAS - DOGGER

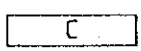


LIAS

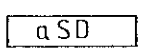
MIDDLE TRIASSIC

LOWER TRIASSIC

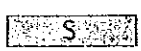
PERMIAN



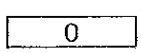
UPPER CARBON



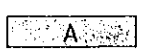
DIABASE PHYLLITOID FORMATION



SILURIAN



ORDOVICIAN



LOWER SERIES OF THE METAMORPHIC COMPLEX - LOWER SEAM SEQUENCE

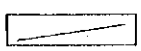

FISSURE DISPLACEMENT

Figure 1-1 (cont..)

GEOLOGICAL MAP OF THE REGION - SHEET 2

Upper Cretaceous eruptions are evidenced by andesites and andesite tuffs. They are to be found mainly on the western and south western slopes of the plain - Herakovo, Bankya, Gorna Banya. At many places their presence has been confirmed by bores through the Paleogenic and Pliocene sediments.

Paleogenic rocks are represented by a diverse conglomerate series, coarse grain sands, clays, gravel. They have been found on the northern slopes of the Lozen mountain, south to the German and Lozen villages.

Pliocene sediments are found mainly on the western parts of the Valley basin; Balsha, Peturch, Voluyak, Bozhurishte, Gourmazovo and fill completely the central parts of the plain, their thickness reaching 1000 m at certain places. Pliocene sediments are divided into three horizons. The complete stratographic make up is to be found only in the central part of the plain.

The lower strata comprises sands with different grain size, clays and clay sands having a thickness of 20 to 70 m. The middle strata comprises different clays, small layers of sands and lignite layers having a thickness of 200 to 300 m. The upper strata comprises alternating layers of gravel, sands and clays having a thickness of 50 to 150 m.

Quarternery sediments cover almost completely the central and eastern parts of Sofia Basin. They comprise deluvial and proluvial sediments. They occupy the peripheral part of the basin and comprise sand-like olines, gravel and coarse cobbles with a sand and clay binding material, having a thickness of 30 to 300 mm. Alluvial sediments are deposited in the central part of the plain quite often based on graded gravels below gravels and sands permeated by clays and topped by clayish sands and sandy clays. The thickness of this alluvial layer varies from 4 to 50 meters, (and even more in places).

The tectonic structure the Sofia plain is a complex graben filled with Pliocene and Quarternery sediments.

1.2 Seismic Sensitivity

Bulgaria is unfortunately in an area of known and studied seismic activity. Sofia in particular suffers from this activity and lies in a Force IX Medvedev-Schponheor-Carnic Scale Zone. Figure 1-2 designates the General Bulgarian Activity Zones and illustrates the situation.

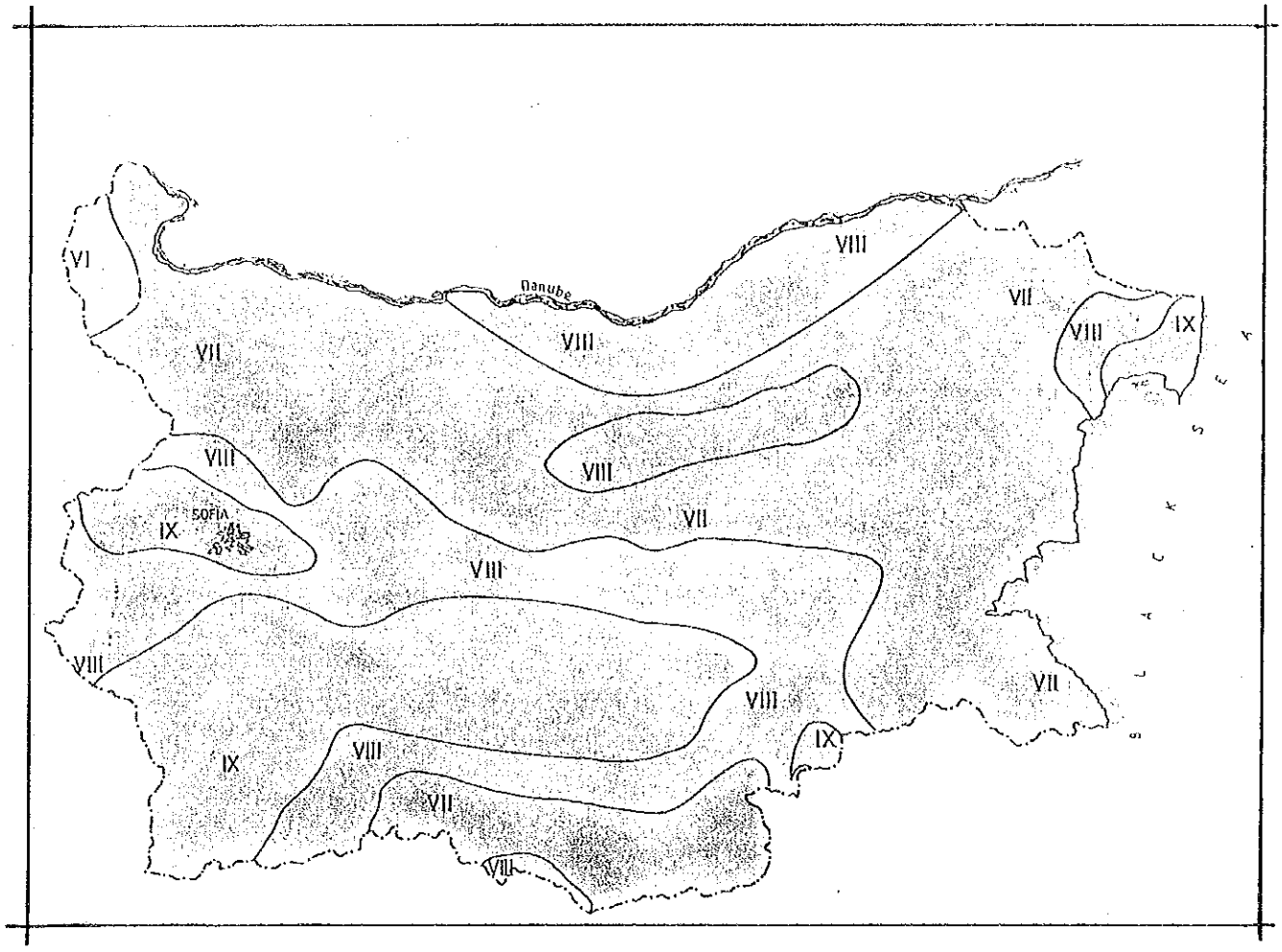


Figure 1-2

GENERAL BULGARIAN ACTIVITY ZONES

Degree	Manifestation
1	Registered only by seismographs
2	Only registered from people staying still
3	Registered only by a small number of people
4	Felt by many people. Dishes and windows rattle
5	Many sleeping people wake up, hanging objects sway
6	Light cracks in masonry
7	Cracks in masonry, walls and foundations
8	Big cracks in masonry, some roofs cave in
9	In some buildings walls and roofs cave in
10	Many building cave in, cracks in the earth
11	Numerous cracks in the earth, landslides in the mountains
12	Great changes on the surface of the earth

Degrees 8, 9, 10 corespond approximately to degrees 5 & 6 of the Richter scale

N

Scheme

The last major earthquake of significance occurred in 1977 and was centered in Vrabcha, Rumania. In Danube Valley several fatalities occurred at Svishtov in NE Bulgaria. In Sofia effects were milder with little serious structural damage. In subsequent years at least 4 'noticeable' (force 4 or 5) quakes have disturbed Sofia.

The Zone classification for SGM Area is liable to:

"Walls and Ceilings caving in on some Buildings"

The full scale listing is included with Figure 1-2.

This general classification will be accounted for when considering the costs, the technological features and environmental protection necessary for the Solid Waste facilities.

1.3 Rainfall

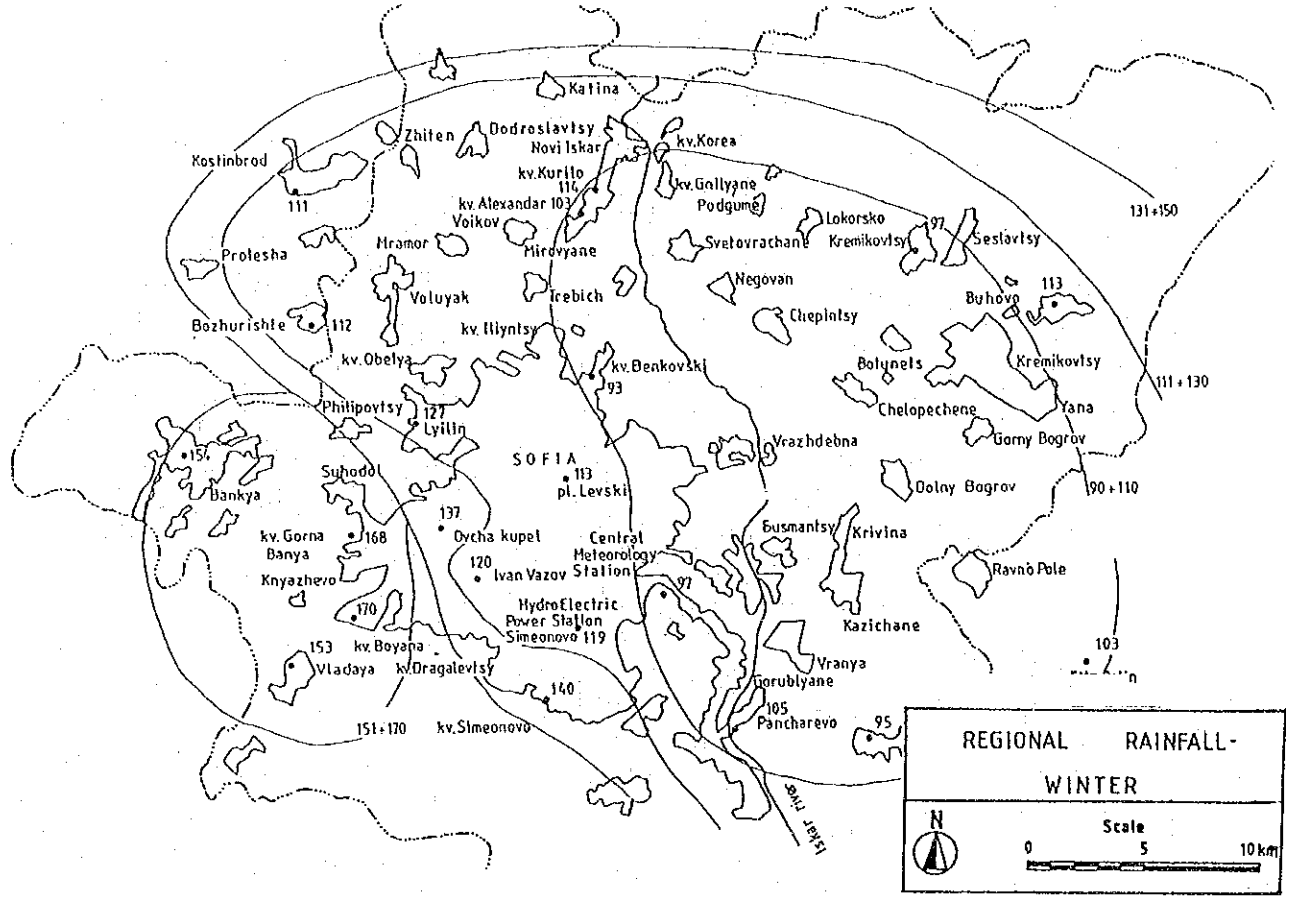
The average annual precipitation is 638.5 mm. It is heaviest in the spring (May, June) and the least in winter (January and February). In winter 60% of the precipitation is in the form of snow which lies in the Sofia plain some 3 months each year and in the surrounding mountains for up to 7 months (eg. on Mt. Vitosha). The prolonged annual snow melt assists surface water recharge and promotes an even rate of infiltration of the surface waters.

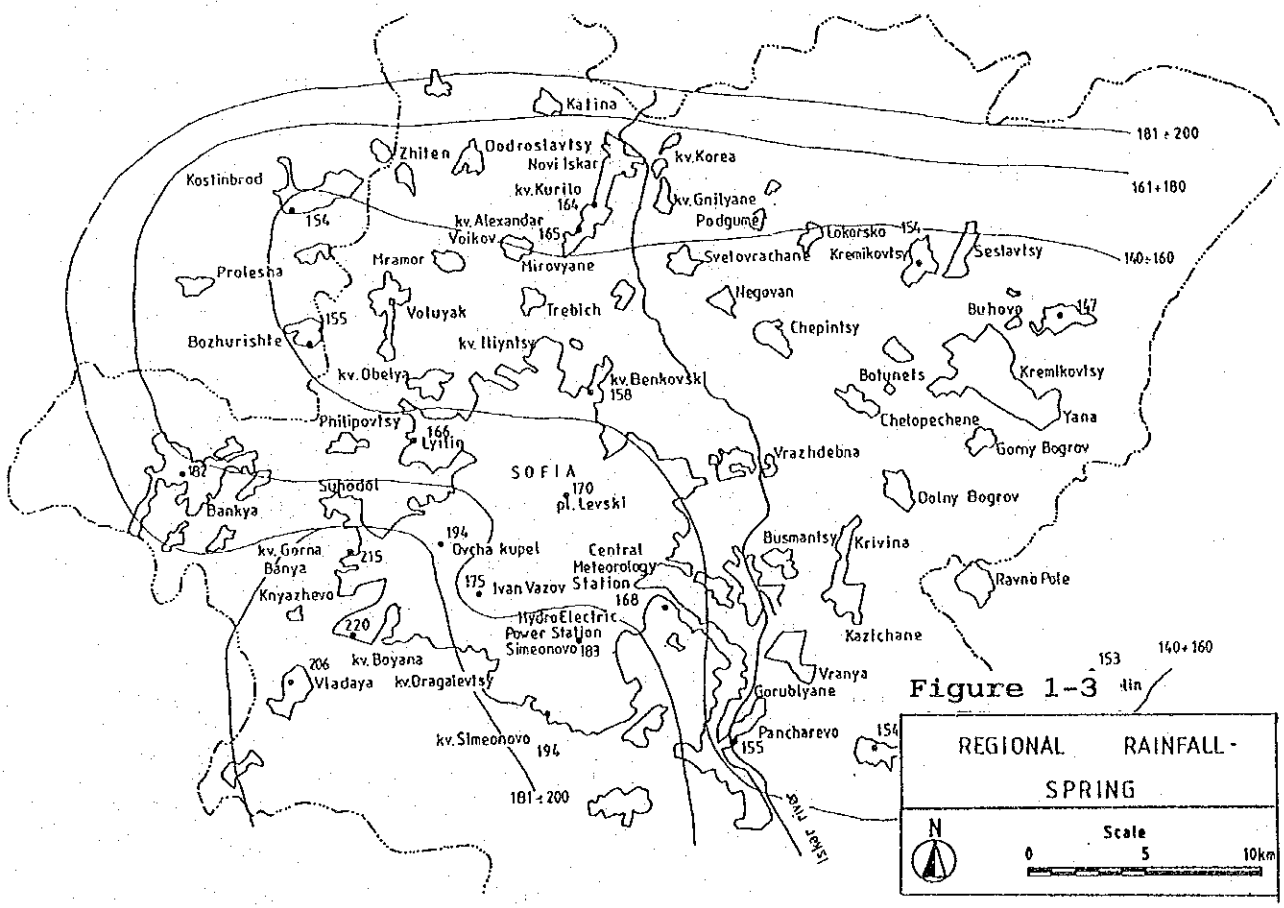
Detailed precipitation distribution predictions are available for the area and are presented as seasonal and annual average rainfalls in Figures 1-3 to 1-5 resp. Data from these maps was used in the preliminary studies and designs.

Hydrological flood data have been established for design purposes within the Sofia region. Normal maximum flood was taken at the statistical 1:100 year, 5 minute peak intensity.

Maximum April to October precipitation design intensities are:

Duration	Intensity	Precipitation
5 mins	3.56 mm/min	593 l/ha
10 mins	2.28 mm/min	380 l/ha


Katina
Zhiten
Dodroslavtsy
Novi Iskar
kv.Korea
Kostinbrod
kv.Kurilo
kv.Gnilyane
Podgume
kv.Alexandar
Voikov
Lokorsko
Kremikovtsy
Sestavtsy
Mramor
Mirovyane
Svetovrachane
Negovan
Buhovo
Prolesha
Voluyak
Trebich
Chepintsy
Bozhurishte
kv.Iliyntsy
kv.Obelya
kv.Benkovski
Botunets
Philipovtsy
Lyulin
Chelopechene
Yana
SOFIA
Vrazhdebna
Gorny Bogrov
Bankya
Suhodol
pl.Levski
Dolny Bogrov
kv.Gorna Banya
Ovcha kupel
Central Meteorology Station
Ivan Vazov
Busmantsy
Krivina
Knyazhevo
Ravno Pole
HydroElectric Power Station Simeonovo
Kazichane
Vranya
kv.Boyana
Vladaya
kv.Dragalevtsy
Gorublyane
Pancharevo
kv.Simeonovo
Iskar river
131÷150
111÷130
90÷110
REGIONAL RAINFALL-
WINTER
N
Scale
0 5 10 km


Katina
Zhiten
Dodroslavtsy
Novi Iskar
kv.Korea
Kostinbrod
kv.Kurilo
kv.Gnilyane
Podgume
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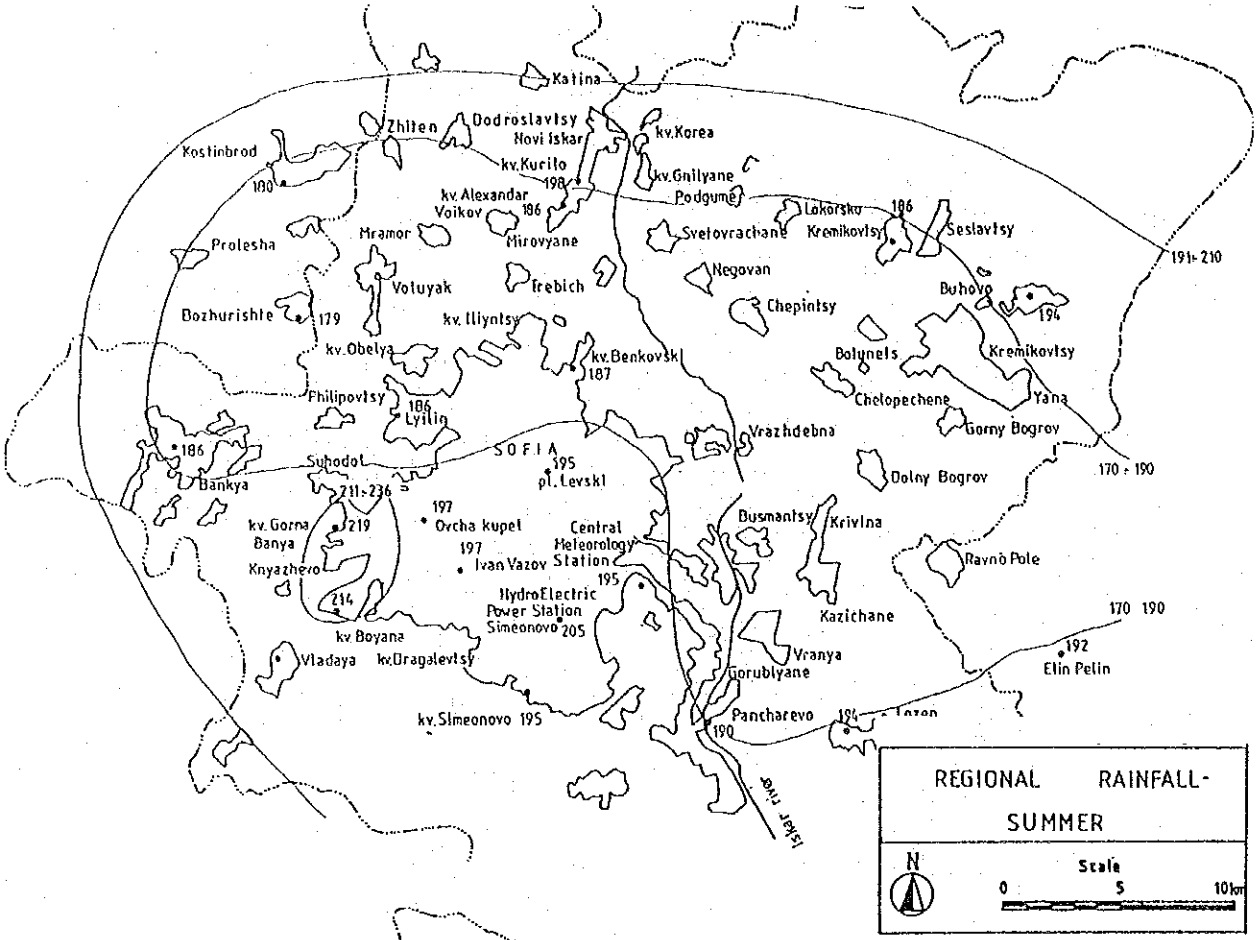
Voikov
Lokorsko
Kremikovtsy
Sestavtsy
Mramor
Mirovyane
Svetovrachane
Negovan
Buhovo
Prolesha
Voluyak
Trebich
Chepintsy
Bozhurishte
kv.Iliyntsy
kv.Obelya
kv.Benkovski
Botunets
Kremikovtsy
Philipovtsy
Lyulin
Chelopechene
Yana
SOFIA
Vrazhdebna
Gorny Bogrov
Bankya
Suhodol
pl.Levski
Dolny Bogrov
kv.Gorna Banya
Ovcha kupel
Central Meteorology Station
Ivan Vazov
Busmantsy
Krivina
Knyazhevo
Ravno Pole
HydroElectric Power Station Simeonovo
Kazichane
Vranya
kv.Boyana
Vladaya
kv.Dragalevtsy
Gorublyane
Pancharevo
kv.Simeonovo
Iskar river
181÷200
161÷180
140÷160
140÷160
REGIONAL RAINFALL-
SPRING
N
Scale
0 5 10km

Figure 1-3


Katina
Zhiten
Dodroslavtsy
Novi Iskar
kv.Korea
Kostinbrod
kv.Kurilo
kv.Gnilyane
Podgume
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Voikov
Mirovyane
Lokorsko
Kremikovtsi
Sestavtsy
Svetovrachane
Mramor
Protesha
Negovan
Buhovo
Votuyak
Trebich
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Bozhurishte
kv.Iliyntsy
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kv.Benkovski
Bolunets
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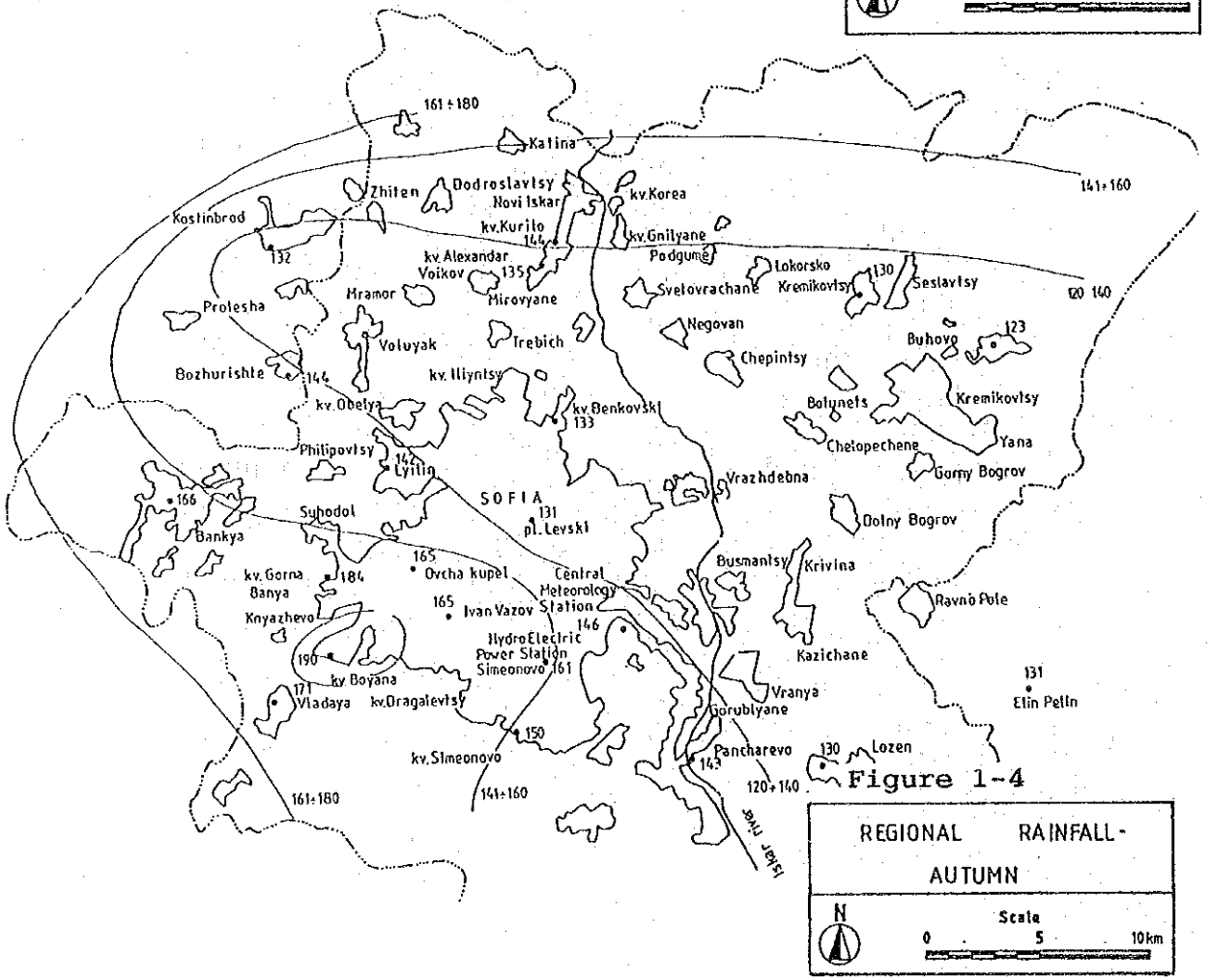
Kazichane
kv.Boyana
Vladaya
kv.Dragalevtsi
Vranya
Gorublyane
Elin Pelin
kv.Simeonovo
Pancharevo
Lozen
Iskar river
191÷210
170 ÷ 190
REGIONAL RAINFALL-
SUMMER
N
Scale
0 5 10km


161÷180
Katina
141÷160
Zhiten
Dodroslavtsy
Novi Iskar
kv.Korea
Kostinbrod
kv.Kurilo
kv.Gnilyane
Podgume
kv.Alexandar
Voikov
Mirovyane
Lokorsko
Kremikovtsi
Sestavtsy
Svetovrachane
120 140
Mramor
Protesha
Negovan
Buhovo
Votuyak
Trebich
Chepintsy
Bozhurishte
kv.Iliyntsy
kv.Obelya
kv.Benkovski
Bolunets
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Kazichane
kv.Boyana
Vladaya
kv.Dragalevtsi
Vranya
Gorublyane
Elin Pelin
kv.Simeonovo
Pancharevo
Lozen
120÷140
Iskar river
REGIONAL RAINFALL-
AUTUMN
N
Scale
0 5 10km

Figure 1-4

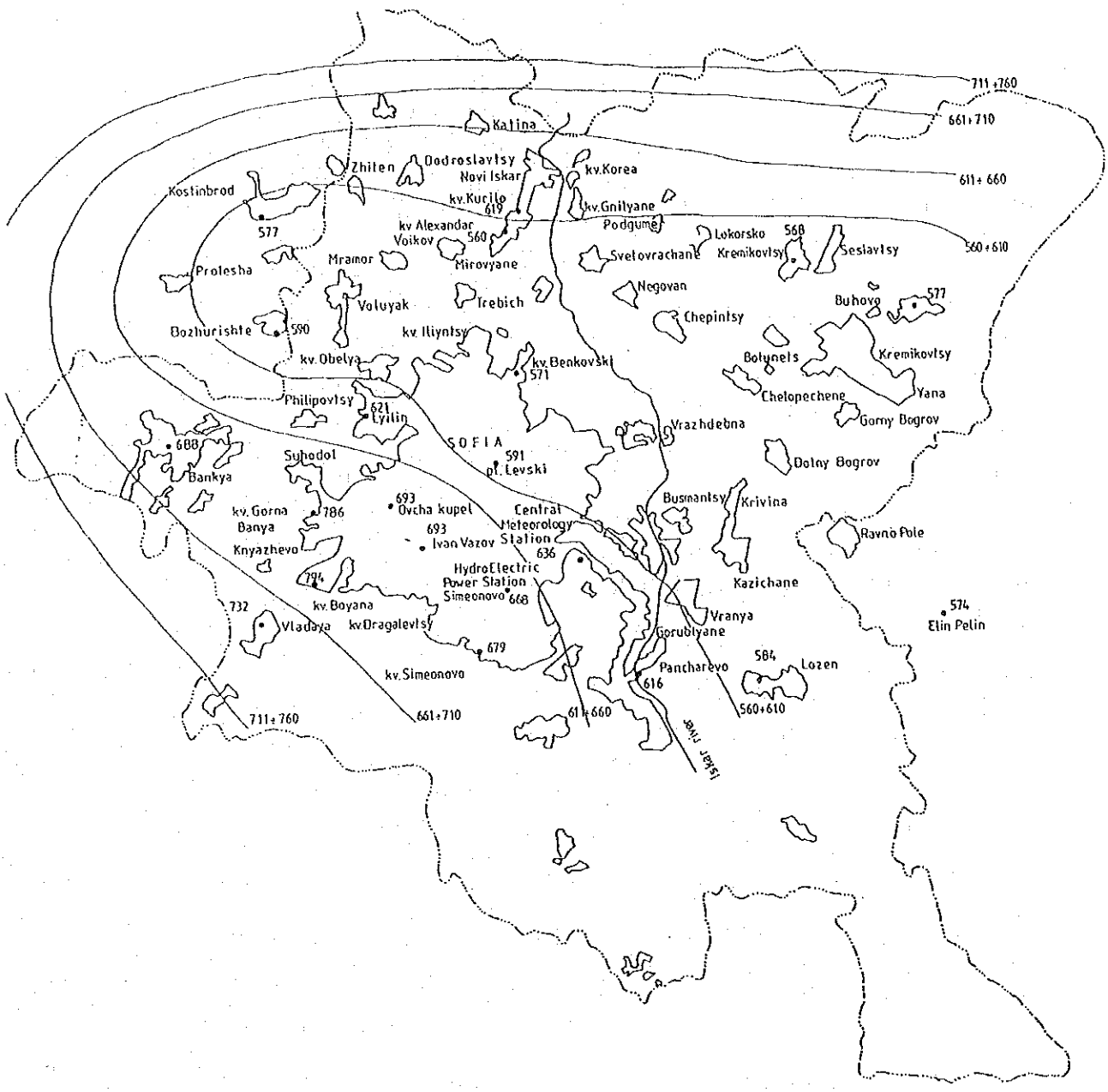


Figure 1-5

REGIONAL RAINFALL - AVERAGE ANNUAL

N

Scale 0 5 10km

1.4 Wind

Equivalent statistical data relating to wind intensity has not been similarly developed for the Sofia Area.

Average annual wind speed in the city area is reported to approximate 2.0 m/sec and 2.5 to 3.5 m/sec on the outskirts.

The peak 1 in 50 year general gust speeds adoptable for structural elemental design purposes is 34 m/sec in the Sofia plain, at an mean altitude of 10m. Wind pressures and suction characteristics can therefore be applied using the techniques developed by the UK BRS and reflected in BSCP3.

Average wind orientation and percentage occurrences at Sofia are:

N	NE	E	SE	S	SW	W	NW	No Wind
4.7	5.6	18.0	18.0	10.3	4.3	21.7	17.4	31.1

At higher wind speeds (> 14 m/sec), these percentages become:

N	NE	E	SE	S	SW	W	NW
1.3	0.3	2.2	4.3	6.3	11.1	39.7	34.8

1.5 Hydrology

The entire Sofia Basin is mainly drained by Iskar River which originates from Rila Range, an outlier of Rhodopen Range. Many other river systems important for the southern basins rise from this mountain: Maritsa, Mesta and Struma Rivers.

Cutting through Vitosha mountain and creating steep gorges, Iskar River enters the Sofia Basin from the south and crosses the area of SGM. In the northern territories some tributaries join Iskar River which then cuts across the Balkan Range and finally joins the Danube river system north of the Range.

Figure 1-6 denotes national Ministry of Environment protective zones for discharging into these waters. Iskar River is the principal river of the area. It is one of the main Danube River tributaries. It is ranked category I (source to treatment plant at Kubratovo village) and 2nd (from Kubratovo onwards) water quality category, according to Reg.no.2, St.Gaz.96/86 (determination dated 1992).

Within SGM areas average amount of run-off has been estimated in the range of 15-32mm per year. Average unit discharge ranges from 5-10 litres per second and km^2.

The eastern fluvial terraces of the Sofia Basin lying in close vicinity to Iskar River system show a high groundwater level and have long been used for their sediments.

1.6 Hydrogeology

Geomorphological, geological and lithological and tectonic structure of the surrounding mountains and of the Sofia plain determine the different conditions for formation of the groundwater. A general hydrogeological map of the region has been constructed as is set out in Figure 1-6.

1) Groundwaters in the Surrounding Mountains

From a hydrogeological position of view the surrounding mountains are characterized by fissure and fissure-karst waters.

The fissure waters are connected to the different age and type fissures and fissure systems. They are accumulated and circulate mainly in:

- Metamorphites from the lower series of the metamorphic complex
- Permial sands and conglomerates
- Lower Triassic sands
- Senonian marls, sandstone, andesites and andesite tuffs and tuffites
- Upper Cretaceous and Paleogenic diorites, sienites and granodiorites
- Priabonic conglomerate sandstone and marls

These waters are fed by the infiltration of the precipitation waters and are connected to the weathered and shallower lying tectonic fissures. Their water flow levels are insignificant (they start small creeks with a water flow rate of 0.3 to 0.5 l/second). The water transmissibility of the layer is insignificant - not more than $10m^2$/day which limits the possibility for deeper infiltration.

The fissure-karst waters are connected to the karsted and fissured middle Triassic and Jurassic limestone. Their outcrop is to be found on the southern slopes of the Stara

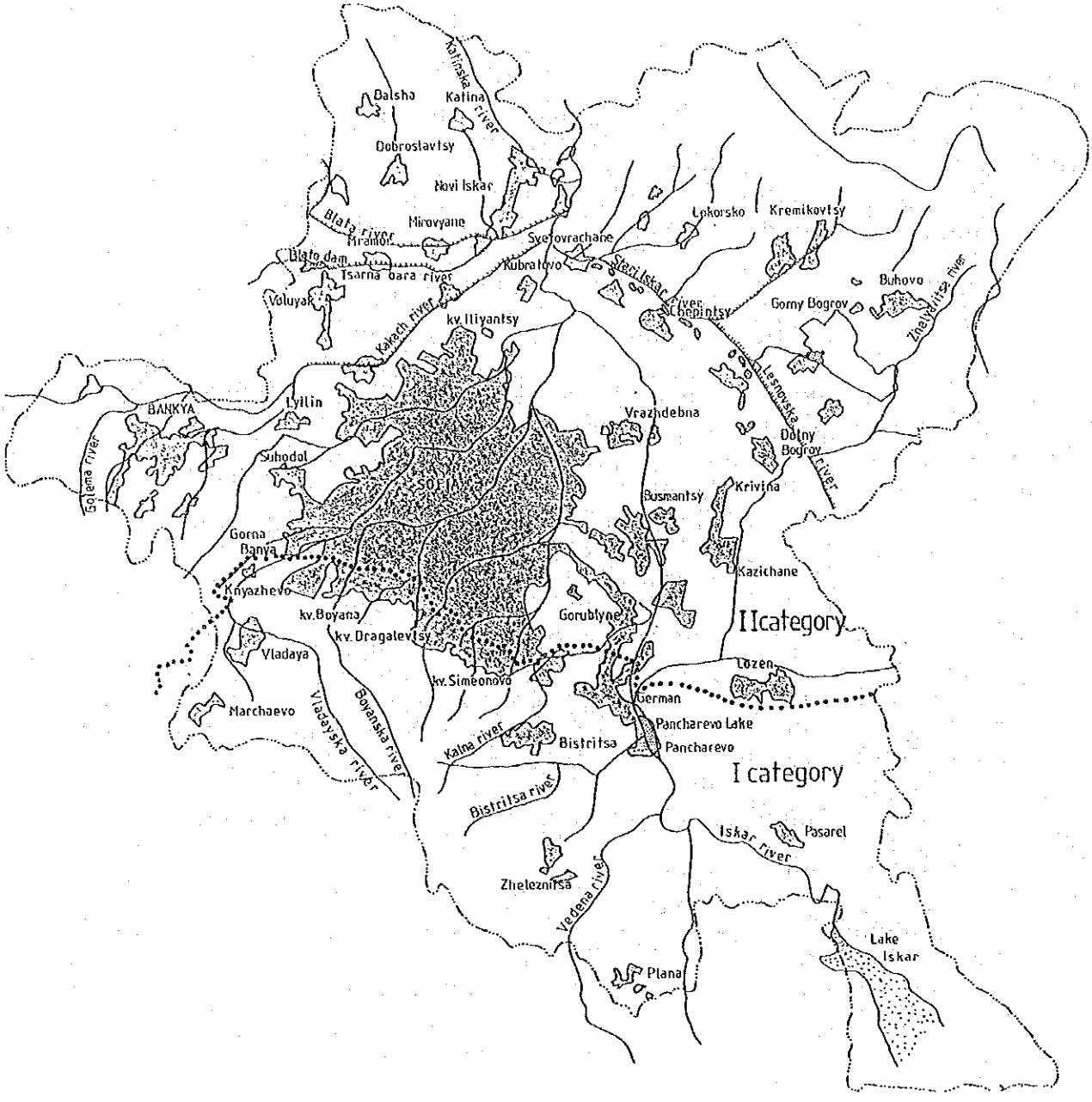


Figure 1-6

RIVER CATEGORIES - ZONAL BOUNDARIES	
N	Scale 0 5 10km

Planina mountain, around Kremikovtsi and north of Peturch and Dobroslavtsi. These limestones sink steeply to the south and are covered by Pliocene sediments. Part of the karst water flows into pliocene sands. Possibilities exist for the karst waters to flow out when drilling where the pliocene sediments are clays.The karst waters in some drills have a water flow rate of 30-40 l/second.

The necessity of taking certain protective measures in the regions where these waters originate, i.e. the outcrops of the middle Triassic and Jurassic limestone in the terrain.

The water impermeable rocks hindering the penetration of precipitation waters in the surrounding mountains should also be positioned out. These are:
- Cambrian phyllites and phyllite shales
- Ordovician - Silurian argillytes, phyllites and sands

In reality they block the deeper penetration and circulation of the waters completely. In some deeper tectonic fissures and faults in the surrounding mountains conditions are created for deep circulation of the infiltrated surface and precipitation waters. At the fringe areas of the plain these waters are drained along other fissures and faults and surface as thermal springs - at Pantcharrevo, Knyazhevo and others having a water flow rate of 8 - 15 l/s and a temperature of 40-50^{o}C.

2) Groundwaters in the Sofia Plain

Groundwaters in the plain are connected to pliocene and quarternery sediments. The relevant hydrogeological characteristics of the Greater Sofia basin are of significant importance particularly in relation to environmental engineering to be applied in SWM. It is therefore reviewed in detail on the hydrogeological map of Figure 1-7 and in the following:

(1) Lower Pliocene Aquifers

Various particle size sandstones make up the aquifers of this zone which are permeated by layers of olines and sandy clays. The average total thickness of the sands is 30-40m. Waters for these aquifers originate from the outcrops in the areas surrounding the plain. Some of the waters also may originate from thermal waters circulating in the base rock. The waters here are under pressure and form an artesial thermo-mineral aquifer. In the central part of the plain these waters are

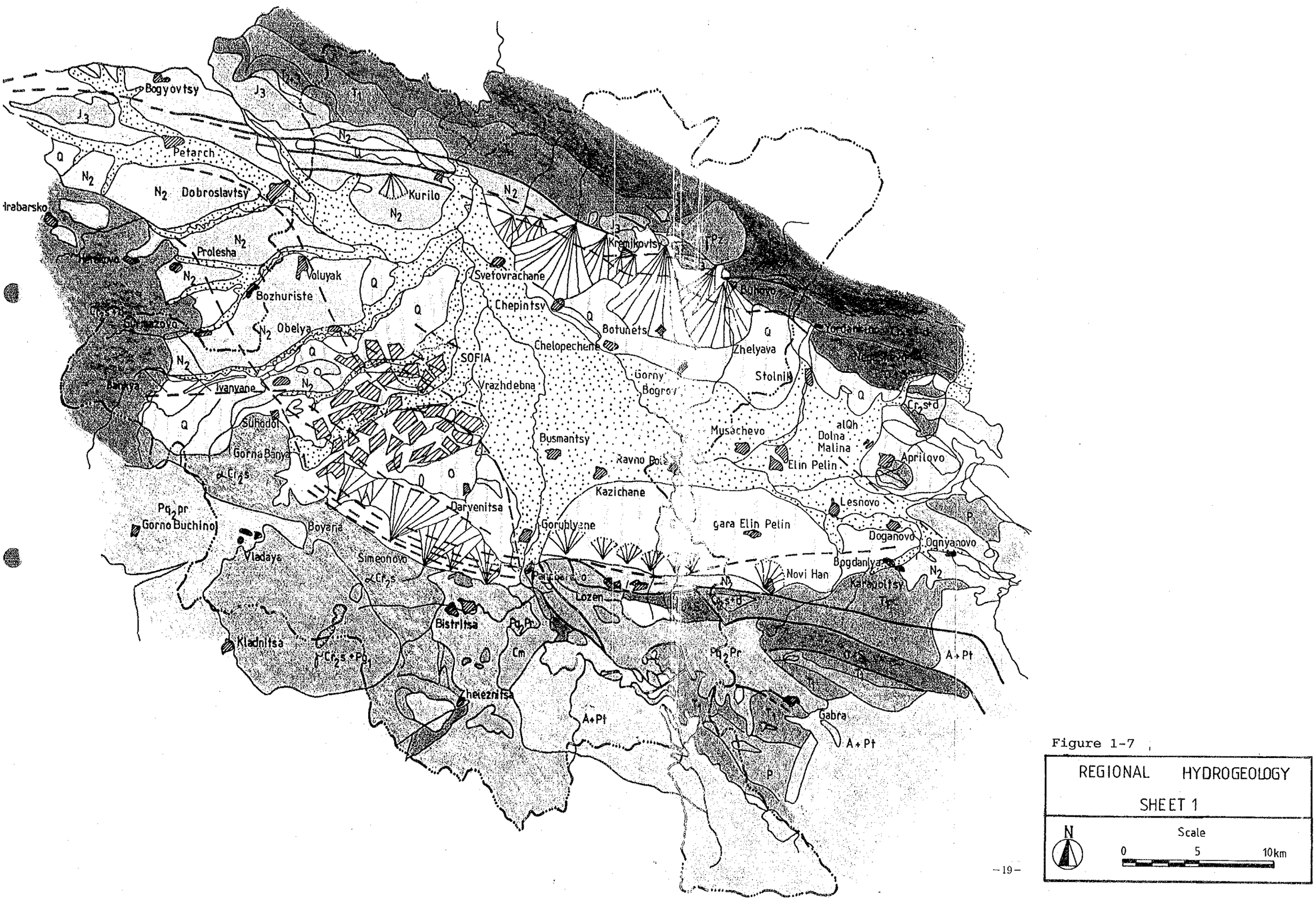


Figure 1-7

REGIONAL HYDROGEOLOGY

SHEET 1

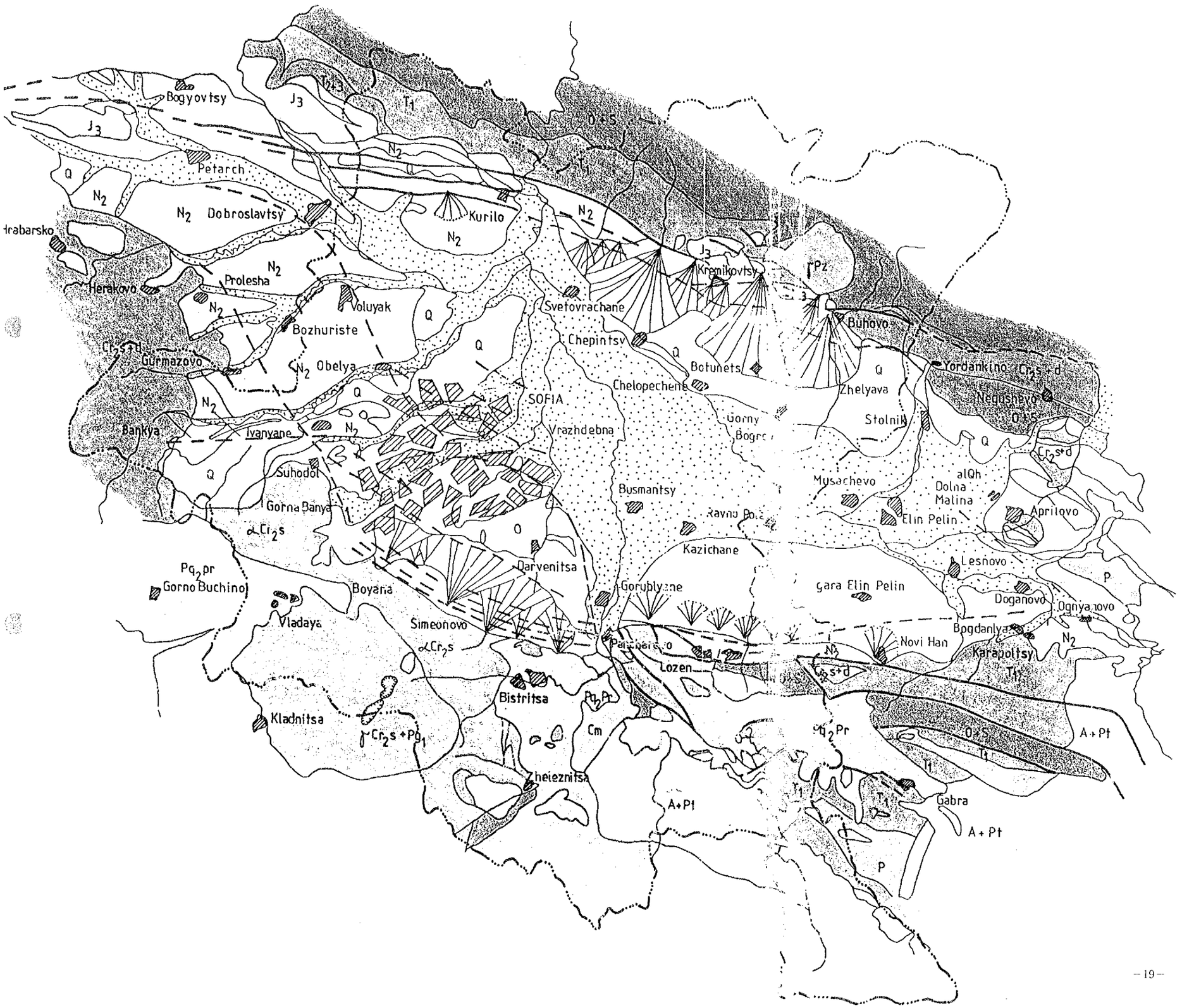


Figure 1-7

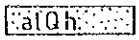
REGIONAL HYDROGEOLOGY

SHEET 1

N

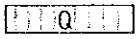
Scale

0 5 10km

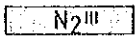


GROUND WATERS IN THE HOLOCENE ALLUVIAL SEDIMENTS,PEBBLES, SANDS AND CLAY

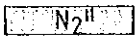
GROUND WATERS IN THE QUARTERNERY PROLLUVIAL SEDIMENTS



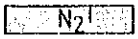
GROUND WATERS IN THE QUARTERNERY, SANDS AND CLAY



PLIOCENE COAL COVERING WATER BEARING HORIZON, CLAYS AND SANDS



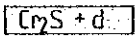
PLIOCENE COAL AND INTRA-COAL WATER BEARING HORIZON CLAYS, COALS AND SANDS



PLIOCENE SUB-COAL WATER BEARING HORIZON, CLAYS AND SANDS

PRIABONIAN WATER COMPLEX CONGLOMERATES, SANDSTONES AND MARLS

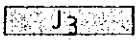
UPPER CRETACEOUS-PALAEOCENE INTRUSIONS WITH WATERS IN THE WEATHERING ZONES AND TECTONIC FISSURES - DIORITES, GRANODIORITE AND SYENITE



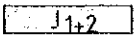
SENONIAN-DANIAN WATER BEARING COMPLEX, MARLS AND SANDSTONES

SENONIAN-DANIAN SEDIMENTARY EFFUSIVE WATER BEARING COMPLEX, MARLS, SANDSTONES, ANDESITES, TUFFS AND TUFFITES

SENONIAN EFFUSION WITH WATER IN THE WEATHERING ZONE AND TECTONIC FISSURES, ANDESITES



MALM WATER BEARING HORIZON



LIAS - DOGGER WATER BEARING COMPLEX SANDS, QUARTZITES MARLS AND LIMESTONES

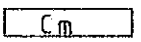
MIDDLE AND UPPER TRIASSIC WATER BEARING HORIZON LIMESTONE

LOWER TRIASSIC WATER BEARING COMPLEX, SANDSTONE AND CONGE BRECCIA

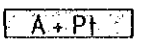
PERMIAN WATER BEARING COMPLEX, CONGE BRECCIA

INTRUSIONS AND DIORITE FORMATION WITH WATERS IN THE WEATHERING ZONES AND TECTONIC FISSURES, GRANITES, GRANODIORITE AND DIORITES

ORDOVICIAN SILURIAN WATER IMPERMEABLE LAYERS ARGYLLITES, PHYLLITES AND SANDSTONES



CAMBRIAN DIABASE PHYLLITOID WATER RESISTANT STRATA PHYLLITES AND DIABASE



ARCHAIC PROTEROZOIC METAMORPHYTES WITH WATERS IN THE WEATHERING ZONES, GNEISS AND SCHISTS

a, b DISLOCATION: A)FOLLOWED, B)HYDROGEOLOGICALLY SUPPOSED

Figure 1-7 (cont..)

alQh	GROUND WATERS IN THE HOLOCENE ALLUVIAL SEDIMENTS, PEBBLES, SANDS AND CLAY
prQ	GROUND WATERS IN THE QUARTERNERY PROLLUVIAL SEDIMENTS
Q	GROUND WATERS IN THE QUARTERNERY, SANDS AND CLAY
N_2^{III}	PLIOCENE COAL COVERING WATER BEARING HORIZON, CLAYS AND SANDS
N_2^{II}	PLIOCENE COAL AND INTRA-COAL WATER BEARING HORIZON CLAYS, COALS AND SANDS
N_2^{I}	PLIOCENE SUB-COAL WATER BEARING HORIZON, CLAYS AND SANDS
Pg 2 pr	PRIABONIAN WATER COMPLEX CONGLOMERATES, SANDSTONES AND MARLS
γCr_2s+pg_1	UPPER CRETACEOUS-PALAEOCENE INTRUSIONS WITH WATERS IN THE WEATHERING ZONES AND TECTONIC FISSURES - DIORITES, GRANODIORITE AND SYENITE
Cr_2S+d	SENONIAN-DANIAN WATER BEARING COMPLEX, MARLS AND SANDSTONES
Cr_2S+d	SENONIAN-DANIAN SEDIMENTARY EFFUSIVE WATER BEARING COMPLEX, MARLS, SANDSTONES, ANDESITES, TUFFS AND TUFFITES
αCr_2S	SENONIAN EFFUSION WITH WATER IN THE WEATHERING ZONE AND TECTONIC FISSURES, ANDESITES
J_3	MALM WATER BEARING HORIZON
J_{1+2}	LIAS - DOGGER WATER BEARING COMPLEX SANDS, QUARTZITES MARLS AND LIMESTONES
T_{2+3}	MIDDLE AND UPPER TRIASSIC WATER BEARING HORIZON LIMESTONE
T_1	LOWER TRIASSIC WATER BEARING COMPLEX, SANDSTONE AND CONGE BRECCIA
P	PERMIAN WATER BEARING COMPLEX, CONGE BRECCIA
γP_2	INTRUSIONS AND DIORITE FORMATION WITH WATERS IN THE WEATHERING ZONES AND TECTONIC FISSURES, GRANITES, GRANODIORITE AND DIORITES
O+S	ORDOVICIAN SILURIAN WATER IMPERMEABLE LAYERS ARGYLLITES, PHYLLITES AND SANDSTONES
Cm	CAMBRIAN DIABASE PHYLLITOID WATER RESISTANT STRATA PHYLLITES AND DIABASE
A+Pt	ARCHAIC PROTEROZOIC METAMORPHYTES WITH WATERS IN THE WEATHERING ZONES, GNEISS AND SCHISTS
a, b	DISLOCATION: A)FOLLOWED, B)HYDROGEOLOGICALLY SUPPOSED

Figure 1-7 (cont..)

found at more than 150m. The natural outlet of these is manifested in some of the well known mineral springs - The Sofia mineral spring, Ovcha Kupel and others.

(2) Groundwaters in the upper Pliocene horizon

The upper layer of the pliocene comprises sands, gravel stones and gravels alternating with clay layers and infiltrations. The water bearing layers are the sandy and gravel layers. The waters come from precipitation where this layer comes to the surface, from underground flowing waters from the surrounding slopes and from the waters of the upper quarternery water bearing layer. Drainage normally takes place through the Quarternery water-carrying horizon or through drilling holes mainly in the region of Sofia, where a large number of the plants on the territory of Sofia get their water supply.

The upper levels of the central plainar region is characterized by a notable water bearing capacity. At depths of 80 to 100 m yields of 5 to 15 l/sec are obtained. The water transmissibility of this layer is 500-2,000 m^2/day.

In the western part of the basin, where the upper layer reaches the surface the water bearing is not high due to the dominating clay faces. Drilling produces yields of around 1 to 5 l/sec, and the water transmissibility is up to 5,500 m^2/day.

(3) Groundwaters in the Proluvial sediments

Proluvial sediments are to be found in the peripheral parts of the kettle. They form two proluvial trains - north and south which mix at their lower parts with alluvial matter. Groundwater streams have been formed in this region, flowing to central parts of the kettle. Water bearing layers comprise mainly sand matter embedded in clay which also accounts for the low water transmissivity level. The water in these layers comes from the infiltration of surface waters, precipitation as well as from irrigation channels. Drainage is from small springs (max. 1 l/sec) at the border with the alluvial matter or the waters drain off in the underground alluvial sediments. Formation of swamps is observed at some places.

Groundwater level is 3 to 15 m from the surface (depending on geomorphological conditions). Water transmissibility of the layer is between 20 and 30 m^2/day. The coefficient of infiltration of the uppermost layers of the proluvial materials is

between 0.5 and 5m/day.

(4) Groundwaters in the alluvial deposits

Alluvial deposits of Iskar and Lesnovska rivers as well as their tributaries are the main place where groundwaters are accumulated. They are found in the central part of the plain.

Alluvial deposits comprise various particle size gravel, sands and clays. The prevailing types are the water bearing gravel and sands. The thickness of the layer is at places above 50 m. Alluvial gravel and sand deposits together with those of the upper Pliocene plane form a common aquifer, having common levels, common drainage and common resources.

The water originates from infiltrating precipitation and river waters underneath the conuses, as well as in depth from the upper Pliocene face. Drainage is through the river system when water levels are low.

In the central and eastern parts of the basin (east of Iskar river) where sands and gravel predominate, aquifer capacity is high. Water yields of up to 50 l/sec are readily achievable from boreholes. Transmissivity of the layer is between 500 and 2,000m^2/day and upwards. Transfer coefficient is 10^4-10^6/day. Infiltration coefficient of the uppermost quartenery layers (up to 1 m deep) changes within a wide range but nevertheless can be described as high: from 0.5 to 5 m/day. Water table varies between 1 and 3m below ground level.

In the western part of Sofia basin, where thickness of the alluvial sediments is smaller and clays are predominantly to be found the aquifer yield is lower. Water flow rates in the 3 to 5 l/sec range are obtained when drilling. The transmissibility of the layer is generally lower - up to 500 m^2/day. Coefficient of infiltration for the uppermost layers is generally between 0.3 and 3 m/day. The depth of these groundwaters is between 2 and 4 meters from the surface.

1.7 Flora, Fauna and Agriculture

Bulgaria is known for its famous natural sites and localities which are legally protected. In total, 9 National Parks, 85 Reserves, 48 protected localities and 1645 age-old trees have been defined as legally protected sites (data from 1981). These sites cover a total area of 118.815,8 ha.

1) Natural vegetation

In the center of Sofia Basin the phytocoenis' are dominated by azonal vegetation elements in humid to semiaquatic locations of the river catchment areas: riparian forests with oak-elm (*Quercus robur -Ulmus* sp.), poplar, willow associations (e.g. *Salicion eleagani*) and some plane trees (*Platanus orientalis*).

The surrounding montan areas are mainly covered with coniferous forests in which pine trees (*Pinus cembra*), larches (*Larix decidua*) as well as spruces (*Picea abies*) grow.

Among the higher plant species 64 have been placed under protection. This group includes organisms of ecological, scientific, medical as well as economic value. Examples of the *laureola, Spirea salcifolia, Taxus baccata, Juniperus excelsa, Viola delphynantha, Primula deorum* (data from 1981).

In 1981 the General Administration of Geodesy, Cadastre and Cartography counted 134 protected "Natural Sites" of decidous and coniferous trees in the area of SGM. Its south-western borders overlap with the Vitosha National Park, one of the most prominent protected park areas in Bulgaria.

2) Faunal associations

Apart from the normal distribution of species in the various habitats within Sofia Basin, the avifauna of the area is of high importance. The close vicinity to the Bosphorus as one of the main migration corridors for the birds of passage from northern Europe, Scandinavia and northern Asia, makes the Sofia Basin highly significant as a feeding area for the wintering species and a resting area for migrating avifaunal species. The numerous aquatic and semi-aquatic habitats of the entire basin are the locations where these species are especially found.

Over 450 animal species (140 invertebrates, 310 vertebrates) are placed under legal protection and cover most of the existing taxonomic groups (invertebrates: *Annelida, Crustacea, Arachnoidea, Insecta; vertebrate classes: Amphibia, Reptilia, Aves, Mammalia*). Some of the most outstanding species and taxa should be worth mentioning here :

<u>Butterflies, *Lepidoptera*</u>

Balkan Yellow Butterfly	:*Colias balcanica*
Red Apollo	:*Parnassius apollo*

Beetles, *Coleoptera*

Alpine Rosalia	:*Rosalia alpina*

Amphibians, *Amphibia*

3 species of newts	:*Genus Triturus*
Salamander	:*Salamandra salamandra*
Toads	:*Bufo bufo, B.viridis* *Bombina bombina, B.variegata*

Reptiles, *Reptilia*

Night Lizard	:*Gymnodactylus kotschyi*
Viviparus Lizard	:*Lacerta vivipara*
Gekko	:*Ophisaurus apodus*

Birds, *Aves* (240 protected species !)
among the innumerous families the best known are:

Kingfisher	:*Alcedo atthis*
Herons	:*different species*
Storks	:*Ciconia alba, C.nigra*
Flamingo	:*Genus Phoenicopterus*
Pelican	:*Genus Pelicanus*
Shelduck	:*Todorna todorna*
Eagles	:*Genus Aquila*
Osprey	:*Pandion haliaetus*
Buzzards	:*Genus Buteo*
Vultures	:different species
Bats	:different species
Hedgehog	:*Erinaceus roumanicus*
Shrews	:different species
Otter	:*Lutra lutra*
Jackal	:*Canis aureus*
Monk Seal	:*Monachus monachus*
Dolphins	:*Delphinus delphis,* *Tursiops truncatus,* *phocaena phocaena*

The Vitosha mountain area whose northern foot hills are partly within SGM area is habitat of many species found in Bulgaria. One hundred and twenty bird species (340 known in Bulgaria) live in the Vitosha National Park. Eight of 16 species found in Bulgaria live in this area and over 800 butterfly species have been indentified so far.

It is obvious and very likely that the close vicinity of habitats within the municipality borders and the National park enhances species exchange in both directions: species dwelling in the basin area will occur in the moderate montan areas and montan species will occur in adequate habitats in the plain.

This ecological principle known as "network of biotops" which enables habitats to exchange both species and individuals and thus ensures exchange of genetic material necessary for recombination, is considered an important guideline in protecting habitats from any uncontrolled development with unforeseeable detrimental impact on the natural characteristics of these sites.

In this respect many protected areas have been established in Bulgaria. Among them 17 "Biosphere Reservates" and 2 "Natural Heritage sites" have been defined in collaboration with international organizations, namely UNESCO, UNEP (United Nations Environmental Programme), IUCN (International Union for the Conservation of Nature and Natural Resources) as well as WWF (World Wildlife Fund).

3) Agriculture

Agricultural activities on the fertile soils within Sofia Basin are restricted by climate conditions. Thus maize and sunflower are less than the prevailing wheat, barley and potatoes. In recent years however vegetable, fruit and grapevine plantations gained importance not only in the Sofia plain but also in adjacent plains like the Samokov Basin.

The Sofia town markets are agricutural centers for products of all cultivation areas surrounding the Sofia Basin.

CHAPTER 2

SOCIOECONOMIC CONDITIONS AND PUBLIC UTILITIES

2. SOCIOECONOMIC CONDITIONS AND PUBLIC UTILITIES

2.1 Socioeconomic Conditions

2.1.1 General

The year of 1989 brought in political and economic changes for all of Eastern Europe and Bulgaria was no exception. The 1990s began with symbols of westernization. The ensuing plunge into market economy lead to undreamt of opportunities for some, but plummeting living standards for the majority. Though political passions were quite extreme it is a tribute to Bulgarian moderation and forbearance that political changes have been achieved without much social unrest or serious violence. In a region notorious for its propensity to descend into chaos, Bulgaria is fast gaining respect as a model of democracy and stability.

The new government initiated a crash economic reform program, removing barriers to foreign investments, speeding up privatization of state-run firms and establishing rules for restitution - the process by which property and land nationalized by the Communists could be reclaimed by its former owners.

The new political and social realities ushered in many problems and issues which required resolution, among which are:

- Monarchy or Republic - many Bulgarians believe that Simeon, the Madrid based son of Tsar Boris III, will be an ideal figurehead for uniting the nation
- The Holy Sinod and the Patriarch (the head of Orthodox church) accused of collaboration with Zhivkov - the former leader of the Communist party - regime or new elections (though over 90% of Bulgarians are non-believers);
- Who is to blame for the difficult situation - the former communist leaders or the new statesmen
- To disclose the dossiers of politicians or not;
- Are Trade Unions - something new for Bulgaria - participating in business and politics or not;
- Should privatization be on a "social" or economic basis;
- Structural changes in the industry of Bulgaria - machine building, hardware equipment, chemical, mining and other branches as well as the military industrial complex work with 50%, even 30% of their capacity;
- 50 - 60% of the trade activities only is carried by private companies;
- Inflation and as a result very high loan interests that makes trade the only profitable activity;

- No ownership on arable land with an exception of 10 - 15% given back to the former owners;
- Less than 5% of the industrial output comes from private "factories";
- Burden of the foreign debt - over $ 12 000 000 000;
- Unemployment - the official figure is 17%;
- High criminal rate and lack of security.

The economy of Bulgaria is presently undergoing a major transition from a command and controlled economy to a market economy. In the past the Bulgarian economy was insulated from changes which had a major impact on Organization for Economic Cooperation and Development Countries in the 1970s and 1980s: oil price shocks and steep rise of energy prices, restructuring of inefficient heavy industry and shift towards service sector. Little efforts were made to save energy and raw materials since these were usually inexpensive and in any case the management of the company was judged on the company's output, not on its profitability. As a result, compared to Western practices, heavy industry in Bulgaria uses excess energy and raw materials and pollutes the environment.

From the beginning of 1991 Bulgaria imports energy at world market prices. Government' policy was to align all domestic energy prices with economic costs over the medium term. With the exception of electricity, heat and coal (especially for household use) prices of all other energy reached international level after the June 1991 and February 1992 price adjustments. Coal and petroleum product are tradable commodities and when adequate competition can be created between suppliers price liberalization is the optimum solution. Supplies of electricity and heat is a natural monopoly, therefore a mechanism for regular adjustment of prices is under consideration and indeed prices of these services have began increasing since 1993.

A macroeconomic adjustment process has been underway since 1990. GDP declined an estimated 11.8% in 1990, lead by industry which declined about 16.3%. Despite the government's efforts to establish a stabilization programme the economy in 1990 has contracted at a faster pace than initially envisaged due to the collapse in exports to the former Council for Mutual Economic Assistance countries, sharp reduction of domestic demand and lower-than-anticipated access to foreign financing. Composition of final demand in 1995 is expected to differ significantly from that in 1989 with a relative shift from investment and government consumption towards exports and private consumption.

2.1.2 Industrial Structure of the Bulgarian Economy

(1) Industry

Industry is the biggest sector of the Bulgarian economy in both production and employment. According to National Statistic Institution data, it shared 50% of National income and 37% of employment in 1991. At present the receipts from sales of industrial output in Jan.-Mar.'93 totaled at current prices 44.2 billion lv, which is about 62% of receipts from sales of goods and services in Jan.-Mar. Industrial sales in March of 1993 amounted to 16.7 billion lv. As compared to February sales increased by 12.1%, and output - by 10%. But the seasonally adjusted output indices showed output in March to have dropped by 16% as compared to February. But some branches of industry showed a return to prosperity as shown in Table 2-1.

Table 2-1 Structure and Indices of Industry by Branches

Branch Groups	Receipts from Sale 1993 Jan.-Mar.	Index 1993/1992	Industrial Output 1985	1993 Jan.-Mar.	Index 1993/1992
Industry	100.00	84.3	100.0	100.00	83.6
Production of Electricity & Steam	17.96	110.6	3.8	16.47	105.7
Coal-Mining	3.02	88.7	1.4	2.88	91.2
Petroleum & Gas	0.13	143.1	0.1	0.11	153.9
Ferrous Metallurgy	4.05	92.5	3.5	4.28	93.0
Non-Ferrous Metallurgy	4.58	113.5	2.8	3.97	95.0
Machinery & Metal Products	9.31	63.4	15.3	8.97	62.5
Electrical Machinery & Electronics	5.62	92.8	11.8	5.49	87.6
Chemical Products	19.50	86.1	16.6	20.18	86.1
Building Materials	1.71	67.3	2.9	1.55	70.3
Timber & Wood-Processing	2.75	78.5	3.0	2.61	77.4
Paper & Products	1.50	101.7	1.4	1.55	96.1
Pottery,China,Glass & Protects	1.30	82.0	0.9	1.38	89.2
Textiles	4.02	85.6	5.6	4.28	85.9
Wearing Apparel	1.07	78.7	2.2	1.07	81.8
Leather, Footwear & Products	1.23	77.2	1.3	1.27	79.9
Printing & Publishing	0.40	104.8	0.4	0.40	121.4
Food Products, Beverages & Tobacco	20.69	69.7	23.9	22.39	73.7
Other Industrial Subsectors	1.16	50.3	3.1	1.15	49.9

source: Consultex-99 "Quarterly Report January-March 1993"

(2) Agriculture

Agriculture is the second largest sector of Bulgarian economy. It shared 19% of national income and 17% of employment.

(3) Construction

Construction share was only 6% of national income and 7% of employment. In the first quarter of 1993, revenue from construction sales output was 2.1 billion lv, which is only 2.9% of total receipts of goods and services. A sharp drop of 41% took place as compared to Jan.-Mar. 1992.

(4) Transportation

Transport share was 9% of national income and 6% of employment. Income from transport services amounted to 6.0 billion lv in Jan.-Mar.

(5) Domestic Trade

Trade and logistics share was 10% of national income and 7.5% of employment. Total retail turnover realized in Jan.-Mar. 1993 amounted to 22.6 billion lv. In comparison with the first quarter of 1992 it was less by 15%. At the same time the private sector reached 50.1% in total turnover and realized an increase of 4.8 billion lv or by 2.5%.

2.1.3 Data on Industrial Activity in Sofia Region

In SGM, industries are distributed among the 24 districts as shown in Table 2-2. Data for 1990 shows that in Sofia there were 120 state enterprises of machine-manufacturing and metal-working industry, electrical and electronic industry, chemical industry, construction and production of construction materials, textile and knit wear industry, transport, wood-pulp and paper industry, ore mining and metallurgy, employing in total 604,500.

Ferrous and non-ferrous metallurgy were represented by giant companies KREMIKOVTSI and POLIMET and smaller one RARE METALS (Redki metal) - Buhobo. In 1990 these companies employed 62,540 people. More than 20 metal-working and machine-manufacturing companies were founded in 1990, with 86,580 employees. 109,180 people worked in 11 electrical and electronics companies.

Table 2-2 Distribution of Industries in SGM

Municipality	Types of Industries							
	I	II	III	IV	V	VI	VII	VIII
Sredets	-	-	-	-	-	-	-	-
Krassno Sello	0	0	-	-	0	0	-	0
Vazrazhdane	0	-	-	-	-	0	0	-
Oborishite	0	-	-	-	-	-	-	-
Serdika	0	0	-	0	0	-	-	-
Poduyene	0	0	-	-	0	-	-	-
Slatina	-	-	-	-	-	-	-	0
Izgrev	-	-	-	0	-	0	-	-
Lozenets	0	0	-	-	-	0	-	-
Triaditsa	-	-	-	-	-	-	-	-
Krassna Polyanna	-	-	-	-	-	-	0	-
Ilinden	0	0	-	-	0	-	-	-
Nadezhda	-	0	-	0	0	-	-	0
Iskar	-	0	0	0	0	0	0	0
Mladost	0	-	-	-	-	-	-	-
Studentska	-	-	-	-	0	-	-	-
Vitosha	-	-	-	0	0	0	-	-
Ovcha Kupel	0	-	0	-	0	-	-	-
Lyulin	0	-	-	-	-	-	-	-
Vrabnitsa	-	0	0	-	-	-	-	0
Novi Iskar	-	-	-	0	-	0	-	-
Kremikovtsi	0	0	0	-	0	-	-	-
Pancharevo	0	-	-	-	-	-	-	0
Bankya	0	-	-	-	-	-	-	-

Notes: I-Food Industries, II-Machine Building and Electrical
III-Metallurgy and Ore-Mining, IV-Chem., Pharm. and Rubber
V-Construction, Construction Materials and Ceramics
VI-Textile,Leather and Footwear, VII-Furniture,Wood-Pulp and Paper, VIII-Power and Transport

In 1990, 4 textile and knit wear companies were founded. Only in two of them, - PAMUKOTEXT and RMEN - there were 30,700 employees. In the clothes-making company RILA, with 28 subsidiaries, had 32,700 employees.

The chemical industry in SGM is relatively less developed.

There are 9 companies which produce construction materials. Only in one - INERTMATERIALS - there were 4,790 employees, and in FERRO - CONCRETE STRUCTURES (Stomano-betonni konstruktsii) 5,320 employees.

The staff of BALKAN - Bulgarian Civil aviation was 8,600.

Due to re-structuring of industry and the sharp decline of production in the last 3 years, number of employees has rapidly decreased as evident from the information provided by the Regional Statistics Bureau in Sofia in Table 2-3.

The reduction in the number of employees, compared to 1990, was smallest in food, chemical, construction, construction materials, furniture, wood-pulp and paper making industries and in the power industry.

Table 2-3 Employees Data

Kinds of Industries	Companies with over 300 employees (by 3.05.1993)	
	No of Companies	No of Employees
1.Food Industry	11	6,088
2.Electric & Electronics	17	9,441
3.Machine mnfct & metal working	11	11,380
4.Metallurgy	2	17,283
5.Chemical Industry	8	5,992
6.Construction material	3	1,495
7.Textile and knit wear	9	4,783
8.Leather & footwear industry	4	2,010
9.Wood Pulp & paper industry	2	1,599
10.Furniture/Woodwork	3	1,053
11.Elec. & therm. power ind.	2	2,921

2.2 Public Utilities

2.2.1 General

This section of the report reviews existing conditions and relevant development plans in SGM for the following:

a) Highways
   The regional road system
b) Public Utilities
   - Electricity
   - Water
   - Gas
   - Steam and hot water supplies
   - Sewerage

2.2.2 Road Network Description

The road network in SGM is used by public transport modes of tram, rail, trolley buses and buses, and private vehicles. In 1990 approximately 40% of the trips were made by trams and public transport mode accounted for roughly 60%.

1) Road Network Administration

Sofia Greater Municipality has three companies which are responsible for transportation matters. These are:

- Sofia Public Transport Co.
  This company operates buses, trams , trolley buses and Vitosha lifts.
- Road Signalization Co.
  This company is responsible for installation and maintenance of traffic signals, traffic signs, road markings and street lights.
- Parking and Garages Co.
  This company operates and maintains municipality owned open parking spaces and garages.

The Transport Activity Department of SGM is charged with overseeing public transport and traffic operations within the city, identifying any problems and seeking solutions.

Roads linking the nation's regions and cities are constructed under the planning and supervision of the Ministry of Transportation. In SGM two organizations for road construction are involved, namely Sofia Investment Co., and Department of Investment of the municipality.

Vehicle registration is done by the police department and at present the Transport Activity Dept. estimates that there are about 250 vehicles per 1,000 population in Sofia.

2) Road Classification and Length

The roads in Sofia are classified into three classes; IInd class, IIIrd class, and IVth class. Roads are shown by classification in Figure 2-1.

The Ring Road, and major two east-west combined arterials of Bul. Slinitsa and Bul. Vladimir Vazov, and Bul. Tsar Boris and Bul. Tsarigradsko Shose are all classified as II class roads. Most city center streets fall under class III roads. A significant point is the lack of northbound main roads from the city center to the Ring Road. In principle the southern part of the city appears to have a more dense road network.

The geometric design criteria of the three classes are shown in Table 2-4.

Table 2-4 Geometric Design Criteria by Road Class

Class	Design speed (Kph)	Min. dist. between junctions (meter)	Max. longitudinal slope (%)	Horiz. curve min. radius (m)	Number of lanes	Lane width (m)	Approx. traffic capacity /lane (pcu/hr)
II	70	400	5.0	200-300	2x3-4	3.5	800
IIIA	60	300	5.5	130-190	2x2-4	3.5	600
IIIB	50	250	6.0	85-115	2x2	3.5	600
IV	50	250	6.0	85-115	2x2-4	3.5	500

The length and area of the roads, carriageway and pedestrian sidewalks for Sofia, as of 1991, are as follows:

- Street length : 4,255 km, Area: 4,339 Ha
- Carriageway length : 3,948 km, Area: 2,741 Ha
- Side walk length : 5,142 km

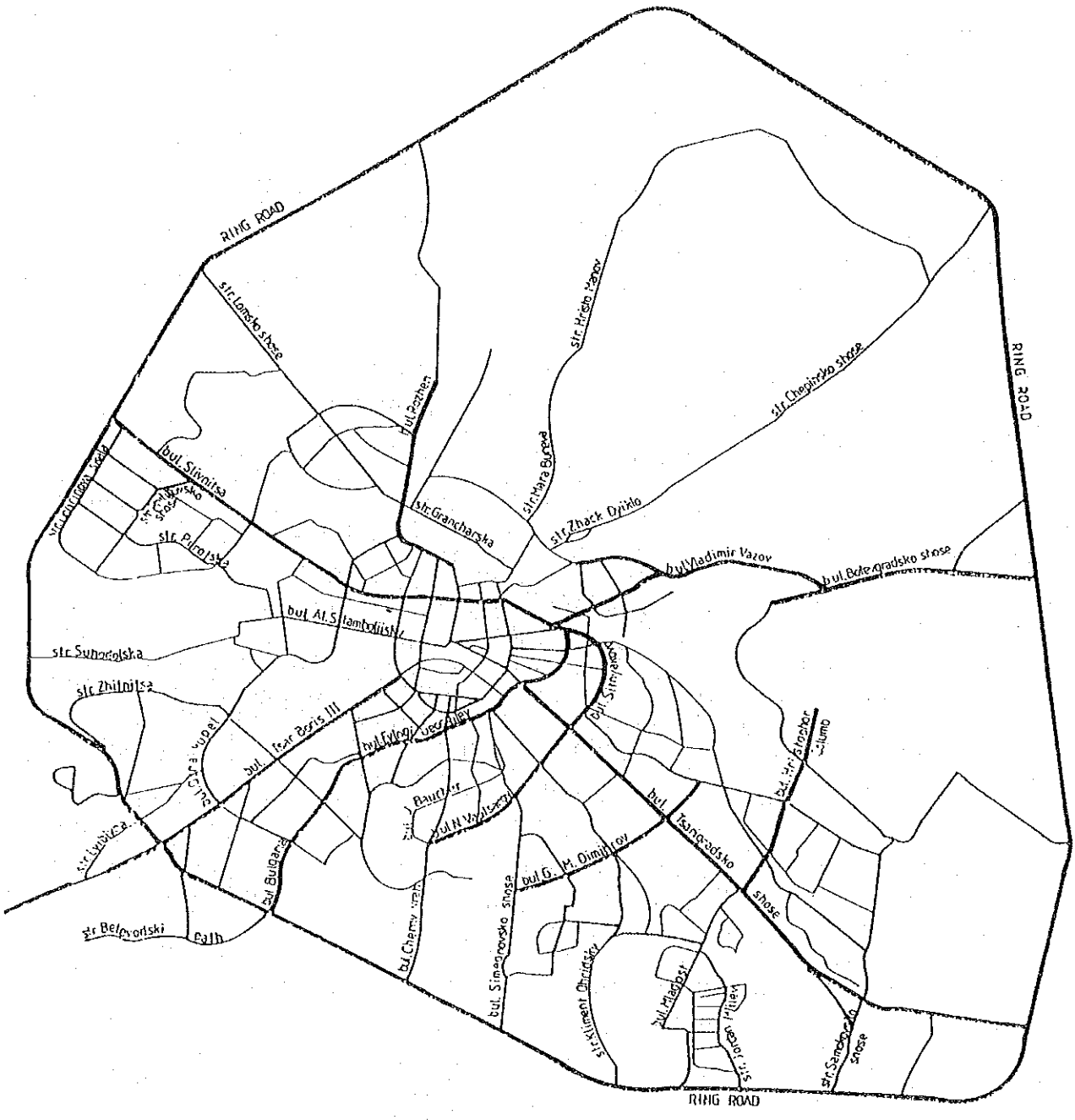


Figure 2-1

SOFIA ROAD NETWORK

ROAD NETWORK CLASSIFICATION

- IIth Class Urban arterial
- IIIth Class District arterial
- IVth Class District feeder

N

Scale 0 1000 2000 3000 4000m

3) New Road Projects

INNER AREA

Figure 2-2 shows the road network projects planned up to the year 2000. This information is extracted from the transportation master plan prepared by Sofia Greater Municipality. This scheme was selected from six different proposals and has been approved by the concerned authorities.

The main objective of the plan appears to be the completion of the middle ring road. No new north-south arteries are envisioned in the plan. The plan calls for implementation of a number of junction improvements in the city center and along the southern arc of ring road. Most of the junction improvement shall be at grade, however six grade separated junction improvement projects shall be executed.

One important transport project under construction at present is the subway project. Five Km have been completed and at present 2 Km are under construction. The subway, in its first phase shall connect Lyulin district to the city center. All the route through the trespassing the center shall be underground.

OUTER AREA

Of particular importance to the project is a proposed by-pass highway to be used by northbound traffic from the outer ring road without entering into Novi Iskar town, the Novi Iskar By-pass. Construction is scheduled to be completed in 1996. This project is discussed in more detail in the Main Report.

2.2.3 Public Utilities

Data on public utilities were collected and are described hereafter.

1) Electricity

(1) General

The amount of electricity consumed in Bulgaria in 1992 was 38 million Mwh, of which 36 million Mwh is generated in Bulgaria and the remainder is imported from the Ukraine.

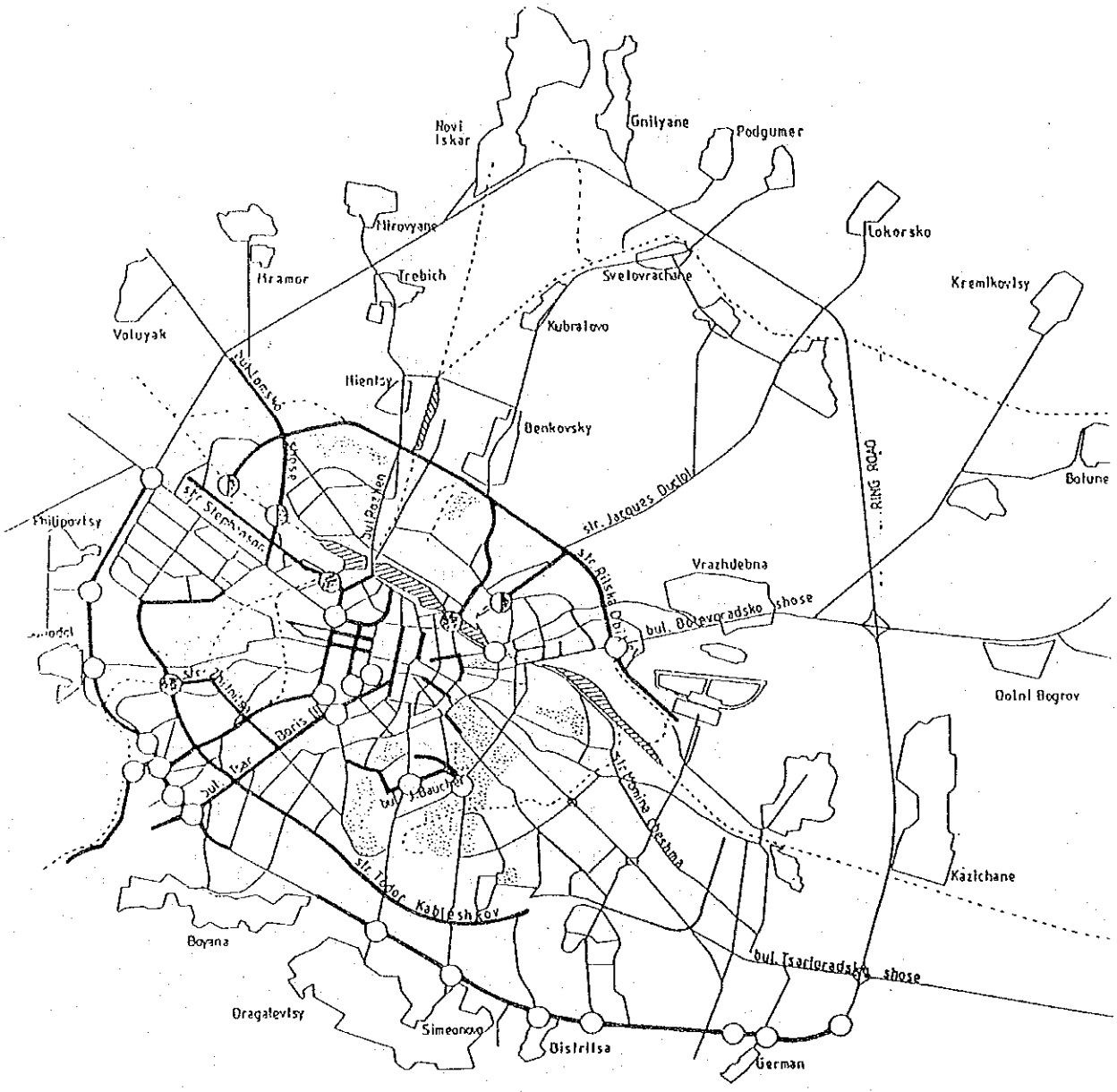


Figure 2-2

ROAD CONSTRUCTION PROGRAMME
Stages to 2000 year

TRANSPORT PROJECTS

- Completion of projects, that are under construction
- New or reconstructed streets
- Construction of road junctions
- Construction of overpasses and underpasses.

N

Scheme

Electric power generation in Bulgaria is as follows:

a. Thermo-Electric Power Plant: 63%
b. Nuclear Power Plant : 35%
c. Water Power Plant : 2%

(2) Present Situation of Electricity in Sofia

As of December 1991 the following indices reflect the condition of electric power in Sofia.

- Percentages of households with electricity: 100%
- Total length of electricity network: 7,884 km
- Total number of electricity stations: 4,584 km

Two rings around Sofia City are connected with the National Electricity Network (one ring - 220 V, the second - 400 V).

In 1992 year the two thermo-electric power stations which supplied Sofia with 20-22% of its electric power have the following specifications (Table 2-5):

Table 2-5 Power Generating Stations Specifications

Station	Fuel	Energy generated (Mwh)	Energy sold (Mwh)	Installed Power (Mwh)
Sofia Sta.	Natural gas	369,436	261,592	125
Traicho Kostov Sta.	Natural gas	483,321	345,682	186

Sofia received the remaining electric power (78-80%) from neighboring regions.

(3) Electricity Tariffs (from 1st May, 1993)

According to regulation 87/29.04.1993, electricity tariffs levied on consumption for household purposes were as follows:

- Day time 0.660 Lv/kWH
- Night time 0.350 Lv/kWH

Tariffs on business and public activities consumption are described in Table 2-6.

A different set of tarrifs are charged for consumption of electric power generated by power plants outside the National Electricity Company - Joint Stock (these tariffs are used for selling under contract with National Electric Company Joint Stock).

- Peak hours 1.074 Lv/kWH
- Day hours 0.595 Lv/kWH
- Night hours 0.261 Lv/kWH

Table 2-6 Tariffs on Commercial Electricity Consumption

(Lv/kWH)

Season	Winter season			Summer season		
	Tension Level			Tension Level		
	High	Middle	Low	High	Middle	Low
Peak Hour	1.472	1.527	1.598	1.289	1.324	1.389
Day Hour	0.799	0.826	0.863	0.691	0.716	0.750
Night Hour	0.395	0.407	0.927	0.340	0.351	0.369
By means of one dial measuring	1.187	1.225	1.285	1.032	1.064	1.116

2) Water

(1) General

The water supply system of Sofia is fed by the following water sources and main pipelines and the total water quantity is about 9.0 m^3/s.

A. Iskar Dam
- Maximum volume: 670 million m^3
- Sanitation minimum: 200 million m^3
- Dead storage volume: 90 million m^3
- Quantity of water: 4.5 m^3/s

Water is treated at Pancharevo Water Treatment Plant with a capacity of 4.5 m^3/s, which commenced operation in 1966.

B. Kokaliane Weir

The volume depends on the main water source - Iskar Dam. The water (3.0 m^3/s) is conveyed by a so called emergency pipeline, and the water is treated by chlorination only.

C. Beli Iskar Dam
- Maximum volume: 15 million m^3
- Dead storage volume: 0.2 million m^3
- Rila River derivation: Levi Iskar and Cherni Iskar.

Water is conveyed by the Rila pipeline with about 1.7 m^3/s;
For Sofia - 1.4 m^3/s
For Samokov town and villages in the vicinity - 0.3 m^3/s

D. Vitosa River Derivation
- Vladaiska River and Boianska River:
- Average capacity: 0.13 m^3/s
- The water is treated by chrolination only.

The critical seasons are spring and summer when the water in Iskar dam and Beri Iskar Dam drops to the sanitation minimum volume. In this case the water from Belmeken - Sestrimo Cascade is conveyed. (Volume of water from 1983 to 1992: about 700 million m^3).

The second Water Treatment Plant of Sofia (Bistzitza) is scheduled to be initiated into operation by the end of 1993 and will have a treatment capacity of 6.5 m^3/s.

(2) Present Situation of Water Supply in Sofia

In December 1991 the water supply situation was as follows:

- Total length of main pipelines:	336 km
- Total length of branch lines:	2,643 km
- Hydrobooster system installation:	220 units
- Pumping stations:	22 units
- Water tanks for central supply:	14 units
- Total volume of 14 water tanks:	331,700 m^3
- Total volume of local water sources:	7,600 m^3
- Supplied drinking water(1991):	262,823,000 m^3
- Supplied water:	225.3 l/cap./day
- Total paid drinking water(1991):	161,334,000 m^3

(Households: 50.2%, Industrial factories: 23.2%, Agricultural organizations: 0.70%, Other public consumers: 25.85%)

In broad terms water is supplied by the gravity method, for buildings with maximum 8 floors. Therefore the hydrophore installation is required for high buildings. The water supply system is divided into 8 zones. The water is re-distributed by means of 3 main rings and radial connections.

(3) Water Supply Tariffs (from 1st February, 1993)

- Drinking water for residents:	1.20 Lv/m^3
- Drinking water for companies:	3.80 Lv/m^3
- Industrial water (for all purpose except drinking):	1.90 Lv/m^3

3) Gas

Bulgaria is supplied by Russian natural gas (appr. 1,000 million m^3 in 1990 year) with pressure of 5,500 KPa (55 kg/cm^2). The main pipeline has a diameter of 770 mm. There are 6 gas distribution stations around Sofia - Novi Iskar, Kazichene, Kremikovtzi, Voluiak, Elin Pelin and Ivaniane. They reduce the gas pressure to 1,200 or 600 KPa (12 kg/cm^2 or 6 kg/cm^2).

Gas is supplied to the following facilities in Sofia:
- Thermal Electricity Power Plants
- Thermal Plants
- Green houses
- Industrial Factories

No gas is supplied to households. Households usually use bottled gas for thermal energy.

4) Steam/Hot Water Supply

(1) General

In 1949 the first installation of central heating system by power plant was put into operation. It supplied only steam to industrial factories. In 1955, 32 state and public buildings were supplied with hot water from that power plant.

The territory of SGM is served by 2 thermo-electrical power stations ("TEPS") using natural gas, 2 thermal stations ("TS") using natural gas (mazut used in emergency) and 12 local thermal sources ("LTS"), of which 11 sources use maazut, gas and oil.

(2) The Present situation of Central Heating in Sofia

Central heating in Sofia as of December, 1992 was as follows:
- Length of Central Heating Network: 792 km
- Number of Flats with Central Heating: 315,829
  (The number of houses with small-boilers is not included.)
- Ratio of flats with Central Heating (% of total): 69.3%
- Number of blocks of flats with Central Heating: 7,523
- Number of administrative bldg. with Cen. Heating: 2,814

SGM is divided in to four regions and sales of steam/hot water to each in 1992 are summarized in Table 2-7.

Table 2-7 Present Condition of Central Heating

Regions and Thermal Station	Sold Energy in 1992 Steam Gcal/ Hot water Gcal	Percentage of Total Sold Energy
1. Traicho Kostov Region		36.75
a) Traicho Krastov TEPS	209,604/2,121,219	36.75
b) Gorubliane LTS	built in 1993	
2. Sofia Region		29.96
a) Sofia TEPS	432,760/1,316,246	27.57
b) Suha Reka LTS	- / 4,148	0.06
c) Hadzhi Dimitar LTS	- / 82,635	1.30
d) Zona B-5 LTS	- / 30,339	0.48
e) Levski G-LTS	- / 28,469	0.45
f) Orlandoovtzi-LTS	- / 6,382	0.10
3. Zemliane Region		19.36
a) Zemliane TS	- /1,007,389	15.88
b) Zapad LTS	- / 38,939	0.61
c) Ovcha Kupel 1-LTS	- / 40,084	0.63
d) Ovcha Kupel 2-LTS	- / 56,262	0.89
e) Razsadnika LTS	- / 50,880	0.81
f) NDK LTS	- / 34,114	0.53
4. Liulin Region		13.93
a) Liulin TS	- / 870,493	13.72
b) Ingstroi LTS	- /6,342,975	0.21
Total	642,364/5,700,611	100.00

(3) Thermal Energy Tariffs (from 1st May 1993)

According to regulation 87/29.04,1993, the tariff system was adjusted based on the relationships between suppliers and consumers of thermal energy in relation to measuring, reading and paying of thermal energy. The three cases on which tariffs are calculated are as follows:

Case 1:
Suppliers buy thermal energy at prices separated according to parameters of the thermal medium, as follows;

a. Thermal energy for industrial needs, non-dwelling buildings and premises: 610 Lv/Gcal (Steam of more than 0.25 Mpa)

b. Thermal energy for industrial needs, non-dwelling buildings and premises: 350 Lv/Gcal (Steam of up to 0.25 Mpa or hot water)
c. Thermal energy for institutions at state budget expenses: 350 Lv/Gcal (Steam of up to 0.25 Mpa or hot water)
d. Thermal energy for citizens: 238 Lv/Gcal

Case 2:
Unit prices are determined on the basis of the premise that 100% from the steam condensate or 100% from the return of hot water will be returned. In case of no return of steam condensate or the return of hot water, the consumer pays 36 Lv/T. In case of less condensate return of contract value, the consumer pays 152 Lv/T.

Case 3:
Unit prices are determined for supplying the consumer's place taking into account the range of the property:

a. When pipelines are property of the consumer, the thermal energy is measured at thermal source place.
b. When pipelines are property of the suppliers, thermal energy is measured at main installations of the consumer place.

5) Sewerage

(1) General

The sewerage system consists of 5 main collectors:
- Perlovski collector
- Vladaiski collector
- Kakachki collector
- Slatinski collector
- Suhodolski collector

These collectors collect the waste water from the sewerage network of Sofia and by means of 3 collectors convey the water to Kubratova Waste Water Treatment Plant by gravity.

Technical state of the sewerage network is good except for the network's central part which was built 80-90 years ago.

(2) Present Situation of Sewerage in Sofia

Data on the system, as of December, 1992 are as follows;
- Towns with sewerage system: Sofia city and Bankia
- Towns and villages without sewerage system: 36

- Total length of sewerage network: 1,401 km
- Total numbers of sewerage laterals: 32,945
- Total length of collectors 201 km
- Sewerage system (% of total street network) 40.9%

The city is served by Kubratovo Waste Water Treatment Plant. This plant was built for mechanical and biological treatment of 500,000 m^3/day and treatment of the generated sludge.

Treated water is discharged to Iskar River. The capacity of the Waste Water Treatment Plant covers approximately 70% of the waste water in Sofia.

Specifications of the Plant are as follow:

- Inlet of waste water: 5.7 m^3/s (500,000 m^3/d)
- Inlet waste water during rainfalls: 15.4 m^3/s
- BOD of the inlet waste water: 200 mg/l(100T/d)
- BOD of the discharge waste water: 15 mg/l
- Suspended solid of discharge waste water: 30 mg/l

(3) Sewerage Tariff (from 1st February 1993)

Tariffs levied on residents and commercial activity are as follows:
- Resident: 0.50 Lv/m^3 (drinking water)
- Company: 1.00 Lv/m^3 (drinking water or industrial water)

Costs for treatment of industrial water are described below:
- 1st category industrial water: 1.90 Lv/m^3
- 2nd category industrial water: 2.90 Lv/m^3
- 3rd category industrial water: 4.10 Lv/m^3

CHAPTER 3

CURRENT SITUATION OF SWM IN SGM

3. CURRENT SITUATION OF SWM IN SGM

3.1 Legislation relating to the Environment

i) General

The new Constitution of Bulgaria provides for the right of all the citizens to a healthy environment.

The Environment Protection Law (EPL), passed by the Parliament on October 2, 1991 provides the foundations for Bulgaria's environmental policy. It establishes a system for the implementation of environmental policy and establishes environmental objectives including the following:

- Development of an Environment Impact Assessment (EIA) programme
- Adherence to the "polluter pays" principle
- Provision for citizens' suits
- Harmonization of existing environment standards with EC standards
- Provision for right of access to information on the state of the environment

Amendments to the EPL were drafted by the MOE and passed on December 4, 1992. They provide for:

- Revised EIA provisions
- Supplementing the income of Environment Protection Funds by monetary sanctions
- Increases in the levels of fines
- Indemnification of investors from liability for past pollution

A number of old environmental laws are still in force and will be replaced by new legislation. These are:

- Law on Mines and Quarries (1957)
- Law on Protection of Air, Water and Soil from Pollution (1963)
- Law on Protection of Nature (1973)
- Laws on Protection of Arable Land and Pastures (1973)
- Law on Public Health (1973)
- Law on Marine Environment (1978)

New laws are currently being drafted on protected areas, waste, protection on biological diversity, land protection, marine environment, water, air.

2) Permitting Process and Regulatory Requirements

The principle permits and approvals required by any legal authority like a municipality or a private investor intending to build and operate a public or commercial or industrial facility in Bulgaria fall into three categories:

- land use and construction permits
- EIA
- operational requirements.

As regards operational requirements permits are needed only for water use and for the discharge of waste water. There is no integrated system in Bulgaria. Special permits are not required neither for air, noise emissions, the generating of waste nor for the operation of waste treatment facilities at present.

The authorities granting these permits and the steps to be followed are:

-	Land use permit :	Commission of Land
-	EIA approval :	MOE and Regional Environment Inspectorate
-	Water use permit :	National Water Council
-	Water discharge permit :	MOE
-	Construction permit :	Municipality
-	Completion including operation permit :	Chief inspectorate on Governmental Technical Control council Regional Inspectorate on Government Technical Control Council

3) Enforcement of Environmental Legislation

MOE and REI and the Municipalities are responsible for the enforcement of environmental legislation. The EPL does not give any enforcement role to the Districts. It allocates enforcement responsibilities among these three bodies as follows:

- MOE is the enforcement authority if the result of a person's polluting activity occurs or may occur within the territory under the authority of more than one REI.
- REI is the enforcement authority if the result of person's activity occurs or may occur within the territory of one or more than one Municipality.
- The Municipality is the enforcement authority if the result of person's polluting activity occurs or may occur wholly within its territorial area.

Each REI has its own laboratory and a staff of technical specialists working on a territorial basis. The municipalities rely on the REI's for monitoring functions because they lack the necessary equipment. If violations of standards are noted by the REI monetary sanctions may be imposed on companies and fines on individuals by an order of the Environment Minister.

REIs and Municipalities have the power to halt the activity of specific enterprises or organizations if environmental protection requirements are being violated. They can also impose measures to remedy the consequences of environmental damage.

Hygiene Epidemiological Inspectorates (HEI) may prohibit any activity which violates the relevant health standards.

Any person or group of citizens or Municipality can apply to a court to require a person who is in violation of the provisions of the EPL of 1991 to stop the violation and to repair the damages caused. (Source: "White & Case".)

3.2 Legislation Related to Waste Management

A list of legal documents in force categorized according their level, specifying the type of document whether it treats solid waste only generally or specifically, and the classification either household or industrial waste is shown in Table 3-1.

The list of legal documents under preparation assembled in the same way as the list of existing legal documents in force is shown in Table 3-2.

Table 3-1

List of legal documents in force related to solid waste (Level, type, of waste, available in English or Bulgarian language)

#	Full name, first promulgated and amended - # and year of State Gazette	Levels				Type		Waste type		Available	
		1	2	3	4	Gene-ral	Spe-cific	House-hold	Indu-strial	Engl.	BG
	2	3	4	5	6	7	8	9	10	11	12
1	Environment Protection Law 86/91 100/92	•				•				•	•
2	Territorial and Settlement Organisation Law 29/73 32/73 87/74 102/77 36/79	•				•					
3	Regulation on Application of Territorial and Settlement Organisation Law 62/73 24/75 87/76 37/78 7,44/80 38/83 48/85 53/87		•			•					
4	Public Health Law 88/73 92/73 53/76 28/83 66/85 27/86 89/88 87,99/89 15/91	•				•					
5	Regulation on Application of Public Health Law 31/74 99/80 101/89 76,101/90 81/91 4/92		•			•					
6	Property and use of Agricultural Land Law 17,20,74/91 18,18,46,105/92	•				•					•
7	Regulation on Application of Property and use of Agricultural Land Law 34&60&80/91 34/92, 8/93		•			•					•
8	Protection of Water , Soil and Air from Pollution Law 84/63 26/68 29/59 95/75 3/77 1/78 26/88 86/91	•				•					
9	Regulation on Application of Protection of Water , Soil and Air Law 80/54 9/78		•			•					
10	Forest Law 89/58 26/68 44/77	•				•					
11	Regulation on Application of Forest Law 24/75 33/79 2,4/85 25/83		•			•					
12	Local Government and Administration Law 77/91	•				•					•
13	Regulation on Cleanness of Settlements 79/66		•			•					
14	Regulation on the Procedure of Specifying and Charging Pollution and Environmental Harm above the Set Standards 15/93			•		•					
15	Regulation on Environment Impact Assessment 10/93			•		•				•	•
16	Regulation on Designing Sanitary Disposal Sites for Solid Household Waste (SHW) - Institutional Paper (IP) Nov. 89				•		•	•		•	•
17	Instruction for Designing and Running of Sites for Controlled Deactivation of SHW IP Nov.- 89				•		•	•		•	•
18	Instruction for Disinfecting and Elimination of Pests in the Waste transporting Vehicles (IP) Nov. 89				•		•	•			•
19	Instruction for Separate collection of SHW				•		•	•			•
20	Methodical Guidelines for Collection and Transport of SHW (IP) Dec. 92				•		•	•			•
21	Methodical Guidelines for Designing of an organisation for SHW Collection and Haulage (IP) Nov. 89				•		•	•		•	•
22	Methodical Guidelines for Elimination and Recultivation of Unofficial Dumping Sites IP Dec. 92				•		•	•			
23	Methodical Guidelines for Preparing a Regulation on Maintaining and Keeping Cleanness on Municipal Territory IP Dec. 92				•		•	•	•		
24	Guidelines for Season Cleaning of settlements IP Dec.92				•	•					

Table 3-1(cont..)

1	2	3	4	5	6	7	8	9	10	11	12
25	Quality and Quantity Characteristics of Solid waste in BG. Shirt Term Forecast IP Dec. 92				•		•	•			
26	Methodical Guidelines for Designing of Transfer Stations IP Dec. 92				•		•				
27	Instructions for Designing of Sites for Containers for Collecting SHW IP Dec. 92				•		•	•			
28	Regulation 2 for Sanitary Protective Zones around Water Sources and Potable Water Facilities IP Aug. 89				•	•					
29	Instruction on Hygienic Requirements for Health Protection of Settlements 46/92			•		•					•
30	Temporary Sanitary and Technical Norms and Rules for SHW Arising from Populated Areas 55/73			•			•	•			
31	Criteria for Communal Issues that Correspond to the Hygiene Requirements - Set of documents on communal Hygiene				•	•					
32	Ordinance 3 on Threshold Limit Concentrations of Toxic Substances in Soil 36/89			•		•					
33	Ordinance 5 on Hygienic Norms for Maximum Admissible Quantities of Chemical and Biological Pollutants in Foods 39/84			•		•					
34	Standards for Permissible Emission /Concentration of Gases / of Noxious Substances Emitted in the Atmosphere 16/84			•		•					•
35	Ordinance 2 on Maximum Admissible Concentrations of Noxious Substances in the Atmospheric Air in Towns and Villages 16/84			•		•					•
36	Bulgarian State Standards - Drinking Water			•		•					
37	Ordinance 4 for Hygienic Requirements of Utilisation of Dams for Drinking Water Supply 18/84			•		•					
38	Ordinance 2 on the Admissible Content of Noxious Substances Discharged in the Sewerage System of Towns and Villages 72/78			•		•					
39	Ordinance 7 for Indexes and Standards for Determination of the Quality of the Running Surface Water 96/86				•						•
40	Nature Protection Law	•				•					
41	Regulation on Application of Nature Protection Law		•			•					
42	Regulation on Functions and Tasks of the MOE		•			•					•
43	Regulation on Functions and Tasks of the MRD		•			•					•
44	Regulation on Functions and Tasks of the MOH		•			•					•
45	Regulation on Functions and Tasks of the MOA		•			•					
46	Regulation on Activities and Functions of Regional Environment Inspectorates			•		•					
47	Regulation on the Zones round the Reserves			•		•					
48	Regulation on the Monetary Sanction for Pollution of Air, Water and Soil			•		•					
49	Tariff for Penal Fines for Causing Unremovable Injures of Protected Sites			•		•					
50	Water Law	•				•					

Table 3-2 List of Legal Documents under Preparation

(Level, type, of waste,available in English or Bulgarian language)

#	Full name of the Legal Document	Levels				Type		Waste type		Available	
		1	2	3	4	Gene-ral	Spe-cific	House-hold	Indu-strial	Engl.	BG
1	2	3	4	5	6	7	8	9	10	11	12
1	Waste Law	•					•	•	•	•	•
2	Regulation on The Cleanness of Settlements		•				•	•		•	•
3	Regulation on Hazardous Waste			•			•		•	•	•
4	Appendices And Annexes to the Regulation on Hazardous Waste (HW) - Catalogue on HW - Criteria for classifying substances/waste as hazardous - List of incompatible materials - Information Chart for transportation of HW - Information Chart for acceptance, delivery and transportation of HW - Signal Chart - for accidents with HW - Blank form for recording accidents during storing, transportation and treating - Information Chart for HW - Instruction for filling in "Information Chart for registration of HW" - Instruction for filling in "Information Chart - report for HW			•			•		•	•	•
5	Law on Organisation and Building up of territory	•				•					
6	Law on construction	•				•					
7	Health Protection Law	•				•					
8	Forest Law	•				•					
9	Law on Cleanness of Atmospheric Air	•				•					
10	Regulation on Tariffs, Charges, Fees, etc. connected with Environment (waste water pollution within the Standards)			•		•					
11	Water Law	•				•					
12	Regulation on Indicators and Standards for Concentration of Harmful Substances in Industrial Waste Water Discharged in the Sewerage of Cities			•		•					
13	Regulation on the Requirements for the Quality of the Industrial Waste Water Discharged in Surface Water			•		•					
14	Regulation on Indicators and Standards for Specifying the Quality of Surface Water Flows and Basins			•		•					
15	Regulation on the Requirements for the Water Used for Different Main Purposes			•		•					
16	Regulation on Indicators and Standards for Specifying the Quality of Coastal Sea Water			•		•					
17	Law on protected Areas	•				•					
18	Law on Medicinal Herb	•				•					
19	Law on Biological Diversity	•				•					
20	Law on Hunting	•				•					
21	Protection of Earth Bowels	•				•					