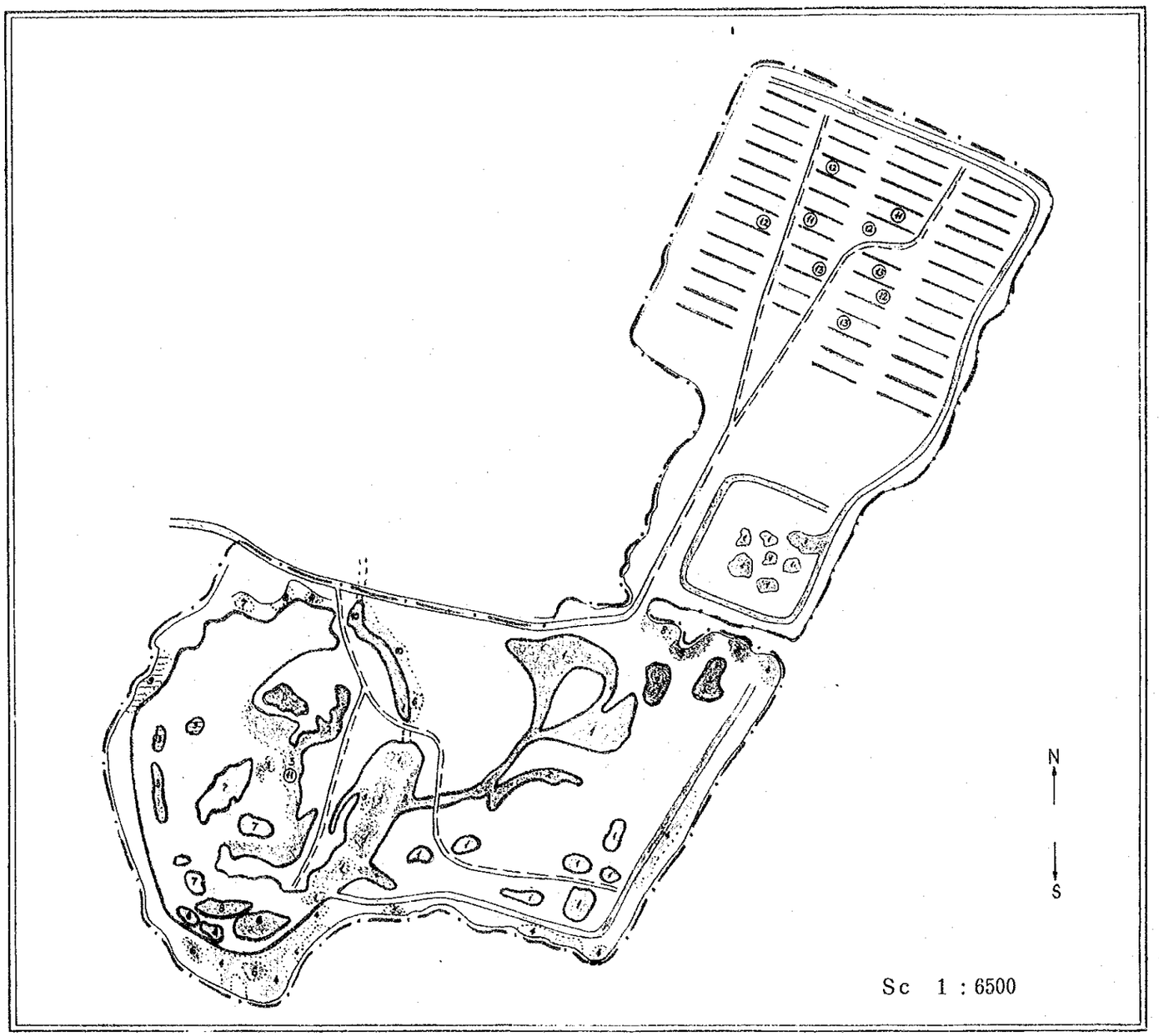
KORIYATA

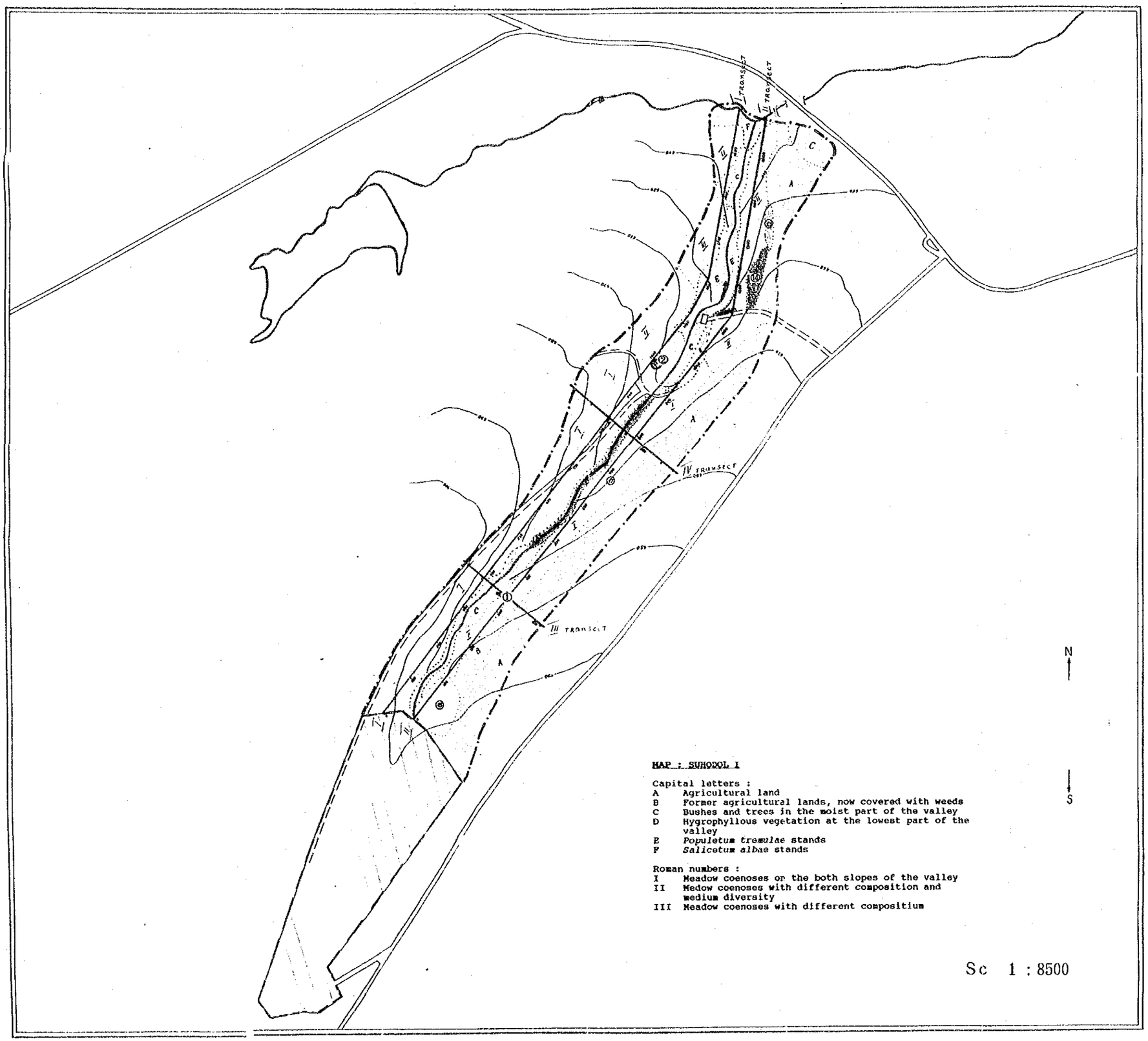



MAP : KORIYATA

Capital letters :
N Plant species or their communities

Black numbers :
1 *Typha latifolia, T. angustifolia, Juncus conglomeratus*
2 *Typha angustifolia*
3 *Myriophyllum spicatum*
4 *Salix alba, S. caprea, Populus tremula, P. nigra, Betula alba*
5 *Sambucus ebulis*
6 *Alnus glutinosa*
7 *Populus nigra, S. alba*
8 *Salix alba, S. caprea*
9 *Salix caprea, Populus nigra*
10 *Salix alba, Populus nigra*
11 *Polygonum hydropiper*
12 *Potamogeton pectinatus*
13 *Chara sp.*

Red numbers:
Sites of Plankton and Benthos samples

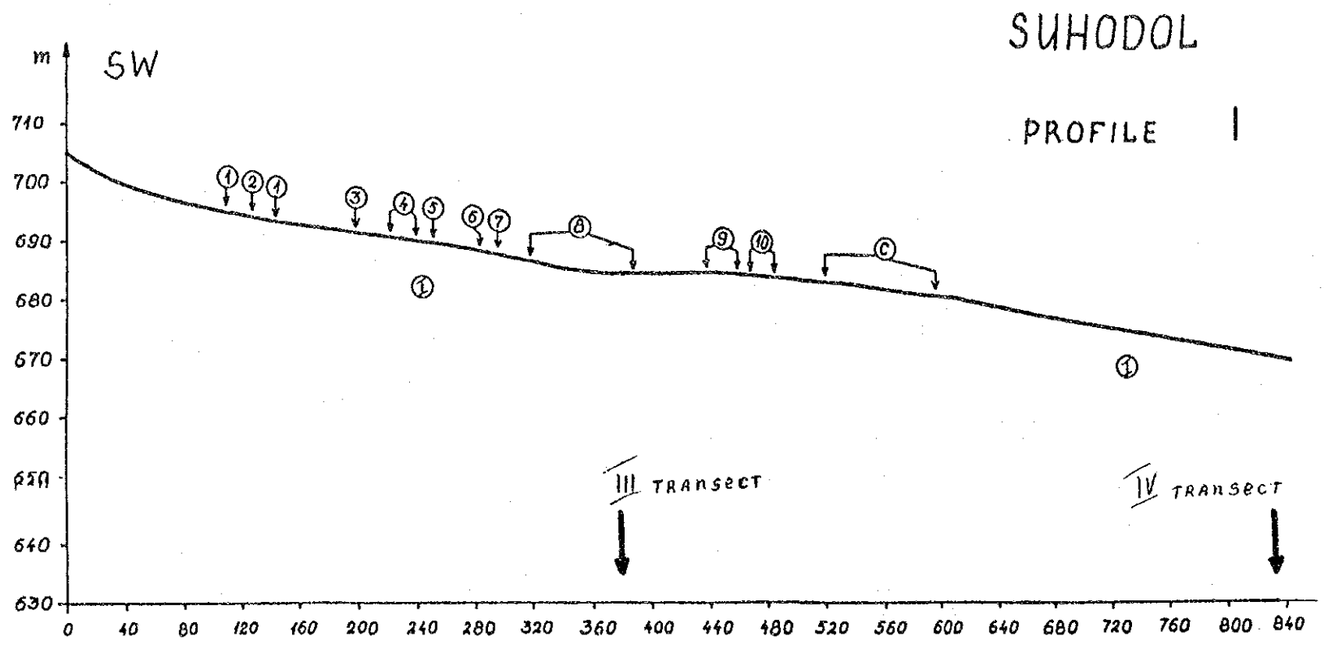


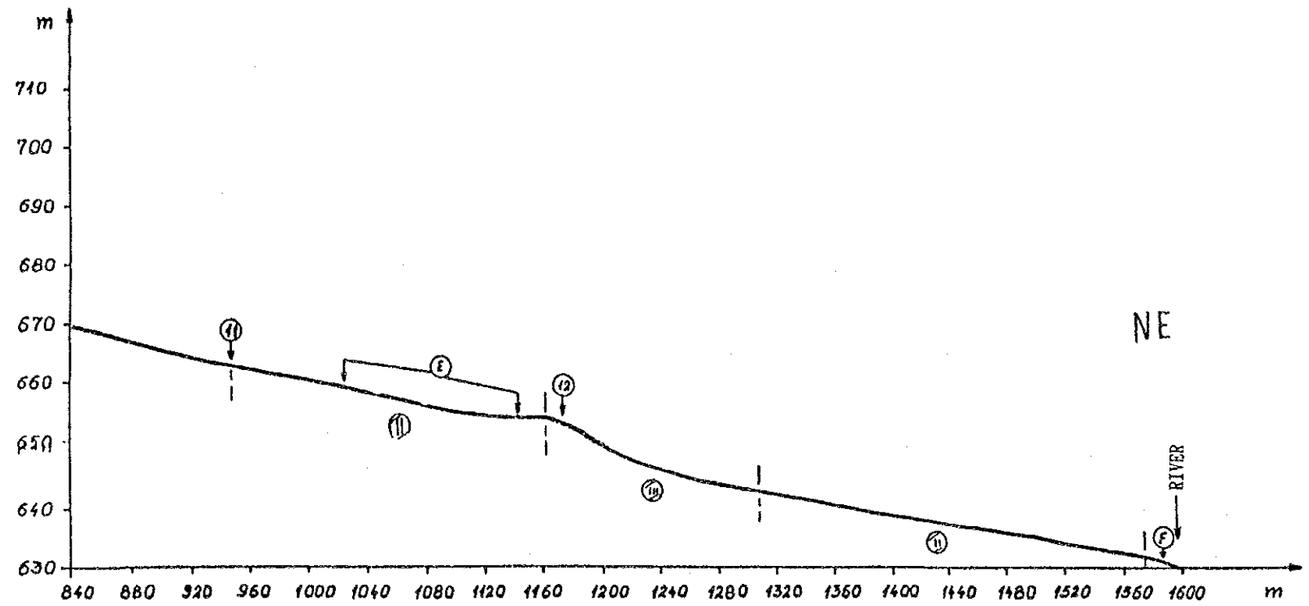

MAP : SUHODOL I

Capital letters :
A Agricultural land
B Former agricultural lands, now covered with weeds
C Bushes and trees in the moist part of the valley
D Hygrophyllous vegetation at the lowest part of the valley
E *Populetum tremulae* stands
F *Salicetum albae* stands

Roman numbers :
I Meadow coenoses on the both slopes of the valley
II Medow coenoses with different composition and medium diversity
III Meadow coenoses with different compositium

Sc 1 : 8500




VERTICAL SCALE 1:1000

HORIZONTAL SCALE 1:4000

**PROFILES : Symbols**

Capital letters :

A Agricultural land
B Former agricultural lands, now overgrown with weeds
C Trees and bushes
D Hygrophyllous vegetation elements
E *Populetum tremulae* stands
F *Salicetum albae* stands
N Plant species and communities

Roman numbers :

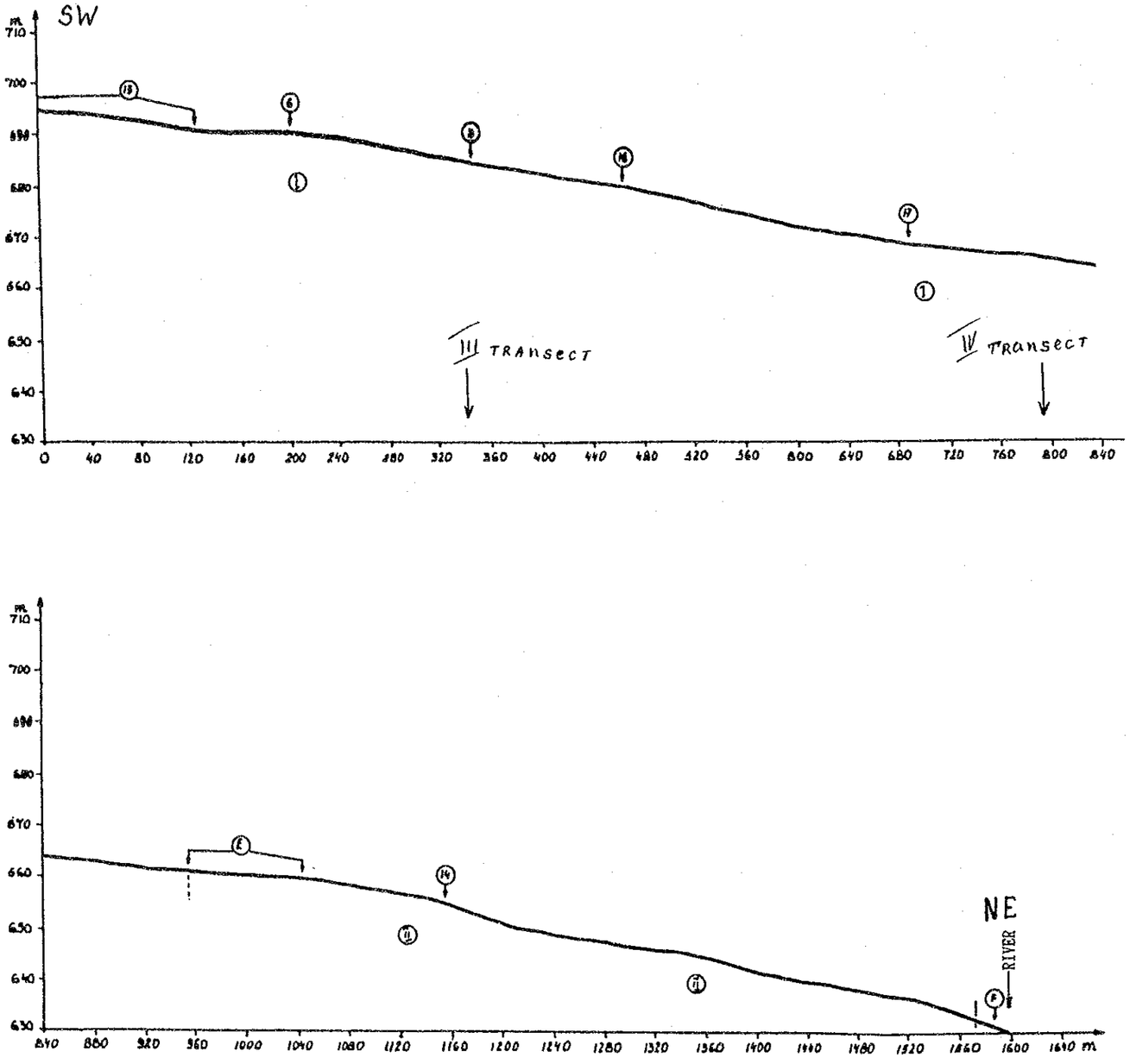
I Meadow coenoses
II Meadow coenoses
III Meadow coenoses
IV Populus canadiensis stands
V *Viscaria atropurpurea* stands

Black numbers :

1 *Typha latifolia, T. angustifolia, Juncus conglomeratus*
2 *Acer tataricum* stands
3 *Quercus cerris* stands
4 *Sorbus torminalis, Quercus cerris, Q. frainetto, Cornus mas, Prunus spinosa, Crataegus monogyna, Carpinus orientalis, Acer tataricum*
5 *Quercus cerris, Acer tataricum, Crataegus monogyna, Rosa canina*
6 *Clematis integrifolia*
7 *Malus domestica, Cornus mas, Crataegus monogyna*
8 *Populus tremula, Betula alba, Acer tataricum, Quercus frainetto*
9 *Quercus cerris, Rosa canina*
10 *Pyrus communis, Quercus cerris, Crataegus monogyna, Rosa canina*
11 *Typha latifolia, Salix alba, Equisetum palustre*
12 *Prunus domestica, Rosa canina*
13 *Phragmites australis, Typha angustifolia, Tusslago farfara, Festuca elatior, Urtica dioica*
14 *Sambucus ebulis* stands
15 Strongly polluted moist ungrassed area
16 *Prunus spinosa, Crataegus monogyna, Rosa canina*
17 *Pyrus communis* (with *Parmelia sp.*)
18 *Rosa canina* (single bush)
19 *Typha latifolia, Equisetum palustre, Juncus conglomeratus*
20 *Crataegus monogyna, Veratrum lobelianum*

SUHODOL

PROFILE II




VERTICAL SCALE 1:1 000

HORIZONTAL SCALE 1:4000

**PROFILES : Symbols**

Capital letters :

| | |
|---|---|
| A | Agricultural land |
| B | Former agricultural lands, now overgrown with weeds |
| C | Trees and bushes |
| D | Hygrophyllous vegetation elements |
| E | *Populetum tremulae* stands |
| F | *Salicetum albae* stands |
| N | Plant species and communities |

Roman numbers :

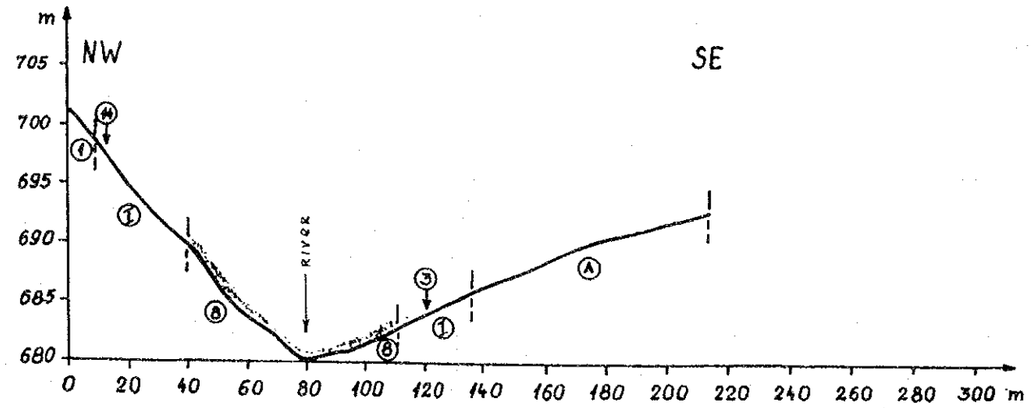
| | |
|---|---|
| I | Meadow coenoses |
| II | Meadow coenoses |
| III | Meadow coenoses |
| IV | Populus canadiensis stands |
| V | *Viscaria atropurpurea* stands |

Black numbers :

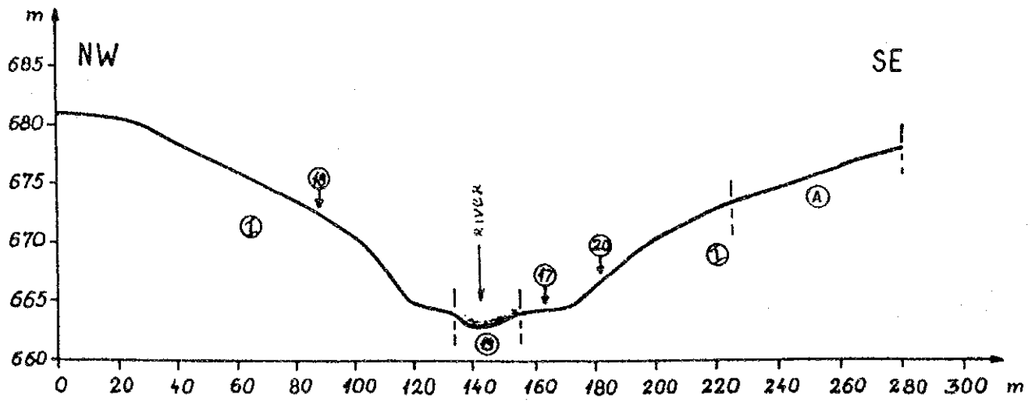
| | |
|---|---|
| 1 | *Typha latifolia, T. angustifolia, Juncus conglomeratus* |
| 2 | *Acer tataricum* stands |
| 3 | *Quercus cerris* stands |
| 4 | *Sorbus torminalis, Quercus cerris, Q. frainetto, Cornus mas, Prunus spinosa, Crataegus monogyna, Carpinus orientalis, Acer tataricum* |
| 5 | *Quercus cerris, Acer tataricum, Crataegus monogyna, Rosa canina* |
| 6 | *Clematis integrifolia* |
| 7 | *Malus domestica, Cornus mas, Crataegus monogyna* |
| 8 | *Populus tremula, Betula alba, Acer tataricum, Quercus frainetto* |
| 9 | *Quercus cerris, Rosa canina* |
| 10 | *Pyrus communis, Quercus cerris, Crataegus monogyna, Rosa canina* |
| 11 | *Typha latifolia, Salix alba, Equisetum palustre* |
| 12 | *Prunus domestica, Rosa canina* |
| 13 | *Phragmites australis, Typha angustifolia, Tusslago farfara, Festuca elatior, Urtica dioica* |
| 14 | *Sambucus ebulis* stands |
| 15 | Strongly polluted moist ungrassed area |
| 16 | *Prunus spinosa, Crataegus monogyna, Rosa canina* |
| 17 | *Pyrus communis* (with *Parmelia sp.*) |
| 18 | *Rosa canina* (single bush) |
| 19 | *Typha latifolia, Equisetum palustre, Juncus conglomeratus* |
| 20 | *Crataegus monogyna, Veratrum lobelianum* |

SUHODOL

PROFILE III




PROFILE IV




VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000

PROFILES : Symbols

Capital letters :
A Agricultural land
B Former agricultural lands, now overgrown with weeds
C Trees and bushes
D Hygrophyllous vegetation elements
E *Populetum tremulae* stands
F *Salicetum albae* stands
N Plant species and communities

Roman numbers :
I Meadow coenoses
II Meadow coenoses
III Meadow coenoses
IV Populus canadiensis stands
V *Viscaria atropurpurea* stands

Black numbers :
1 *Typha latifolia, T. angustifolia, Juncus conglomeratus*
2 *Acer tataricum* stands
3 *Quercus cerris* stands
4 *Sorbus torminalis, Quercus cerris, Q. frainetto, Cornus mas, Prunus spinosa, Crataegus monogyna, Carpinus orientalis, Acer tataricum*
5 *Quercus cerris, Acer tataricum, Crataegus monogyna, Rosa canina*
6 *Clematis integrifolia*
7 *Malus domestica, Cornus mas, Crataegus monogyna*
8 *Populus tremula, Betula alba, Acer tataricum, Quercus frainetto*
9 *Quercus cerris, Rosa canina*
10 *Pyrus communis, Quercus cerris, Crataegus monogyna, Rosa canina*
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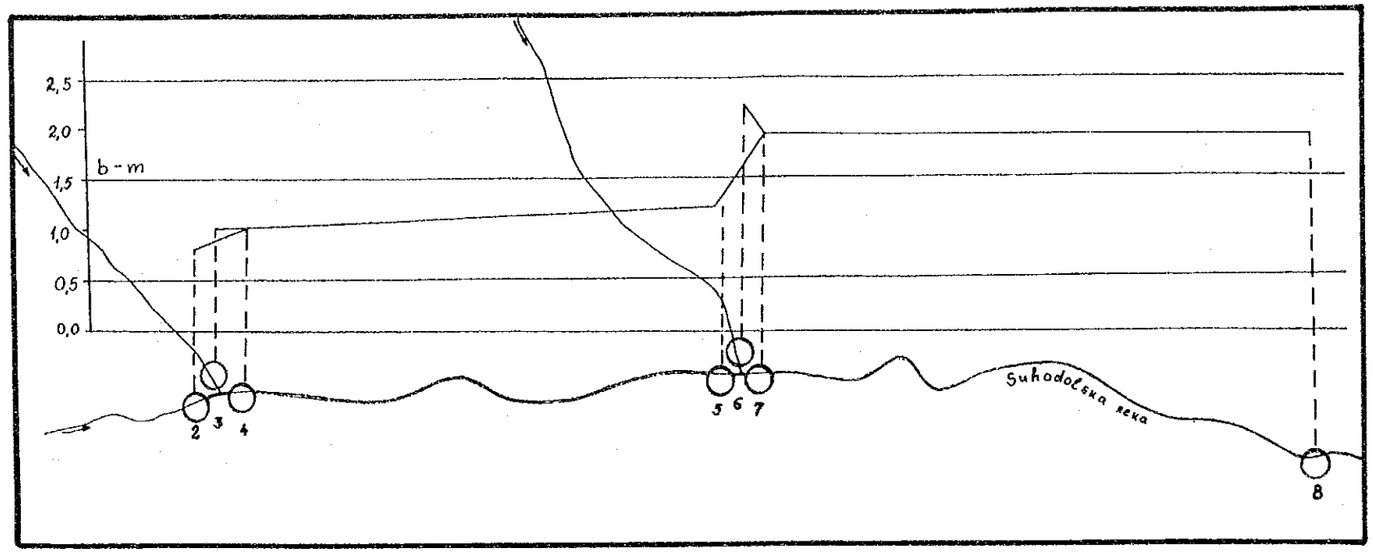
12 *Prunus domestica, Rosa canina*
13 *Phragmites australis, Typha angustifolia, Tusslago farfara, Festuca elatior, Urtica dioica*
14 *Sambucus ebulis* stands
15 Strongly polluted moist ungrassed area
16 *Prunus spinosa, Crataegus monogyna, Rosa canina*
17 *Pyrus communis* (with *Parmelia sp.*)
18 *Rosa canina* (single bush)
19 *Typha latifolia, Equisetum palustre, Juncus conglomeratus*
20 *Crataegus monogyna, Veratrum lobelianum*




APPENDIX TO MAP 1

| Species | sim | Abundance at 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Ancylus fluviatilis | 1.35 | 4 | 10 | 12 | 1 | 0 | 0 | 0 |
| Bactis carpathicus | 0.2 | 2 | 3 | 5 | 0 | 0 | 0 | 0 |
| B. scambus | 1.5 | 3 | 1 | 7 | 2 | 0 | 0 | 0 |
| Brachiptera seticurmis | 0.6 | 5 | 3 | 7 | 0 | 0 | 0 | 0 |
| Brachicentrum montanus | 0.2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| Centroptilum luteolum | 1.85 | 0 | 0 | 0 | 4 | 2 | 9 | 11 |
| Diamesa sp. | 2.25 | 0 | 0 | 0 | 0 | 16 | 0 | 0 |
| Dugesia gonocephala | 0.3 | 3 | 5 | 7 | 2 | 0 | 0 | 0 |
| Ephemera danica | 1.5 | 0 | 0 | 1 | 1 | 0 | 3 | 2 |
| Gammarus balcanicus | 0.2 | 6 | 10 | 8 | 4 | 0 | 0 | 0 |
| G. fossarum | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 12 |
| Glossifonia complanat | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Goera pilosa | 1.5 | 0 | 0 | 0 | 3 | 0 | 5 | 7 |
| Halesus digitatus | 1 | 0 | 0 | 3 | 2 | 0 | 1 | 2 |
| Hydrospyche sp. | 1.95 | 3 | 10 | 15 | 18 | 0 | 3 | 4 |
| Hydroptilla sp. | 1.75 | 0 | 0 | 0 | 7 | 0 | 5 | 3 |
| Molenna angustata | 1 | 0 | 0 | 3 | 5 | 0 | 0 | 0 |
| Odagmia ornata | 2.25 | 0 | 0 | 0 | 0 | m | 0 | 0 |
| Oligoneuriella rhenana | 1.75 | 0 | 0 | 0 | 1 | 0 | 3 | 2 |
| Perla marginata | 0.65 | 1 | 0 | 5 | 2 | 0 | 0 | 0 |
| Physa fontinalis | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Planorbis planorbis | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| Stylaria lacustris | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| SPI | | 0.76 | 0.94 | 1.04 | 1.33 | 2.23 | 1.88 | 1.83 |

Determination of Saprobiological Index
(Pantle–Buck)

Abbreviations :

sim : Saprobial Importance of Species

SPI : Index

m : Abundance > 100 individuals

2,3,4.. : Sample positions

PROFILES : Symbols

Capital letters :

A Agricultural land
B Former agricultural lands, now overgrown with weeds
C Trees and bushes
D Hygrophyllous vegetation elements
E *Populetum tremulae* stands
F *Salicetum albae* stands
N Plant species and communities

Roman numbers :

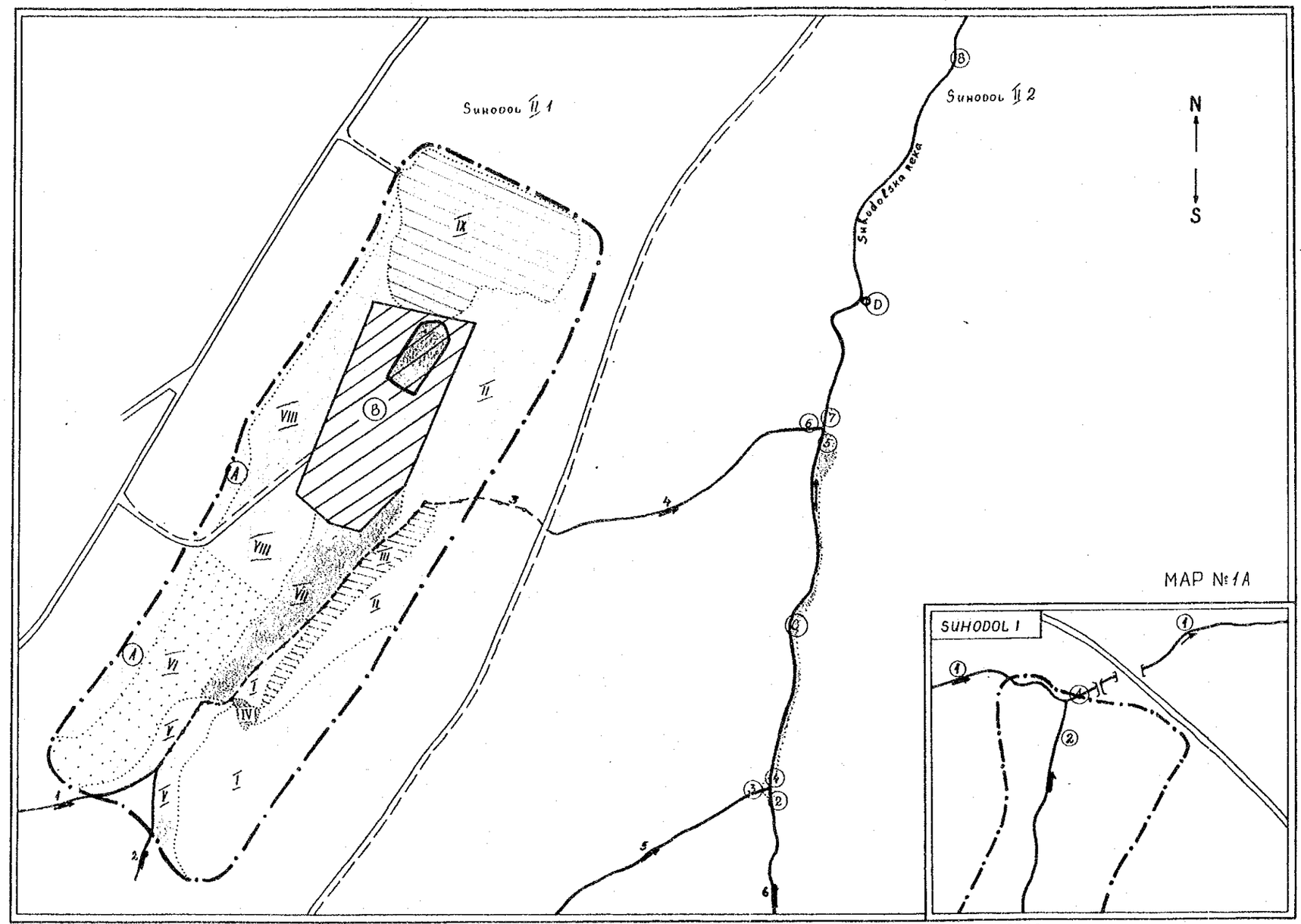
I Meadow coenoses
II Meadow coenoses
III Meadow coenoses
IV Populus canadiensis stands
V *Viscaria atropurpurea* stands

Black numbers :

1 *Typha latifolia, T. angustifolia, Juncus conglomeratus*
2 *Acer tataricum* stands
3 *Quercus cerris* stands
4 *Sorbus torminalis, Quercus cerris, Q. frainetto, Cornus mas, Prunus spinosa, Crataegus monogyna, Carpinus orientalis, Acer tataricum*
5 *Quercus cerris, Acer tataricum, Crataegus monogyna, Rosa canina*
6 *Clematis integrifolia*
7 *Malus domestica, Cornus mas, Crataegus monogyna*
8 *Populus tremula, Betula alba, Acer tataricum, Quercus frainetto*
9 *Quercus cerris, Rosa canina*
10 *Pyrus communis, Quercus cerris, Crataegus monogyna, Rosa canina*
11 *Typha latifolia, Salix alba, Equisetum palustre*
12 *Prunus domestica, Rosa canina*
13 *Phragmites australis, Typha angustifolia, Tusslago farfara, Festuca elatior, Urtica dioica*
14 *Sambucus ebulis* stands
15 Strongly polluted moist ungrassed area
16 *Prunus spinosa, Crataegus monogyna, Rosa canina*
17 *Pyrus communis* (with *Parmelia sp.*)
18 *Rosa canina* (single bush)
19 *Typha latifolia, Equisetum palustre, Juncus conglomeratus*
20 *Crataegus monogyna, Veratrum lobelianum*

# SUHODOL II

MAP №1B




Sc 1 : 6500

**MAP 1A : SUHODOL I**

Blue numbers :
1 : Creek with constant flow
2 : Tributary

Red numbers :
Sites of plankton and benthos samples

**MAP 1B : SUHODOL II**

Blue numbers :
1 : Creek 1
2 : Creek 2
3 : Concrete pipe
4 : End of concrete pipe
5,6 : Initial creeks of Suhodolska river

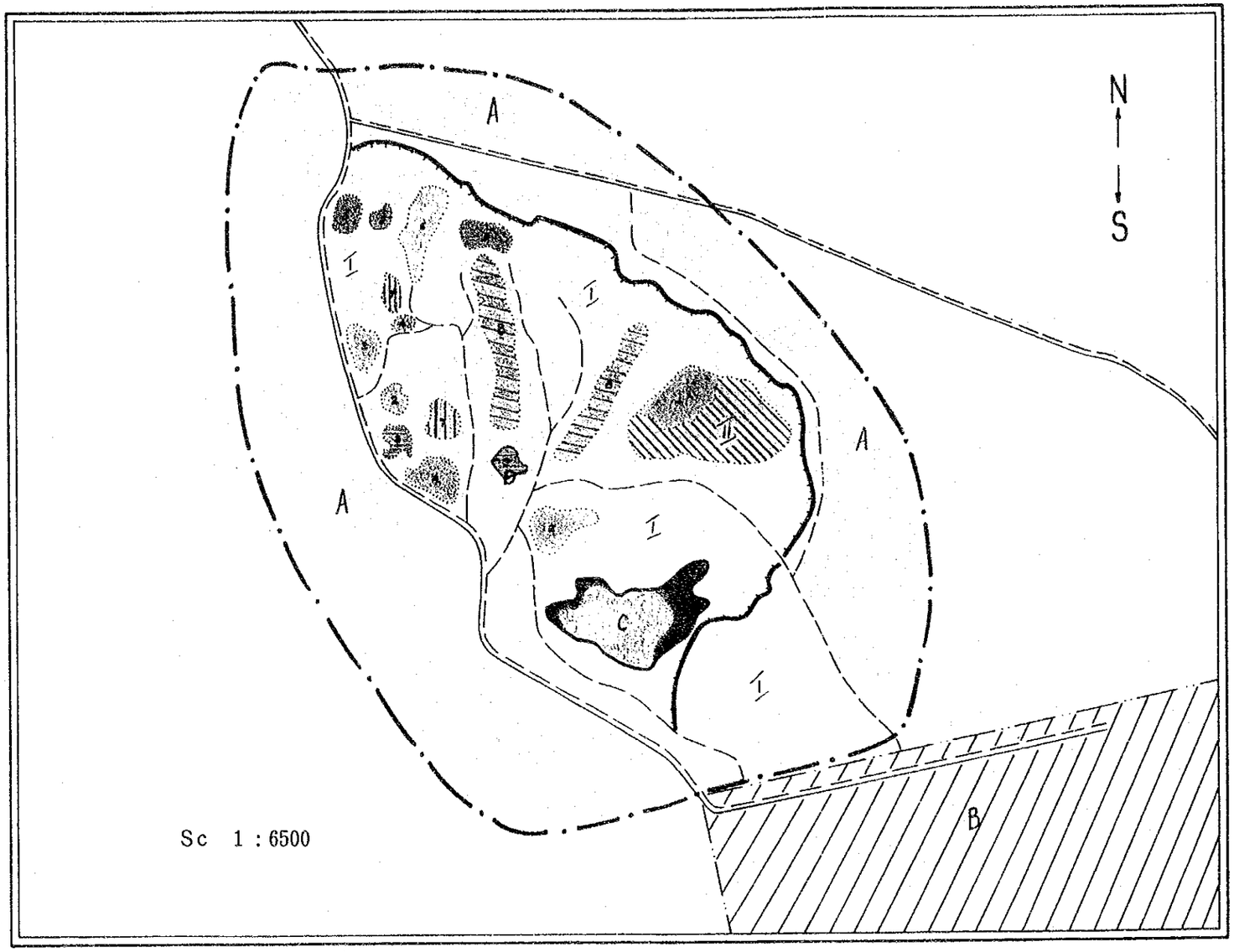
Red numbers :
Site of plankton and benthos sampling

Capital letters :
A Arable lands
B Actual dumping site
C Hygrophyllous and hygro-mesophyllous plant communities with locality of *Dactylorhiza maculata* and *Orchis ustulata*
D Pool with *Typha latifolia* and *Chara* cf. *vulgaris*

Roman numbers :
I *Chrsyopogonetum grylli* stands
II *Chrysopogon gryllus* + *Poa pratensis* community
III *Chrysopogonetum grylli* meadow community
IV Bush vegetation formed with places overgrown by weeds coenoses
V *Carpinetum betulae* stands
VI *Agrostis alba* + *Chrysopogon gryllus* community
VII Ruderalized terrain at the place of covered former dumping site
VIII Densely overgrown by weeds meadow coenoses
IX Secondary engrassed with anthropophytes, area at the place of filled up former dumping site

# NOVI ISKAR

MAP №2




**MAP 2 : NOVI ISKAR**

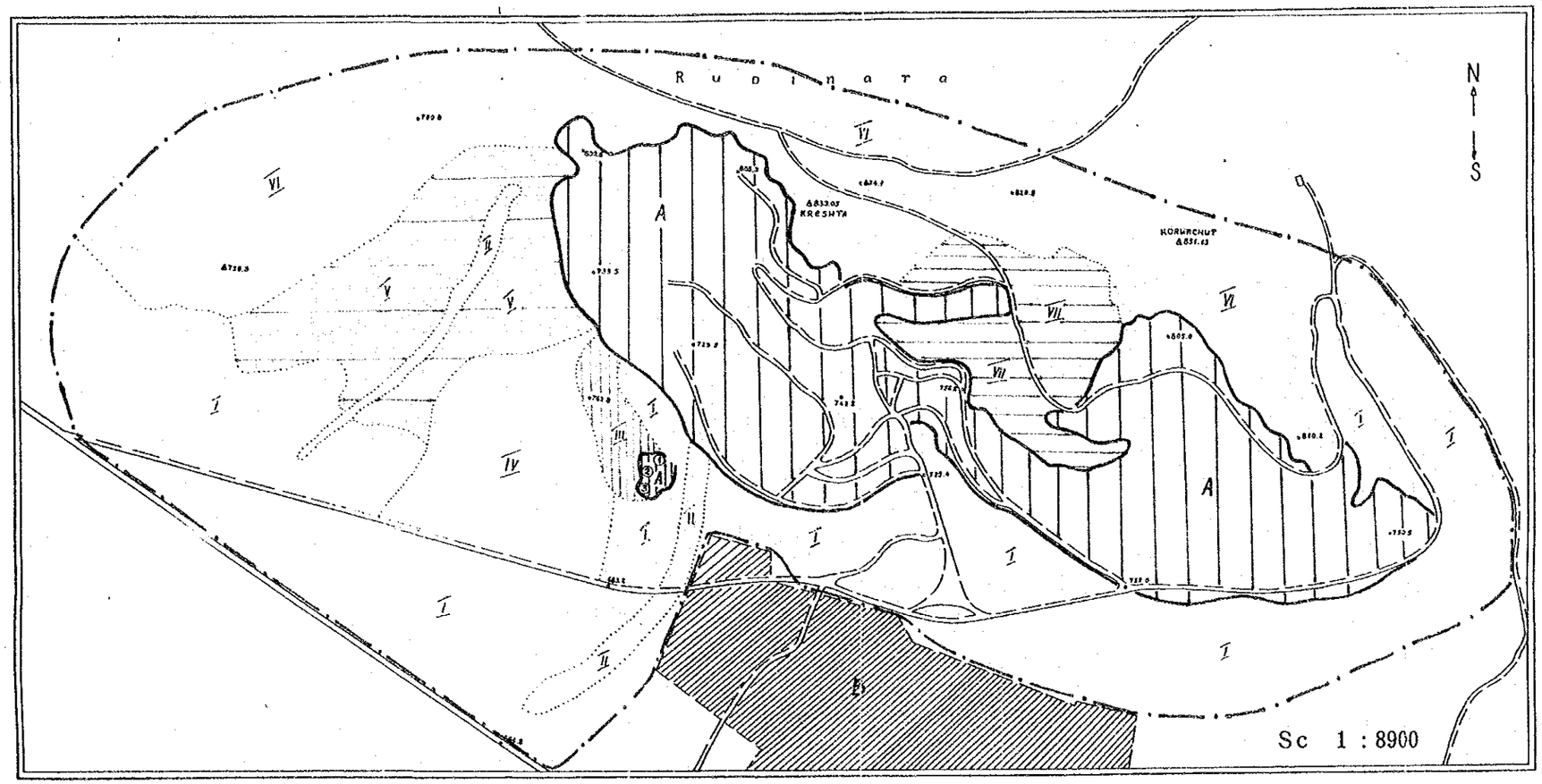
Capital Letters :
A Arable land
B Excavation area

Roman numbers :
I *Festucetum psedovinae* stands
II Slope overgrown by weeds

Black numbers :
1 *Myriophyllum spicatum, Typha latifolia, T. angustifolia*
2 *Phragmites australis, Typha angustifolia, Juncus conglomeratus*
3 *Typha latifolia, T. angustifolia*
4 *Typha latifolia, Typha angustifolia, Juncus conglomeratus*
5 *Agrostis capillaris, Poa pratensis, Oxalis acetosela, Achillea millefolium, Euphorbia cyparissias, Medicago lupulina, Chrysopogon grylluss*
6 Excavation zone with steep slopes, bottom overgrown by ruderal plants
7 Gras communities, fam. *Poaceae*
8 Embankments of inert materials and soil, covered by ruderals with predominance of *Tussilago farfara*

# RUDINATA

**MAP №3**




**MAP 3 : RUDINATA**

Roman numbers :

I *Festuca pseudovina* + *Medicago lupulina* stands
II *Carpinetum orientale* stands
III *Festuca pseudovina* + *Bromus sterillis* stands

IV *Festuca pseudovina* + *Melica ciliata*, meadow-pastural association with fragmentary distributed bushes and trees
V *Satureja montana* + *Andropogon ischemum* stands
VI *Festuca pseudovina* - different grasses
VII Grass and bush coenoses secondary formed at th place of former Quercetum mixtum, Festucetum pseudovinae and different grass sta

STUDY OF THE SOLID WASTE MANAGEMENT FOR THE SOFIA GREATER MINICIPALITY

FINAL REPORT

Additional Report
Environmental Study

Sofia, January 1994

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Chapter, Title Page

8.1 Tables



8.2 Diaqrams



8.3 Figures



8.4 Map



8.5 Photographs

## 1 Introduction

According to the frame of the entire project several areas within the SOFIA plain have been defined as candidate sites:

| | |
|---|---|
| DOLNI BOGROV | - existing disposal site |
| KATINA | - new site |
| KORIATA | - new site |
| NOVI ISKAR | - new site |
| RUDINATA | - new site |
| SUHODOL | - existing disposal site |
| SUHODOL | - closed disposal site |

The ensemble of these areas had to be investigated for their suitability as future disposal sites from the ecological point of view.
The guidelines for the biological, ecological, chemical and infrastructural surveys along which the basic data pool for the final decisions was established, are similar for each of the investigated areas.

For various reasons, based on the results obtained from the different surveys and presented in previous reports, only the old quarry at KATINA proved to be suitable for a further development towards a disposal site.
Mainly due to major environmental impacts arising with the establishment of such a disposal site all the other areas had to be excluded from any further consideration.

## 2 The environmental status of the Katina site

### 2.1 Biology

1) General description

The KATINA site represents a broad and deep quarry, which was built during the last decades for the exploitation of coal. The huge quarry is dominated by a considerably large artificial lake with a depth of 27.0 m (the inner lake), whose waters filled the excavation pit after the exploitation activities ended.
To the west of the investigated site there is another lake (the outer lake) which is in fact of the same artificial origin (excavation pit) with a depth of 53.0 m.
Thus the entire area has to be defined as of anthropological origin rather than being a natural biotope.

The water body of the inner lake is in an advanced stage of eutrophication, thus the composition of plankton and benthos taxa (phyto- and zoo-) are rather poor compared to other wetland- and lake-biotopes. Nevertheless the occurring planktonic biota define the lake as a monomictic waterbody.
The ecological phytotaxa of hygrophylls, hydrophytes and mesophylls resident at the site are influenced by the presence of the lake and their formations appear to be monotonous.
The aquatic and hygrophyllous plant elements are typical for the Bulgarian semi-aquatic lowlands.
The composition of vertebrate taxa is dominated by avifaunal elements represented with common species in low abundance. Globally threatened species have only been determined as one record of *Elaphe longissima* (snake). Since only one individum of *E.longissima* was found, this has to be regarded as an accidental record and cannot necessarily be taken as an evidence for the existence of an entire population of this species at the site. Besides the Bulgarian red data species *Ardea purpurea* and 14 other protected bird species have been identified (cf. chapter 8.1, 8.2, 119 133

The terrestrial vegetation is dominated by mesoxerophylls and xerophylls occurring with a monotonous species composition. Endemic, protected or even globally threatened plant species are not resident at the site.

2) Ecological evaluation

Since the entire area is of artificial origin the floral and faunal elements within the quarry - although they have been determined as typical, poor and monotonous - are in their secondary succession stage. Especially the absence of a sufficient humus layer prevents rapid succession processes of complex associations.

Areas where gleaming coal seams are still to be seen today, are not yet invaded by primary settlers. The engrassing of the slopes as triggering mechanism for the development of a pioneer vegetation is a constructive element of the successional stage.
These ecological characteristics in fact lower the value of the site to an inferior level.

3) Degradation of habitats

Since the described biotopes of the site and their floral and faunal associations are rather young, the degradation of the existing habitats is only combined to the areas where the coal strata inhibit any settlement of vegetation and those terrains where uncontrolled dumping of different solid waste materials takes place.

## 2.2 Waters and water pollution

The water bodies of the region which are in close or in indirect contact with the site itself are of various character:

| | |
|---|---|
| Katinska river | - natural water flow |
| Iskar river | - natural water flow |
| the outer lake | - artificial lake |
| the inner lake | - artificial lake |
| pools | - artificial, temporary small pools |
| ground water | - water table at different levels |
| surface water | - waters from precipitation |

The term "artificial" is used because the establishment of lakes and pools within the site originates from human activities, although - once being mere artificial waterbodies - the inner and outer lake show secondary stage of successive invasion of floral and faunal aquatic elements.

Since the site lays within an area where clay strata are dominating the upper strata, the interferences of the different water bodies proved to range at a very low level.
In this respect the ground water of the area is only in slight contact with the waters from the rivers or the two artificial lakes. The contact of the inner and outer lake, too, is negligible. However the inner lake is not only fed by surface waters, but also from two submersed springs in its eastern parts.

In addition to geological, geomorphological and hydrological surveys, the analysis of the waters with special regard to their content of pollutants has been one of the most important items for the environmental surveys (cf. chapter 8.1, 8.2)

The results of the detailed sampling and analysis programme have not only given information about the present status of pollution but also creates the basis for the definition of environmental impacts combined to the discharge of waters from the future disposal site into the natural water flows like Katinska river and Iskar river respectively.

1) Ground water

The ground waters within the site have been analyzed to their content of various elements and substances. Due to the type of strata occurring at the site their charge of alkaline elements and other anorganic elements is considerably high subsequently rising the conductivity to a range of 1350 to 10.200 µS/cm. Especially the content of sulfates appears to be high (330,9 ppm to 1769.5 ppm) due to the interactions between the coal strata and the ground waters.
According to the water analysis' the concentration for other tested pollutants (e.g. heavy metals in the ground water appears not to be critical.

2) Lake water, pool water

Similar to the ground water the surface water of the lake, too, is highly charged with alkaline elements and anorganic substances (cf. chapter 8.1, 8.2)
This applies especially for Sulfates (1556.8, 1723.8 ppm) and the elements Chlorine (691.5 ppm) and Calcium (668, 678 ppm).
Furthermore there is a remarkable increase of concentrations down to the bottom of the lake (cf. chapter 8.2, page 139 ). The displayed examples of some of the tested parameters (cf. diagram, page 139)prove the increase in concentration by a factor 2 to 5 down to a depth of 18 meters.
Since the depth of the inner lake is thought to be 27 meters the concentrations in the waters at the very bottom have been calculated by means of mathematical operations. In the diagram (cf. page 140) the results are presented for the same parameters. Table 1 (cf. page 5) lists the concentrations to be expected for some of the pollutants.

| Substance | Unit | Concentration |
|---|---|---|
| Arsenic | µg/l | 4.3 |
| Cadmium | µg/l | 12.6 |
| Iron | mg/l | 10.4 |
| Lead | µg/l | 13.7 |
| Mercury | µg/l | 2.1 |
| Zinc | mg/l | 1.77 |

Table 1 : Concentrations of pollutants in the water near the bottom of the inner lake (depth: 27m)

Since there is a considerable increase in concentration of pollutants in the deep water of the inner lake, the sediments (at a depth of 18 meters) have been analyzed, too. The results of the analysis are presented on page 98 for the most prominent parameters. Especially the content of lead (67.5 ppm) proved to be remarkably high.

Since the inner lake is about 27.0m deep it has to be expected, that the concentrations for the deeper laying bottom sediments is even higher. In fact this assumption gives many reasons for concern.

The water of small pools, which occur on the shallow southern flanks of the site, show, due to their temporary character of periodic dry-out and refill, higher concentrations of the analyzed elements and substances. The comparison of the different surface waters displays the considerably high differences between the different waters at KATINA site including the water quality of the outer lake as well as KATINSKA river.
The results clearly prove, that the water quality of the outer lake and KATINSKA river range within the normal distribution (cf. page 124). The inner lake and the small pools, in contrary, are due to the described characteristic of the entire site highly charged with pollutants.
Even in the winterperiod, with a high dilution influence of the precipitation, the concentration proved to be high (cf. page 136)

Since both lakes (inner and outer) have the same origin (excavation pits) the concentration of pollutants in the deeper waters of the outer lake, too, are supposed to be considerably high.

## 2.3 Winds and wind regime

The data of the wind measurements (cf. chapter 8.1. page 129) only show low wind speed with a maximum of 6m/sec, direction SE. The wind stars displayed in the map (cf. part 1, page 75) however prove that the winds in KATINA site are changing their direction rapidly and frequently. This alternation in speed and direction mainly derives from the very complex geomorphology of the entire site, where steep downfalls and the hilliness of the surface generate different winds which only appear at the very locality.
The results are congruent with data from the National Institute of Meteorology and the information from the headquarters of the Bulgarian Airforce. According to these information the main direction of winds is East.
Furthermore, the entire region is known to be covered by haze, mist or fog very frequently, especially during inverse weather- (i.e. temperature-)conditions.

## 3 Infrastructural conditions

### 3.1 Human settlements

The human settlements around the sites belong to the villages of KATINA and NOVI Iskar.
The nearest buildings to the site are holiday homes in north-eastern to south-eastern direction within a distance of less than 500m. Along the road which connects KATINA with NOVI ISKAR two larger industrial areas and some agricultural buildings are situated. Permanent settlements, at the village borders of KATINA and NOVI ISKAR, are found within a distance of 1.0km.
Other larger buildings (e.g. kindergarden, hospital, town centre, reservoir) are about 2.0km away from the site.
The airfield of the military airport near DOBROSLAVTSI lays in a distance of 3.0km from the site.

### 3.2 Traffic-Noise conditions

Since the access road to the site and to KATINA village is only used by the local population the number of passing vehicles and the noise combined herewith ranges at a comparative low level. In fact the traffic noise survey (cf. chapter 8.1, 8.2) (page 145) stated the peak for the number of passing vehicles of 59 (daytime: 11:15) with a noise maximum of 63.8 dB(A) (daytime 11:15) at a recording position near the future disposal site.
The road itself is narrow and its surface is broken many times along the way from NOVI ISKAR to KATINA.
At present the access to the site is only possible by trespassing the town centres of NOVI ISKAR (from the South) or those of KATINA (from the North), since no larger road encompasses the villages.

## 4 Major impacts and necessary measures

### 4.1 Water protection

The results of the different waters clearly stated the high charge with pollutants for some of the analyzed water bodies.
It is evident that for the establishment of a disposal site at KATINA the entire volume of the inner lake as well as the volumes of the temporary pools have to be emptied. Since these waters are highly polluted the uncontrolled discharge into KATINSKA river and the culvert and channel of NOVI ISKAR represents a high risk. The waters from the KATINA site would finally reach the ISKAR river, which already is a water flow highly charged with pollutants (cf. page 143) Allthemore ISKAR river is a tributary to the DANUBE river system which finally joins the Black Sea.

The annual discharge of the KATINSKA river and the ISKAR river (cf. page 142) which is highest during the months January to June, gives certain possibilities for the discharge of the water volumes from within the site. The mean discharge in these months ranges between 430.6 and 533.3 l/sec for two different measurement positions. The ISKAR river discharges about 36150.0 l/sec ( mean values during January to June) before he meets the KATINSKA river (cf. chapter 8.3)
These (calculated) data prove, that the water volumes from within the site will be sufficiently diluted supposed they are discharged into the channel of NOVI ISKAR during those months when the discharge of the two rivers is highest (cf.page 142)

The dilution for three substances has been calculated for a discharge from the site of 100.0 l/sec during 8 (working) hours per day (six days a week).
The high amount of sulfates will be reduced to a concentration of 699 mg/l before they reach the ISKAR river. With the waters of the ISKAR river they will be again reduced to a concentration of 39.56 mg/l (cf. page 144) The chlorine, too, will be diluted. Their final concentration in the ISKAR river will range at 45.97 mg/l.

The high amount of Zinc in contrary, will only be diluted until the waters reach the ISKAR river. Since the waters of this river themselves are already charged with Zinc the dilution effect will be very low.

At the southern village borders of KATINA (near the outer lake) the KATINSKA river is bypassed into the outer lake. To ensure an efficient dilution further downstream this bypass has to be closed prior to the discharge of the site waters.
The discharge activities will approximately take 160 days since the volume of the inner lake has be calculated to 440.000 $m^3$.

The discharge of the sediments from the inner lake however has to be avoided as this would cause a severe pollution of the areas further downstream (ISKAR river).

One of the most dangerous and therefore important impacts however arises from the water that penetrates the solid waste horizons once the site is in operation.
Since the concentration of pollutants of these leachate waters at the future disposal site KATINA depends not only on the types of waste that are deposited but also on the technical solution for an adequate drainage system a definite characterization of their contents cannot be given in this phase of the project.
However according to experiences from other disposal sites - leachate analysis is available from SUHUDOL disposal site - there is an extremely high charge of pollutants in these waters. Some of the parameters, elements and substances whose concentration in the waters leaving the SUHODOL dumping area, were determined to exceed any given standard are listed in table 2 (see below).

| Item | Unit | Value |
|---|---|---|
| Chlorine | mg/l | 3725.6 |
| Conductivity | µS/cm | 21600.0 |
| COD | mg/l | 2048.6 |
| Nitrogen (total) | mg/l | 1321.7 |
| Oxygen (dissolved) | mg/l | <1.5 |
| Sodium | ppm | 2420.0 |

Table 2 : Analysis of waters at SUHODOL disposal site (extract from sample analysis, June 10th 1993)

The fact, that heavy metals did not appear as critical concentrations in the leachate waters of SUHODOL, follows the general characteristic development of a disposal site: heavy metals appear to have quite different retention times. Thus, once absorbed to a surface, some are quickly (e.g. Copper, Zinc) whereas others are slowly (e.g. Mercury, Lead) remobilized.
Thus for KATINA, too, it is expected, that after a certain time heavy metals are remobilized and will appear in the leachate waters.

Especially this impact demands a thorough and sound technical solution for the prevention of leachate water getting into contact with any natural (ground water, river water) water body. In this respect the sealing of the entire surface of the disposal area as well as the incorporation of an efficient drainage system that

separates leachate from ground water – and partly from surface waters (precipitation), too – are thought to be adequate technical guidelines and measures essential for the future disposal site at KATINA.
Especially the sealing layer should ensure, that chemical and biological degradation processes, which take place at the contact horizon of solid waste and seal, do not reduce the permeability of the layer down to a critical depth.

As the facilities of the site will use different types of waters, adequate water treatment facilities seem to be necessary.
Table 3 (see below) presents the different types of waters that are used within the site area.

| Type | Treatment |
|---|---|
| Leachate | Yes |
| Vehicle cleaning | Yes |
| Vehicle disinfection | Yes |
| Waste water from toilets and other facilities | No |
| Ground water | No |

Table 3: Types of water used within the site and the necessity of treatment

The flowchart of water systems within the site (cf. chapter 8.3, page 148)displays the source of the different waters used within the site together with a recirculation system of the leachate waters as well as their discharge direction. The figure shows the basic system, thus connection between the pipes and drainage systems are not shown. Moreover will parts of the different systems be possibly joined, if changing water qualities should demand a further treatment.

Especially for the leachate waters and the waste waters of the cleaning facilities and disinfection facilities sufficient treatment facilities are necessary.

Furthermore, if biozids (herbizids, fungizids, petizids and other biozids, .g. against rats) are used within the site, the periodical monitoring of the waters, which finally receive residues of these highly dangerous substances is necessary, as the toxicity of biozids ranges within the ppb level.

## 4.2 Human settlements

In the year 1992 the Bulgarian Ministry of Health defined SANITARY PROTECTIVE ZONES (SPZ) (Ordinance No.: 7/25.05.1992) which have to be kept free from any human activity according to the dangerous impacts from buildings (factories, airports, etc.). Eight different zones differentiated by their radius have to be set up as protective corridors depending on the type and character of the planned construction.
Applied for the future disposal site of KATINA four different Sanitary Protective Zones seem to be possible.
The map in chapter 8.4, page 152, displays their radius and largeness. A table (cf. page 153 lists the various settlements that are encountered in the different zones.

1) Temporary settlements

The nearest holiday homes are those of NOVI ISKAR (SPZ group IV, radius 0.5 km) and KATINA (SPZ group III, radius 1.0 km).
As some of these temporary settlements are directly bordering the future disposal site (holiday homes of NOVI ISKAR, north-east to south-east of site) the major important environmental impacts are deriving from :

- light materials transported by winds
- dust and aerosols transported by winds
- noise from the dumping activities during daytime
- noise from access traffic
- evaporation of gases
- shifting of zoocoenosis' and attraction of rodents (e.g. rats)
- exportation of waste material from the disposal site to the access roads
- uncontrolled dumping of waste materials in close vicinity to the site

As there is a considerably large variety of technical as well as management measures by which these impacts may be kept to a minimum, a solution for each of these impacts adequate to the characteristics of the future disposal site has to be defined.
Although most of the impacts described above are of less intensity with increasing distance from the site, the impact from the traffic combined to the dumping activities is expected to be of superior importance.

2) Permanent settlements

Due to the geographical position of the future disposal site some small parts of permanent settlements already occur within the SPZ group IV (NOVI ISKAR, radius: 0.5 km) and group III (KATINA, radius: 1.0 km). The major town parts of NOVI ISKAR and KATINA however are situated in the SPZ group II (radius: 2.0 km).

It is evident that a zones of group I (radius 3.0 km) cannot be kept free as a sanitary protective corridor. Even a zone with a radius of 2.0 km is impossible to be set up.

The sanitary protective zone around the future disposal site of KATINA can only be enlarged to a radius of 1.0 km, which actually represents a zone in which most of the area is covered by grasland and forest.

In this zone the human activities should be restricted to a minimum by governmental measures. This applies especially for the holiday home areas, the industrial and agricultural areas.

## 4.3 Wind drift

Another major impact, the wind drift of light materials and aerosols from disposal sites might possibly be reduced to a large extent for the future site at KATINA.

The geomorphological characteristics of the site enables the establishment of a disposal site perfectly sheltered against the regional occurring wind regime. The efficiency of a statuory tree and bush screen around the site as a wind shield however will finally depend on the planted species and the density of the vegetation.

In addition to this tree and bush screen a fence has to be built around the entire future disposal site.

The combination of these two arrangements includes several advantages :

(I) The ensemble of banket and vegetation represents a perfect wind shield

(II) The combination of banket, vegetation and fence ensures that there is no access possibility for:

- uncontrolled dumping from either side of the site
- larger animals, especially for the cattle of the local farmers who use the area as a pasture

(III) Especially at the ridge of the steep downfall northwest of the site this combination will function as security barrier.

(IV) When the dumping horizons have reached their final height only the inner area has to be replanted or even reafforestated.

This screen should be among the first activities to be undertaken for the construction of the disposal site. Although in its initial phase of dumping activities the tree and bush screen is of minor importance, as the dumping horizons are laying very deep within the site (60.0m), a dense vegetation has to be present when the dumping levels rise and winds can easily drift materials away.
The proposed banket of 2.0m height (cf. chapter 8.3, page 150) should be covered with a humus layer of at least 0.4m to enhance the initial phase of settling plants. In this initial phase fast growing, pioneer species will be planted together with other hygrophyllous species (cf. page 131). For the establishment of the different stages of succession, which will in the end rise the degree of density of plants, however an exchange with the surrounding areas should be kept undisturbed.
As the construction of a fence around the entire site is obligatory it is strongly recommended that it should be placed on that side of the tree and bush screen that faces the disposal areas. Thus a free access to the vegetation screen ensures the sufficient exchange with the surrounding landscape and furthermore the necessary maintainance of the screen can be managed from outside the disposal site.

In adition to this, the gentle incorporation of the construction arrangements (fence hidden behind the vegetation screen) will possibly rise the acceptance of the local population for the establishment of the site.

In fact the arrangements necessary for the construction of the screen are considered to be of high priority and should be started only under the supervision of specialists.

## 4.4 Traffic-noise control

Environmental impacts arising from the access traffic to disposal sites concentrate on the pollution of the roads and streets originating from loss of solid waste materials from the vehicles and the development of an intense traffic noise from the waste trucks.
These impacts will arise especially for the permanent settlements of NOVI ISKAR village since the main access direction crosses NOVI ISKAR village and no bypass access road to the future disposal site exists.

The projections of the future disposal site calculate the maximum possible frequency of vehicles arriving at the site up to 150 vehicles/hour.
In principle the future disposal site at KATINA has two main access possibilities : from the north trespassing the village of KATINA and from the south via the village area of NOVI ISKAR. According to the projections for the development of the site the majority of the solid waste vehicles will use the access via NOVI ISKAR. Since only 2-4% of the entire expected disposal traffic will use the access via KATINA the impact for the village is negligible.

Surveys for the traffic noise at DOLNI BOGROV and SUHODOL clearly stated that the noise combined to the disposal activities rises up to 77,8 dB(A) during the daytime with the highest frequency of waste vehicles.
The comparison between these data from SUHODOL/DOLNI BOGROV and KATINA clarify that the actual noise level of the KATINA access road ranges below those of SUHODOL/DOLNI BOGROV (cf. chapter 8.2, page 146 ). Only in the afternoon the noise of the SUHODOL access road to the disposal site appears to be lower.

In order to keep the impact of traffic noise, which is thought to be intensified within town areas, away from the centre village parts of NOVI ISKAR a bypass road as a main access possibility is obligatory for the establishment of the KATINA disposal site.

This road should be large enough to receive not only the traffic of vehicles when the deposition at the site starts, but should also take into account the increase of traffic, especially in future times when other actual disposal sites within the area of greater SOFIA municipality (e.g. DOLNI BOGROV, SUHODOL) will be closed down.

## 4.5 Dumping horizons and control

### 1) Dumping area and horizons

The entire dumping area may be divided into single dumping cells separated from each other by adequate technical measures and be drained separately. This separation into dumping cells with similar or different dumping space does not only lead to a multiple use of different cells for different solid waste materials but also enables the future site management to open or close single cells depending on the actual spatial demand for the different types of solid wastes.
As the dumping level is rising, an intermediate covering of the horizons with adequate materials should be foreseen.

Another important construction item for the dumping horizons is the ventilation of the gases from the underground, which originate from bacterial degradation activities. According to the experiences from other disposal sites it is well known that these gases, once they reached a certain concentration level, are highly explosive. Even after the dumping horizons have arrived at their maximum height and the site is closed,a sufficient ventilation of the underground gases should be ensured over a long period.

### 2) Dumping height

The final dumping horizon should only rise to a height, which ensures the refill with a volume of earth materials sufficient for the successful replantation of the entire area.
In addition the declination of the final surface area should be adopted from the general angle of the surrounding landscape. This declination angle has to be calculated in accordance with local erosion conditions and depends on the quality of the cover material, too.
To preserve the scenic value of the site at KATINA the rising of the dumping level above the actual topographic surface levels has to be avoided.

### 3) Access possibilities to the dumping areas

Since the natural materials for sealing and refilling different parts of the disposal site are taken from the site itself and contain a high percentage of clays, they are very sticky. In this respect the access roads leading to the different dumping horizons with no concrete surface will cause severe problems to the heavy vehicles.

One the other hand access roads with a tarmac surface will require the expensive removal of the road surface, when dumping horizons are developing in height or

have to be sealed periodically. The construction of these roads should therefore be concentrated on removable and reusable systems of hard substrata modules, which permit a periodical shifting of these access roads.

In addition the entrance-area of the future disposal site should foresee enough space for the arriving vehicles to be parked over a short period of time, in case of any unpredictable events such as traffic jams at the reception.

Similar to the entrance area the exit-area as well should be planned large enough not only for traffic jams but also for cleaning and disinfection facilities for the leaving vehicles.
The adequate dimensioning of the entrance- and exit-areas within the site for the vehicles will finally prevent any traffic jam outside the disposal site.

## 4.6 Animal, pest and bird control

Since disposal sites are known to be highly attractive for different groups of animals, precautions have to be taken for control of these populations.
The development of insect and rodent populations can be easily controlled and regulated by the application of biozids.

Attracted bird populations however is a serious problem of disposal sites especially when they are situated in close vicinity to military or civil airports.
According to the experience of other sites there are several possibilities of control measures for the control of bird populations attracted by the disposal activities.

The most promising technique however is to cover the whole area with nets made of nylon or steel ropes with a different diameter. These nets should have a mesh size of not more than 5.0 cm. Covering the entire area of the dumping horizons they will not only prevent light material from drifting into the air, but also will it be impossible for the birds to reach the dumping ground.

Another technique, which proved to be highly effective at european disposal sites, is the introduction of birds of prey into the site. Various species of birds of prey may be used to control the bird populations at Katina.
As this technique represents a serious impact to the resident bird populations and some legislative constraints (international trade with floral and faunal species : CITES) its application for Katina although strongly recommended, should be prepared by specialists.

In this respect it is recommended, that with the first construction activities monitoring surveys are started. These monitoring activities demand the permanent recording of birds in the site, which should be put into the responsibility of the site management, but also a close collaboration with specialists in Ornithology (Institute of Ecology, University of Sofia. Moreover a close contact to the airfield in Dobroslavtsy for the necessary exchange of information is suggested and in fact represents a essential necessity.

With the begin of the dumping activities the net which covers the dumping horizons should be present. The further development of the bird populations within the site should then be monitored too.

The additional introduction of birds of prey into the site should only be taken into consideration when the control mechanism of the nets fail to be efficient enough and prepared by the ornithologists of the University of Sofia and the Institute of Ecology, Sofia.

## 4.7 Hygienic aspects

### 1) Cleaning facilities

Among the major arrangements for the future disposal site the cleaning facilities for vehicles, that leave the site, is of essential character.
The process of cleaning especially the tires, axles and other outer parts will not only take off the sticky clay - which might possibly be polluted - but also ensures that smaller pieces of solid waste materials will remain within the site.
The necessary facilities should be sufficient enough to clean even the large vehicles and thus prevent the adjacent access roads from being polluted with any material from the disposal site.

### 2) Disinfection facilities

In addition to the cleaning facilities for the outer parts of the vehicles disinfection devices for a periodical cleaning of the inner and outer parts of the vehicles should be provided as well. This disinfection especially aims at the elimination of non pathogenic and human pathogenic bacteria and germs.

## 4.8 Varia

1) Recirculation and combination of water systems

The construction of the disposal site should include the possibility of waters to be recirculated to the dumping horizons. The reuse of leachate waters for example includes two advantages :

I) The decrease of water quantities to be treated
II) The improvement and acceleration of chemical and biological degradation processes within the dumping horizons

A combination of the different watersystems should be taken into consideration, too. This combination does not only enable the quantities of (leachate-)waters to be recirculated to the dumping horizons to be risen, but also may the leachate waters be diluted.

As it is shown in the flowchart (cf. page 55) the waste waters of the vehicle cleaning and disinfection as well as the waste waters from the other facilities, too, might be combined for the discharge.
However the technical solution for this combination should exclude the infiltration of leachate waters into the ground water drainage system.

2) Landslides and earthquake risks

According to geomorphological surveys which have been done for the entire site there is no risk of major land slides within the quarry.
Smaller shallow surface landfalls however temporarily occur along the slopes of the site due to denudation and erosion processes.

Since the KATINA future disposal site is part of the greater SOFIA plain the expected intensity of possible earthquakes is defined to be of degree "IX" (MEDVEDEV-SHPONCHOER-KARNICK Scale). This degree describes earthquakes, whose force is strong enough to destroy the roofs of buildings.
The seismic coefficient ($k_c$) was determined to be 0.27.

3) Strata of self-incending, light coal

The strata of light coal which occur along the slopes of KATINA site have been defined to catch easily fire. As the coal seams do not show open flames the arising smokes at many places within the site originate in fact from gleaming parts of the coal itself.

The fact that neither intense rainfall nor low air temperatures hinder the coal from gleaming gives reasons for the assumption that the carbon and sulfur content of the coal is very high. These circumstances are possibly responsible for katalysatoric enforced chemical reactions, which might have penetrated considerably deep into the coal strata.
The recondensation of elementary, yellow sulfur-crystals around the small funnels in the surface contributes to this assumption.
Prior to any establishment of dumping areas within the site the gleaming parts of these coal strata have to be excavated and sealed in order to eliminate the risk of solid wastes and occurring gases to catch fire.

## 5 Monitoring necessities

To ensure not only a safe operation of the disposal site at KATINA but also to reduce the environmental impacts during the construction phase to a minimum as well as to coordinate the necessary long-term arrangements and control functions several monitoring activities are thought to be obligatory for the establishment and operational stage of the future disposal site.

### 5.1 Constructional stage

The monitoring activities required for the constructional stage are listed in table 4 (see below) :

| Monitoring Activity | Begin / Frequency | Responsibility |
|---|---|---|
| Quality of waters discharged from the inner site area | Begin with the emptying of the inner lake and the temporary pools / once per week | Operating company in collaboration with the National Institute of Hygiene |
| Occurrence of polluted sediments in the discharged waters | Begin with the pumping activities of the inner lake waters / constantly | Operating company in collaboration with the National Institute of Hygiene |
| Establishment and development of statuory tree and bush screen | Begin with the plantations / once per month | Operating company in collaboration with the Institute of Ecology |
| Establishment and development of bird populations within the site | Begin with the construction activities / once per week | Disposal site management authorities in collaboration with the Institute of Ecology and the University of Sofia |

Table 4: Necessary monitoring activities during the constructional stage of the disposal site

## 5.2 Operational stage

Immediately after the dumping activities started several different monitoring activities are thought to be essential for the safe management of the site, all of which are put under the responsibility and supervision of the site management authorities (see table 5 ) and controlled by various official institutions.

| Monitoring Activity | Frequency /Collaboration |
|---|---|
| Recording of amount and types of waste related to their exact position within the dumping area | daily |
| Control of dumping activities in close vicinity to the site | once a week |
| Control of the access roads close to the site as to their pollution with solid waste | once a week |
| Control of water quality :<br>discharged ground water<br>leachate waters<br>waters discharged from treatment facilities | <br>twice a month<br>twice a month<br>twice a month<br>/ National Institute of Hygiene |
| Control of statuory tree and bush screen | once a month<br>/ Institute of Ecology |
| Control of bird populations within the site | frequency depending on the time of year (annual bird migration)<br>/Institute of Ecology |
| Animal and pest control | permanently<br>/National Institute of Hygiene |

Table 5: Necessary monitoring activities during the operational stage of the disposal site

## 6 Additional recommendations

### 6.1 The existing disposal site of Dolni Bogrov

The site of DOLNI BOGROV bears an enormous environmental risk. The uncontrolled disposal of all sort of wastes directly into the water body of a pool and swamp area creates already at present severe ecological problems and risks. The fact that the dumping level still proceeds towards the pools implicate at the same time the progress of higher concentrations of pollutants towards the water areas so far less affected.
The circumstances of the multiple use of the waters at DOLNI BOGROV rises the sensitivity of the entire location to any advancing degradation of the natural conditions. The close vicinity of the LESNOVSKA river to the site, which is a tributary to ISKAR river contributes to the sensitivity of the region towards any environmental impact.

Since it is very likely that the bottom sediments of the pools are highly charged with toxic pollutants (e.g. heavy metals, organic compounds), possible technical solutions for this site should be only evaluated on the base of additional surveys. From the environmental point of view the existing disposal site at DOLNI BOGROV should be closed as rapid as possible. Even after the end of any disposal activity within the site, the enormous environmental risk arising from the deposited materials is expected to remain for the next 2–3 decades.

### 6.2 The existing disposal site of Suhodol

For the existing disposal site of SUHODOL I the situation has to be described as similar to DOLNI BOGROV, yet combined with less severe environmental risks.
Under the detrimental influence of the leachate waters the degradation of nature is complex and has already reached a high level.

The impact on the running waters system of the valley is directly connected to possible health risks for the subordinated watersystems north of the location.
The actual conditions of the disposal site at SUHODOL however include a certain development potential of the site towards an extension of the actual dumping level.

From the environmental point of view, it has to be strongly recommended that prior to any extension further down the valley an adequate safe drainage system for the leachate waters has to be constructed.
Only the prevention of a further contact between leachate waters and local surface waters can exclude the progress of degradation and the increase of health risks.

## 7 Final remarks

The experience from the investigations at the different sites leads to some major considerations :

The development of disposal sites especially those with close contact to natural water bodies can only be based on thorough and sound environmental and technical evaluation of all the important factors and conditions.

The environmental risks and impacts originating from solid waste disposal sites are very complex and intense, especially when aquatic areas are involved.

Ignoring principle guidelines for the establishment of solid waste disposal sites results in a complete and severe degradation of the adjacent terrain often combined with increasing health risks for the local population.

Reparation of degraded and damaged areas and the costs connected herewith exceed the expenditures for initial prevention by a far and often prove to be very complicated or even impossible.

Not only the technical planning of solid waste disposal sites but also its future management will finally decide on the safe operation of the site itself.

The danger of environmental impacts arising from existing disposal sites will not be terminated with the end of the dumping activities. In contrary closed disposal sites proved to represent areas with a high latent risk level.

8. Documentation

8.1 Analytical Tables
8.2 Diagrams
8.3 Figures
8.4 Maps
8.5 Photographs

8.1 Analytical Tables

Species List
(sorted by main taxa, species listed alphabetically)

Abbreviations
Prot. : Status of Protection
blank : no protection
x : protected
xx : Bulgarian Red Data species
xxx : Globally threatened species

\+ : Recorded for the site
– : No record

MYCOTA FUNGI – GABI

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Marasmius oreades | tcheljadinka | + |
| | | | Species total | 1 |

ALGAE ALGAE – VODORASLI
Phytoplankton

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Clamydomonas spp. | | + |
| 2 | | Cyclotella sp. | | + |
| 3 | | Diatoma spp. | | + |
| 4 | | Lepocynclis sp. | | + |
| 5 | | Peridinium sp. | | + |
| 6 | | Phacus pleuronectes | | + |
| 7 | | Scenedesmus acutus | | + |
| 8 | | Trahelomonas hispida | | + |
| 9 | | T. intermedia | | + |
| | | | Species total | 9 |

ALGAE ALGAE – VODORASLI
Phytobenthos

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Bulbochaete sp. st. | | + |
| 2 | | Cylindrospermum sp. | | + |
| 3 | | Oedogonium sp. st. | | + |
| 4 | | O. princeps | | + |
| 5 | | Plectonema sp. | | + |
| 6 | | Spirogyra sp.st. | | + |
| | | | Species total | 6 |

PLANTAE HIGHER PLANTS

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Achillea millefolium | bjal ravnets | + |
| 2 | | Brassica rapa | rapitsa | + |
| 3 | | Chenopodium album | bjala kutcha loboda | + |
| 4 | | Chrysopygon gryllus | techerna sadina | + |
| 5 | | Convolvulus arvensis | polska povetitsa | + |
| 6 | | Crataegus monogyna | glog | + |
| 7 | | Dactilylis glomerata | sborna glavitsa | + |
| 8 | | Equisetum palustre | hvoscht | + |
| 9 | | Erodium cicutarium | tchasovnitche | + |
| 10 | | E. cyparissias | mletchka | + |
| 11 | | Festuca pseudovina | lazhevlasatka | + |
| 12 | | Fleum pratense | livadna timoteika | + |
| 13 | | Filipendula hexapetala | livadno oretche | + |
| 14 | | Lemna minor | vodna leschta | + |
| 15 | | Matricaria chamomilla | laikutchka | + |
| 16 | | Myriophyllum spicatum | chiljadolistnik | + |
| 17 | | Phragmites australis | trastika | + |
| 18 | | Polygonum hydropiper | vodno piperitche | + |
| 19 | | Rosa canina | shipka | + |
| 20 | | Salix alba | bjala varba | + |
| 21 | | S.caprea | iva | + |
| 22 | | Sambucus ebulus | baz | + |
| 23 | | Tussilago farfara | podbel | + |
| 24 | | Typha angustifolia | tesnolisten papur | + |
| 25 | | T. pectinatus | | + |
| 26 | | Verbascum foeniceum | lopen | + |
| | | | Species total | 26 |

ANIMALIA ANIMALS
Insecta Insects – Nasekomi

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Apis melifera | domashna ptchela | + |
| 2 | | Erebia medusa | kadifjana medusa | + |
| 3 | | Formica ssp. | | + |
| 4 | | Ischnura imperator | | + |
| 5 | | Libellula depressa | | + |
| 6 | | Tettigonia viridissima | Obiknoven zelen skakalets | + |
| | | | Species total | 6 |

ANIMALIA
Pisces

ANIMALS
Fish – Ribi

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Alburnus alburnus | uklej | + |
| 2 | | Carassius carassius | karakuda | + |
| 3 | | Cyprinus carpio | div sharan | + |
| 4 | | Esox lucius | schtuka | + |
| 5 | | Gobio gobio | krotushka | + |
| 6 | | Perca fluviatilis | kostur | + |
| | | | Species total | 6 |

ANIMALIA
Amphibia

ANIMALS
Amphibs – Zemnovodni

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Rana radibunda | obiknovena vodna zhaba | + |
| | | | Species total | 1 |

ANIMALIA
Reptilia

ANIMALS
Reptils – Vletchugi

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | *** | Elaphe longissima | smok–mishkar | + |
| | | | Species total | 1 |

ANIMALIA
Aves

ANIMALS
Birds – Ptitsi

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | * | Acrocephalus arundinaceus | trastikovo shavartche | + |
| 2 | * | Ardea cinerea | siva tchalpa | + |
| 3 | ** | A. purpurea | tchervena tchalpa | + |
| 4 | * | Buteo buteo | obiknoven mischelov | + |
| 5 | * | Ciconia ciconia | bjal schturkel | + |
| 6 | * | Cuculus canorus | obiknovena kukuvitsa | + |
| 7 | * | Delichon urbica | gradska ljastovitsa | + |
| 8 | * | Emberiza calandra | siva ovesarka | + |
| 9 | * | E. hortulana | gradinska ovesarka | + |
| 10 | * | Erithacus megarynchos | juzhen slavei | + |
| 11 | | | | |
| 12 | * | Hirundo rustica | selska ljastovitsa | + |
| 13 | * | Ixobrychus minutus | malak voden bik | + |
| 14 | * | Merops apiaster | ptechelojad | + |
| 15 | * | Motacilla alba | bjala startchiopashka | + |
| 16 | * | Oenanthe oenanthe | sivo kamenartche | + |

AVES, BIRDS, contin'd

| | | | | |
|---|---|---|---|---|
| 17 | | Passer domesticus | domashno vrabtche | + |
| 18 | | P. montanus | polsko vrabtche | + |
| 19 | | Pica pica | svraka | + |
| 20 | | Streptopelia turtur | obiknovena gurgulitsa | + |
| | | | Species total | 20 |

ANIMALIA — ANIMALS
Zooplankton
Crustacea — Cancers

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Cyclops strenus | | + |
| 2 | | C. sp. | | + |
| 3 | | Eudiaptomus vulgaris | | + |
| 4 | | Mesocyclops sp. | | + |
| 5 | | Div. nauplii | | + |
| | | | Species total | 5 |

ANIMALIA — ANIMALS
Zooplankton
Rotatoria — Rotifers

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Brachionus calyciflorus | | + |
| 2 | | Synchaeta sp. | | + |
| | | | Species total | 2 |

ANIMALIA — ANIMALS
Zoobenthos
Oligochaeta — Worms

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Limnodrilus udekemianus | | + |
| 2 | | Naididae g. sp. various | | + |
| 3 | | Tubifex tubifex | | + |
| | | | Species total | 3 |

ANIMALIA — ANIMALS

Zoobenthos

Insecta — Insects – Nasekomi

| No | Prot. | Scientific Name / Taxon | Bulgarian Name | Rec |
|---|---|---|---|---|
| 1 | | Chironomus plumosus | | + |
| 2 | | Gryptochironomus defectus | | + |
| | | | Species total | 2 |

ANALYTICAL TABLES

Specification :
Surface waters, various locations
Site : Katina
Sampling Date : 27.07.1993

| No. | Parameter/Unit | Lake 1 | Pool 1 | Pool 2 | Lake 2 | Ka.Riv. |
|---|---|---|---|---|---|---|
| 1 | Temperature Air/ °C | 30 | 30 | 30 | 30 | 0 |
| 2 | Temperature Water/ °C | 20 | 21 | 21 | 20 | 21 |
| 3 | Turbidity Water/ mg/l | 8.3 | 9.6 | 12.4 | 5.6 | 7.3 |
| 4 | Conductivity/ µS/cm | 3570 | 10640 | 13160 | 770 | 1020 |
| 5 | pH/ ./. | 8.12 | 7.28 | 7.4 | 8.18 | 7.54 |
| 6 | COD/ mg/l | 51.2 | 368 | 268 | 19.8 | 20.5 |
| 7 | Sulfate/ mg/l | 2337.7 | 3338.5 | 266.6 | 217.3 | 313.6 |
| 8 | Chlorine/ mg/l | 354.5 | 9424 | 14535 | 30.2 | 36.5 |
| 9 | Ammonia/ mg/l | 0.1 | 10 | 60 | 0.05 | 0.3 |
| 10 | Arsenic/ ppm | 0.006 | ND | ND | 0.004 | 0.012 |
| 11 | Calcium/ ppm | 651.3 | 1432.9 | 1472.9 | 80.16 | 125.25 |
| 12 | Copper/ ppm | 0.005 | ND | ND | 0.008 | 0.022 |
| 13 | Iron/ ppm | 0.04 | 0.65 | 0.13 | 0.04 | 0.05 |
| 14 | Lead/ ppm | 0 | ND | ND | 0.022 | 0 |
| 15 | Manganese/ ppm | 0.06 | 0 | 0 | 0.06 | 0.5 |
| 16 | Magnesium/ ppm | 231 | 705.3 | 395.2 | 34.05 | 42.56 |
| 17 | Sodium/ mg/l | 207 | 4873 | 7055 | 24 | 46 |
| 18 | Zinc/ ppm | 0.04 | ND | ND | 0.08 | 0.07 |

Abbreviations ND : No determination
Sample position Lake 1 : Inner lake
Lake 2 : Outer lake
Pool 1 : Small pool within site
Pool 2 : Small pool within site
Ka.Riv.: Katinska River

ANALYTICAL TABLES

Specification :
Surface waters, various locations
Site : Katina
Sampling Date : 06.12.1993

| No. | Parameter/Unit | Lake 1 | Pool 1 | Ka.Riv. |
|---|---|---|---|---|
| 1 | Temperature Air/ °C | 0 | -1 | 0 |
| 2 | Temperature Water/ °C | -1 | 0 | 1.5 |
| 3 | Turbidity Water/ mg/l | 2.6 | 4.9 | 0.4 |
| 4 | Conductivity/ µS/cm | 3985 | 8200 | 1230 |
| 5 | pH/ ./. | 7.86 | 6.48 | 7.92 |
| 6 | COD/ mg/l | 41.5 | 67.9 | 8.6 |
| 7 | Sulfate/ mg/l | 1556.8 | 2336.8 | 467.8 |
| 8 | Chlorine/ mg/l | 691.5 | 2351.1 | 72.8 |
| 9 | Arsenic/ ppm | 0.0019 | 0.048 | 0.0007 |
| 10 | Calcium/ ppm | 668 | 924 | 196 |
| 11 | Copper/ ppm | 0.02 | 0.003 | 0.01 |
| 12 | Iron/ ppm | 0.01 | 3.7 | 0.02 |
| 13 | Lead/ ppm | 0.005 | 0.006 | 0.005 |
| 14 | Manganese/ ppm | 1.4 | 13.2 | 0.5 |
| 15 | Magnesium/ ppm | 188 | 280 | 54 |
| 16 | Mercury/ ppm | 0.00049 | 0.002 | 0.00049 |
| 17 | Sodium/ ppm | 112 | 362 | 24 |
| 18 | Zinc/ ppm | 0.01 | 0.08 | 0.03 |

Abbreviations ND : No determination
Sample position Lake 1 : Inner lake
Pool 1 : Small pool within site
Ka.Riv.: Katinska River

ANALYTICAL TABLES

Specification :
Water from boreholes near inner lake
Site : Katina
Sampling Date : 27.07.1993

| No. | Parameter/Unit | Pos.C3 | Pos.C4 | Pos.C5 | Pos.C9 | Pos.C10 |
|---|---|---|---|---|---|---|
| 1 | Temperature Air/ °C | 30 | 30 | 30 | 30 | 0 |
| 2 | Temperature Water/ °C | 14 | 15 | 15.5 | 15.5 | 15 |
| 3 | Turbidity Water/ mg/l | 11.5 | 6.3 | 5.8 | 5 | 1.5 |
| 4 | Conductivity/ µS/cm | 10200 | 1370 | 2380 | 2940 | 1430 |
| 5 | pH/ ./. | 6.03 | 7.1 | 7.3 | 6.1 | 7.25 |
| 6 | COD/ mg/l | 54.4 | 56 | 56.7 | 108 | 8.2 |
| 7 | Sulfate/ mg/l | 1400.7 | 299.6 | 811.5 | 1690.5 | 330.9 |
| 8 | Chlorine/ mg/l | 6204.3 | 30.2 | 120.5 | 113.5 | 31.9 |
| 9 | Ammonia/ mg/l | 30 | 8 | 18 | 1.2 | 1.4 |
| 10 | Arsenic/ ppm | ND | 0.01 | ND | ND | ND |
| 11 | Calcium/ ppm | 1402.8 | 190.4 | 288.6 | 581.2 | 200.4 |
| 12 | Copper/ ppm | ND | 0.016 | ND | ND | ND |
| 13 | Iron/ ppm | 0.6 | 0.08 | 0.06 | 10.5 | 0.05 |
| 14 | Lead/ ppm | ND | 0.007 | ND | ND | ND |
| 15 | Manganese/ ppm | 0 | 0.22 | 1.65 | 0 | 1.1 |
| 16 | Magnesium/ ppm | 42.56 | 55.9 | 104.6 | 164.2 | 74.2 |
| 17 | Sodium/ ppm | 2353 | 73 | 188 | 52 | 31 |
| 18 | Zinc/ ppm | ND | 0.08 | ND | ND | ND |

Abbreviations ND : No determination
Borehole position C3 : Southern shore of inner lake
C4 : Northern flanks within site
C5 : Southern flanks within site
C9 : Southern flanks near road to Katina
C10: Near road to Katina

ANALYTICAL TABLES

Specification :
Inner Lake, Water
Site : Katina
Sampling Date : 06.01.1994

| No. | Parameter | Unit | Pos. 1 | Pos. 2 | Pos. 3 | Pos. 4 | Pos. 5 |
|---|---|---|---|---|---|---|---|
| 1 | Time of sampling | -/- | 11.25 | 11.42 | 12.04 | 12.25 | 12.45 |
| 2 | Water depth | m | 0 | 3 | 8 | 16.1 | 18 |
| | ANORGANIC PARAMETERS | | | | | | |
| 3 | Sulfate | mg/l | 1556.8 | 1723.8 | 2405 | 2259.4 | 2323.5 |
| | ORGANIC PARAMETERS | | | | | | |
| 4 | Extr.substances C-Cl4 | mg/l | ND | ND | 0.8 | 1.2 | 2 |
| 5 | Extr.substances Chlorophorm | mg/l | 2.8 | ND | 4.4 | 1.6 | 2 |
| 6 | Phenol (Alkyl-) | mg/l | 0.05 | 0.02 | 0.53 | 0.29 | 0.029 |
| | METALS | | | | | | |
| 7 | Arsenic | mg/l | 0.0019 | 0.0024 | 0.0032 | 0.0035 | 0.0035 |
| 8 | Cadmium | mg/l | 0.001 | 0.003 | 0.001 | 0.003 | 0.006 |
| 9 | Chromium, total | mg/l | 0.012 | 0.013 | 0.013 | 0.015 | 0.02 |
| 10 | Cobalt | mg/l | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 |
| 11 | Copper | mg/l | 0.02 | 0.015 | 0.03 | 0.03 | 0.06 |
| 12 | Cyanide | mg/l | ND | ND | 0.029 | 0.024 | 0.03 |
| 13 | Iron | mg/l | 0.01 | 0.04 | 0.2 | 0.51 | 2.99 |
| 14 | Lead | mg/l | 0.005 | 0.006 | 0.008 | 0.008 | 0.01 |
| 15 | Manganese | mg/l | 1.4 | 1.49 | 0.95 | 0.99 | 1.24 |
| 16 | Mercury | mg/l | 0.0005 | 0.001 | 0.0005 | 0.001 | 0.001 |
| 17 | Nickel | mg/l | 0.001 | 0.002 | 0.002 | 0.002 | 0.004 |
| 18 | Zinc | mg/l | 0.01 | 0.05 | 0.08 | 0.14 | 0.51 |

Abbreviations: ND : No determination
C-Cl4 : Carbon-Tetrachloride

ANALYTICAL TABLES

Specification :
Inner Lake, Sediment
Site : Katina
Sampling Date : 06.01.1994

| No. | Parameter | Unit | Pos. 1 |
|---|---|---|---|
| 1 | Time of sampling | -/- | 12.35 |
| 2 | Water depth | m | 18 |
| | ANORGANIC PARAMETERS | | |
| 3 | Sulfate | mg/kg | ND |
| | ORGANIC PARAMETERS | | |
| 4 | Extr.substances C-Cl4 | mg/kg | ND |
| 5 | Extr.substances Chlorophorm | mg/kg | ND |
| 6 | Phenol (Alkyl-) | mg/kg | ND |
| | METALS | | |
| 7 | Arsenic | mg/kg | 19.4 |
| 8 | Cadmium | mg/kg | 0.25 |
| 9 | Chromium, total | mg/kg | 9.3 |
| 10 | Cobalt | mg/kg | 10.3 |
| 11 | Copper | mg/kg | 78 |
| 12 | Cyanide | mg/kg | ND |
| 13 | Iron | mg/kg | ND |
| 14 | Lead | mg/kg | 67.5 |
| 15 | Manganese | mg/kg | 1320 |
| 16 | Mercury | mg/kg | 0.67 |
| 17 | Nickel | mg/kg | 35 |
| 18 | Zinc | mg/kg | 713 |

Abbreviations: ND : No determination
C-Cl4 : Carbon-Tetrachloride

ANALYTICAL Tables

Specification :
Winddirection - Windvelocity
Site : Katina
Recording Date : July, 1993
Parameter : Compass direction/ velocity as (m/sec)

| Day | Time | Position west | Position east |
|---|---|---|---|
| 12.7 | 9.15 | N/1.0 | NW/1.5 |
| 12.7 | 14.15 | N/4.0 | SE/6.0 |
| 13.7 | 9.15 | -/- | -/- |
| 13.7 | 19.15 | NE/2.0 | SE/4.5 |
| 14.7 | 9.15 | -/- | -/- |
| 14.7 | 14.15 | -/- | -/- |
| 15.7 | 14.15 | -/- | -/- |
| 15.7 | 19.15 | -/- | -/- |
| 16.7 | 9.15 | S/2.5 | S/2.5 |
| 20.7 | 19.15 | -/- | -/- |

For recording positions see map, chapter 8.4

ANALYTICAL TABLES

Specification :
Traffic - Noise
Site : Katina
Recording Date : July 1993
Parameter : Number of vehicels per recording position
Equivalent traffic noise given as dB(A)

| | Position 1 | | Position 2 | |
|---|---|---|---|---|
| Time | Vehicles | Noise | Vehicles | Noise |
| 6.15 | 22 | 50.2 | 21 | 49.6 |
| 7.15 | 87 | 53.5 | 93 | 54.3 |
| 8.15 | 136 | 58.3 | 129 | 58.9 |
| 9.15 | 139 | 59.7 | 134 | 60.5 |
| 10.15 | 122 | 61.4 | 121 | 62.3 |
| 11.15 | 148 | 63.8 | 130 | 61.2 |
| 12.15 | 146 | 60.1 | 130 | 58.3 |
| 13.15 | 112 | 62.2 | 109 | 59.7 |
| 14.15 | 98 | 61.2 | 107 | 58.8 |
| 15.15 | 135 | 62.4 | 119 | 60.2 |
| 16.15 | 137 | 61.7 | 131 | 60.9 |
| 17.15 | 144 | 60.1 | 138 | 61.5 |
| 18.15 | 168 | 59.3 | 163 | 60.4 |
| 19.15 | 114 | 58.4 | 113 | 59 |
| 20.15 | 99 | 55.5 | 95 | 57.9 |
| 21.15 | 75 | 50.2 | 75 | 53.3 |
| 22.15 | 35 | 47.3 | 40 | 48.6 |
| 23.15 | 13 | 38 | 7 | 39.4 |

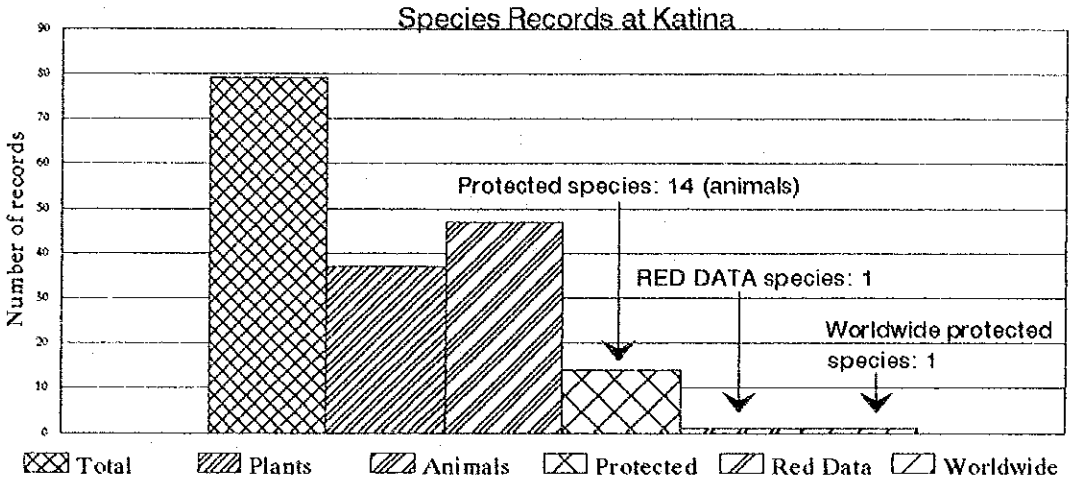
Recording positions :
Position 1 : Katina : Main road to Katina, near power station
Position 2 : Katina : Main road to Katina, near pig-farm

| Family, Species | Bulgarian Name |
|---|---|
| POACEAE | |
| Agrostis capillaris | obiknovena povetitsa |
| Alopecurus pratensis | livadna klasitsa |
| Dactylis glomerata | ezhova glavitsa |
| Festuca pseudovina | lazhevlasatka |
| Holcus lanatus | valnesta medovina |
| BETULACEAE | |
| Betula pendula | byala breza |
| Populus tremula | trepetlika |
| FAGACEAE | |
| Quercus cerris | tser |
| Quercus frainetto | blagun |
| PAEONIACEAE | |
| Clematis integrifolia | povet |
| ROSACEAE | |
| Crataegus monogyna | glog |
| Prunus spinosa | tranka |
| Prunus divaricata | dzanka |
| Rosa canina | shipka |
| Rubus idaeus | kapina |
| Sorbus torminalis | brekinya |
| CAPRIFOLIACEAE | |
| Sambucus ebulus | trevist baz |
| Sambucus nigra | cheren baz |
| Viburnum lantana | kalina |
| CORNACEAE | |
| Cornus mas | dryan |
| FABACEAE | |
| Albizza julibrissin | albizzia |
| Gledisia triacantthos | gleditsia |
| Laburnum anagyroides | zlaten dazhd |
| Amorpha fructicosa | cherna akatsia |
| Wisteria sinensis | glitsinia |
| Robinia pseudoacia | byala akatsia |

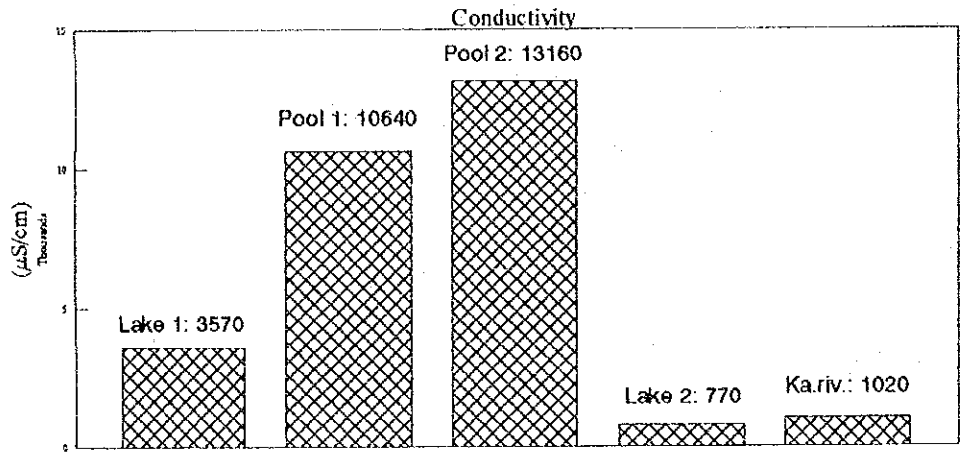
List of plant species suitable for the plantation of the tree and bush screen around Katina future disposal site

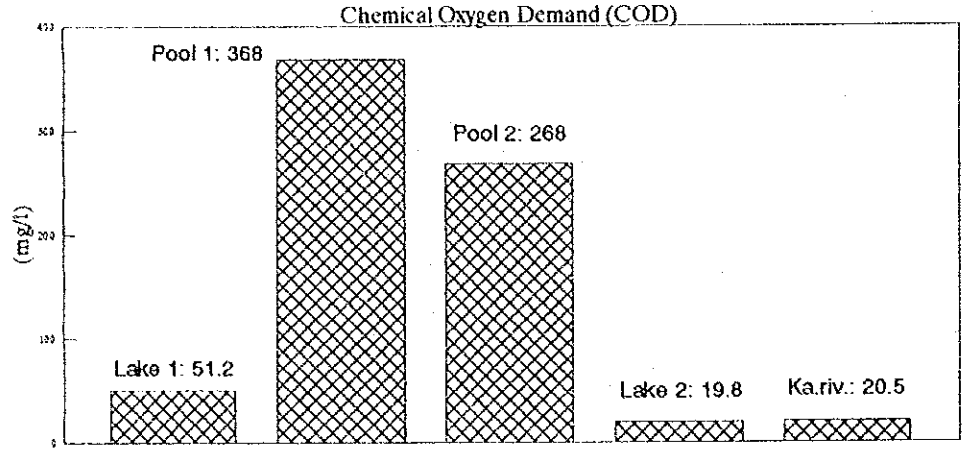
8.2 Diagrams

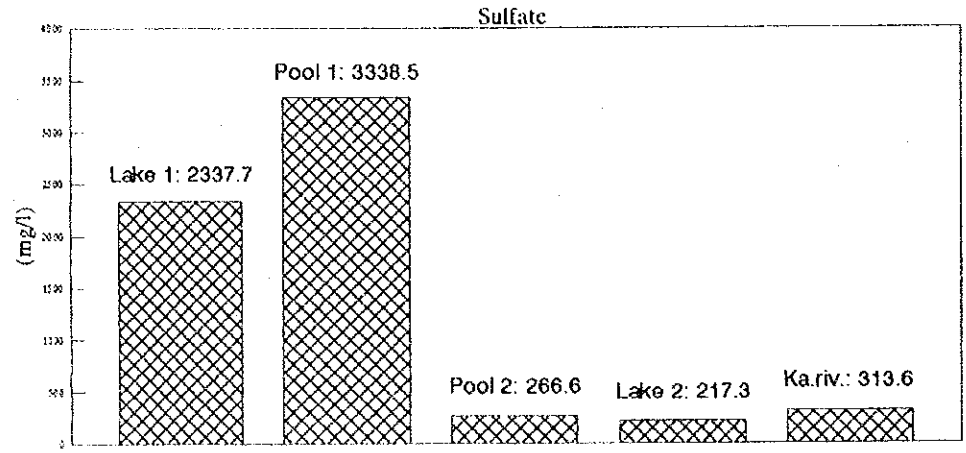
Species – Records KATINA 01



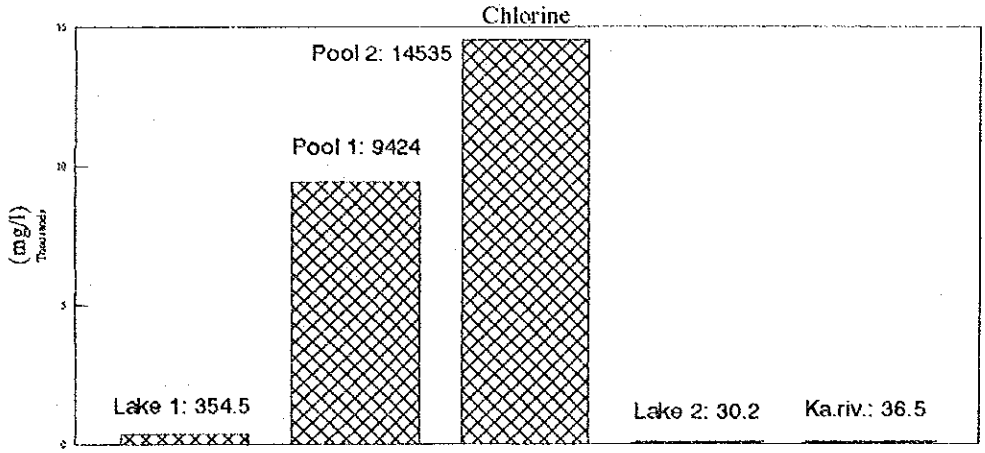
Comparison of surface waters at Katina
(Summerperiod)
Lake 1 : Lake within Katina site Ka.riv. : Katinska River
Pool 1 : Small pool within Katina site
Pool 2 : Small pool within Katina site
Lake 2 : Lake outside Katina site

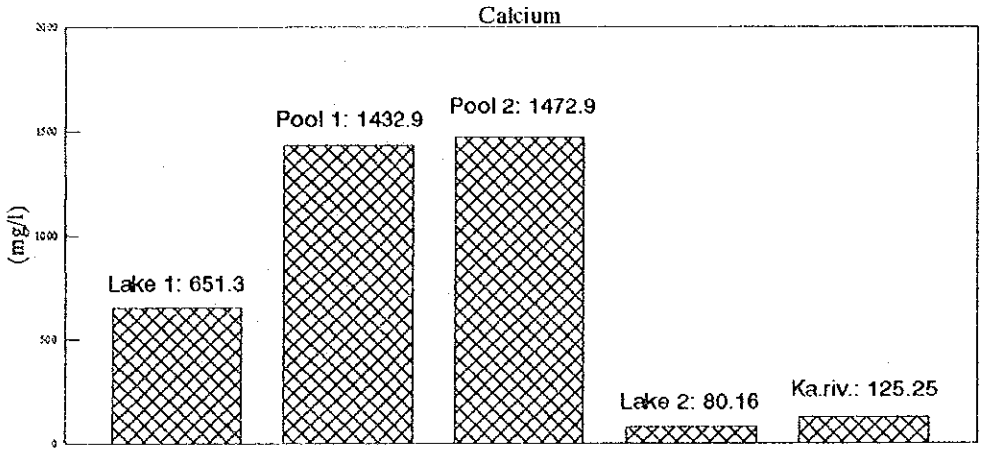


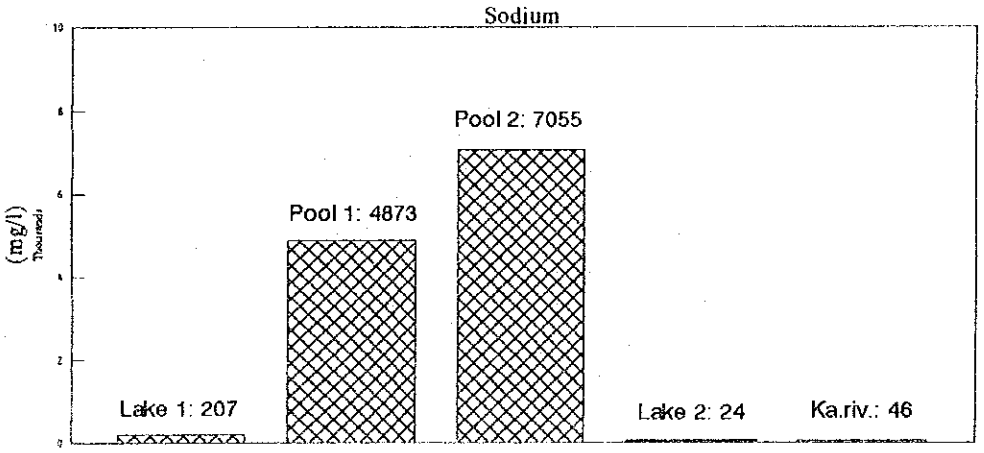



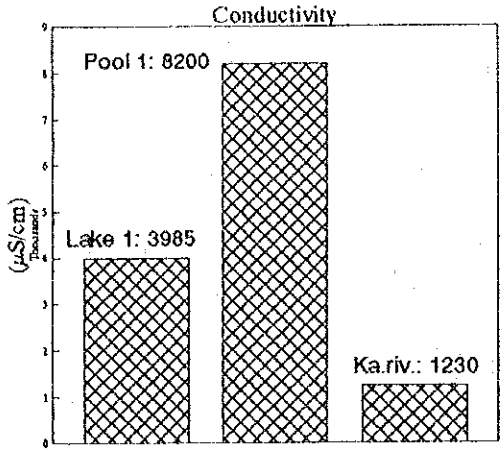
Comparison of surface waters at Katina
(Summerperiod)
Lake 1 : Lake within Katina site Ka.riv. : Katinska River
Pool 1 : Small pool within Katina site
Pool 2 : Small pool within Katina site
Lake 2 : Lake outside Katina site

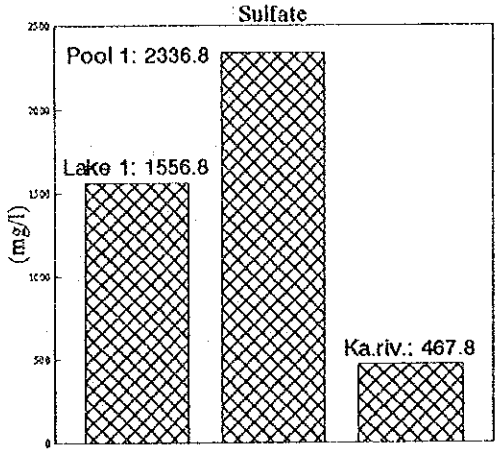


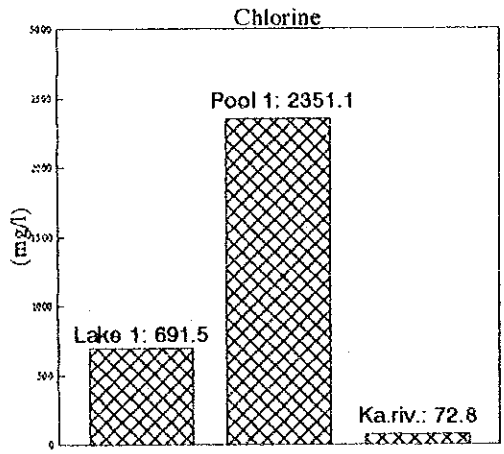



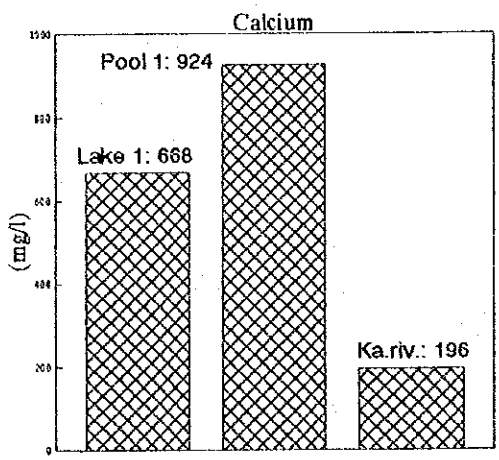



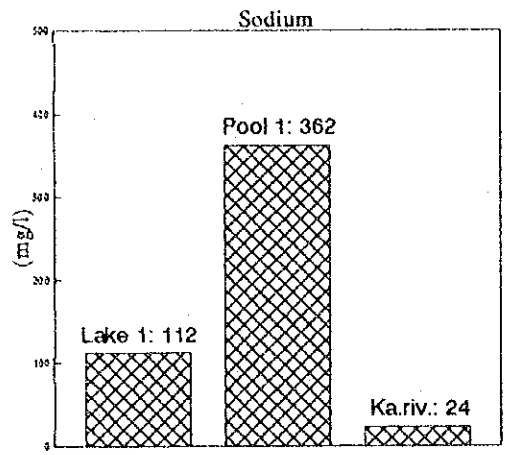
Comparison of surface waters at Katina
(Winterperiod)
Lake 1 : Lake within Katina site Ka.riv. : Katinska River
Pool 1 : Small pool within Katina site

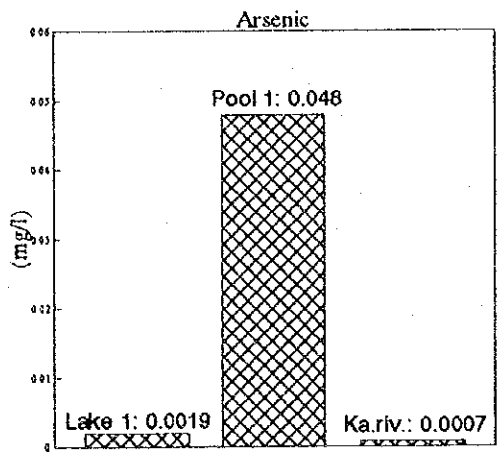


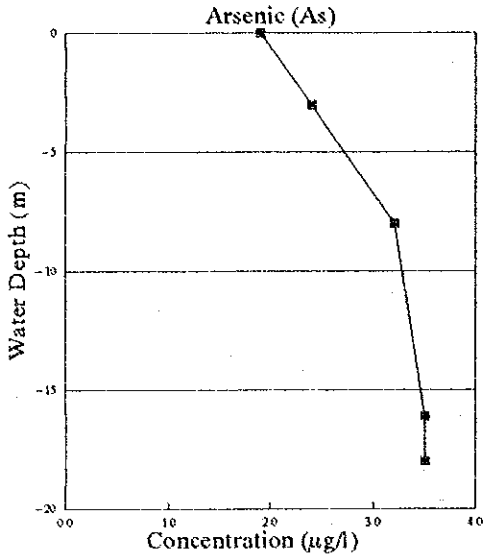



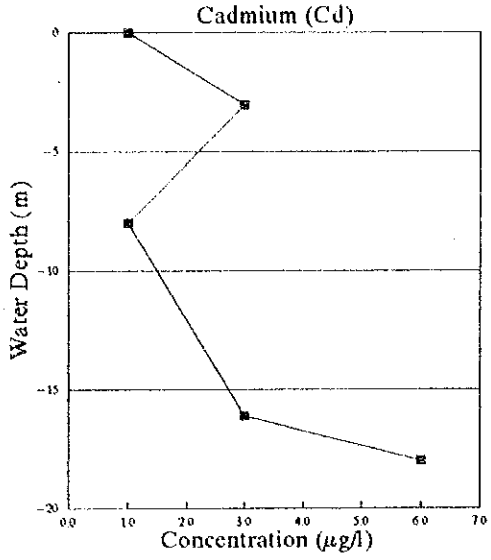



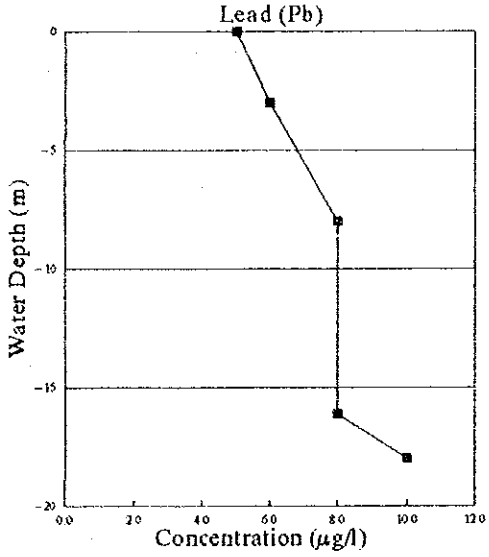



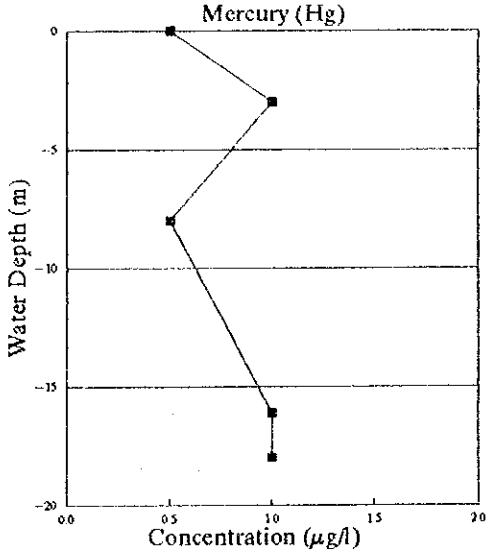



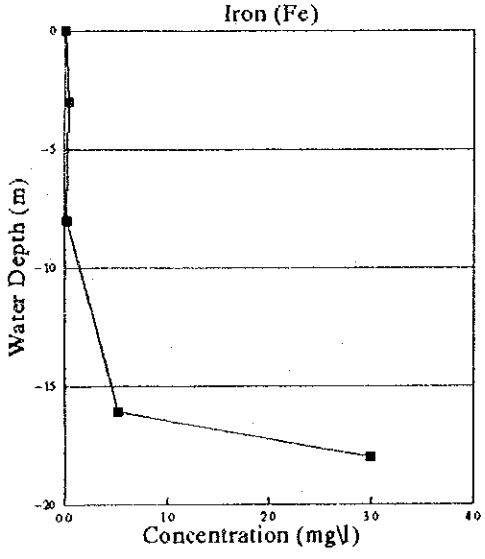
## Distribution of pollutants in the inner Lake of Katina
## Metals : Data from Water analysis

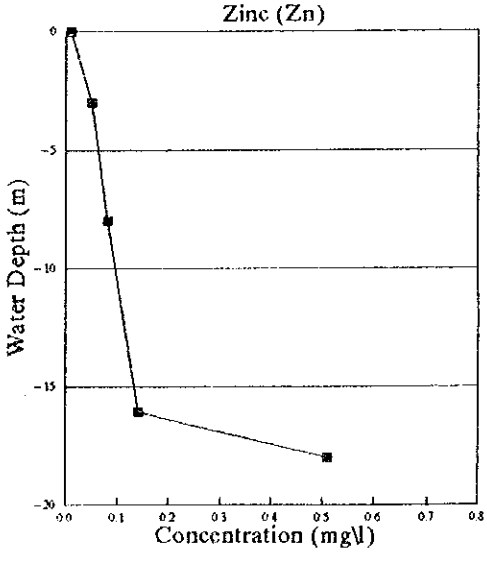


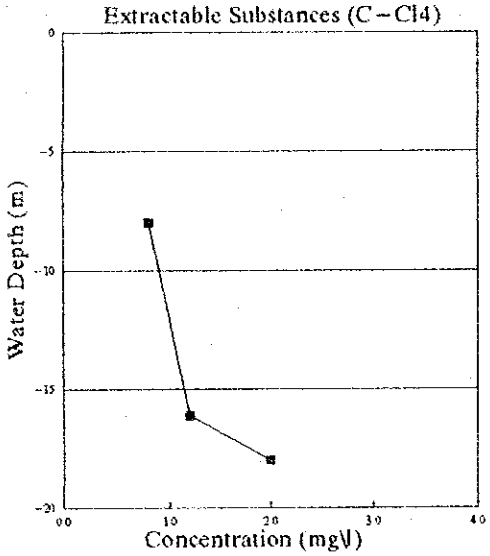



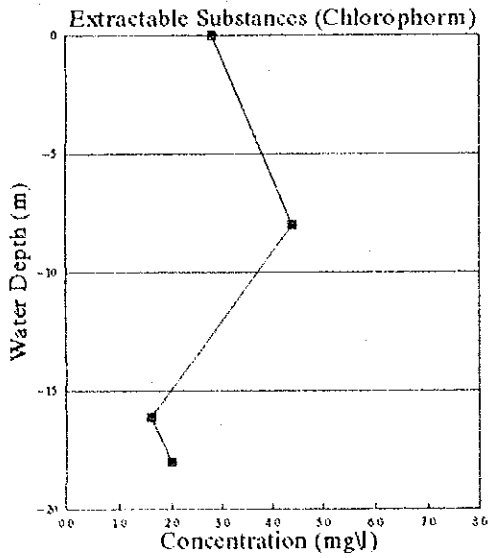



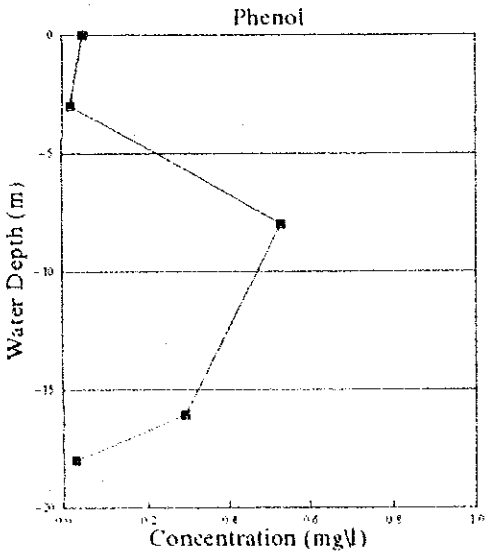



## Distribution of pollutants in the inner Lake of Katina
## Organic compounds : Data from Water analysis

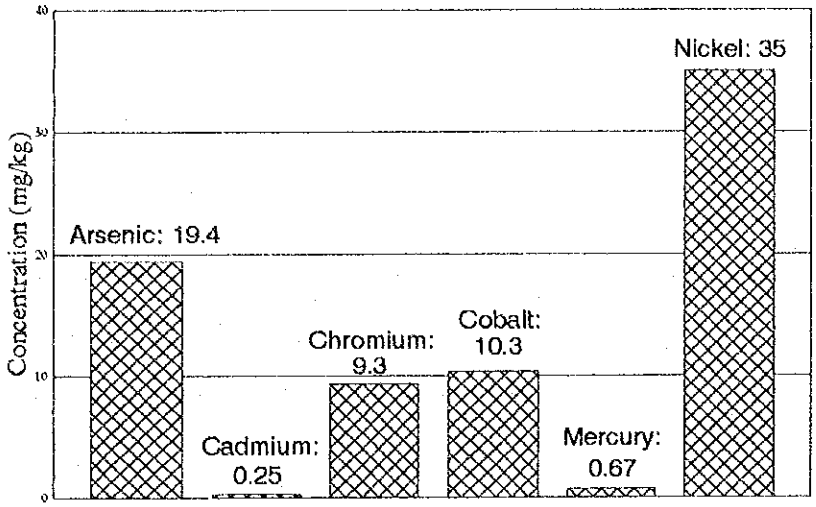


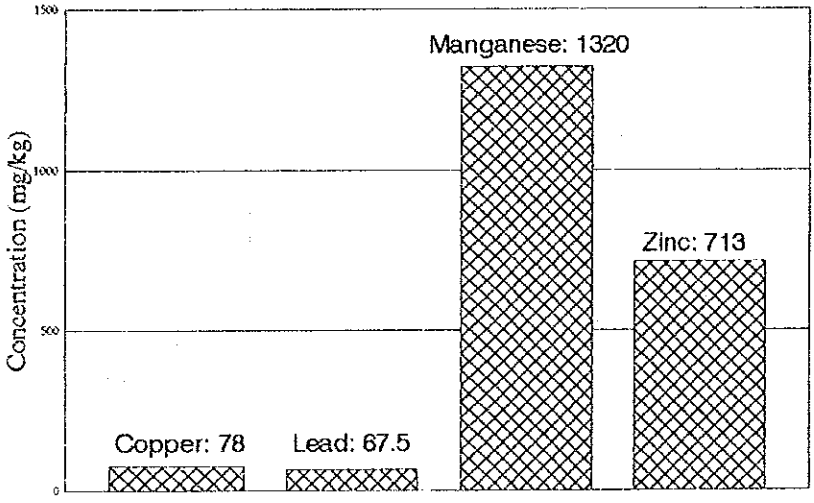



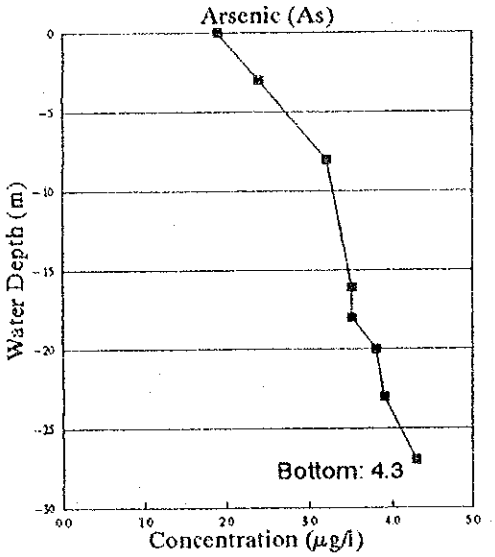
Distribution of pollutants in the inner lake of Katina

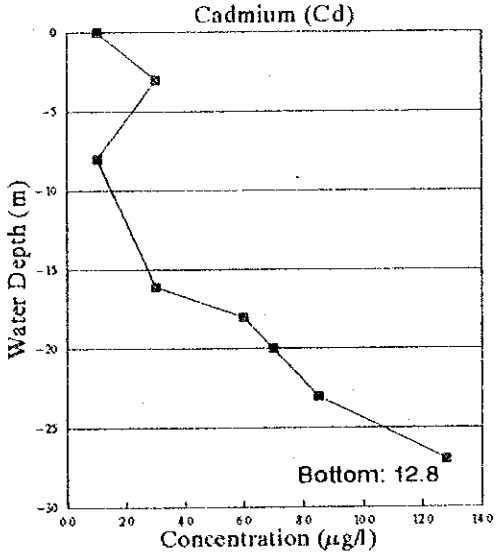
Concentration of metals in sediments, 18m depth

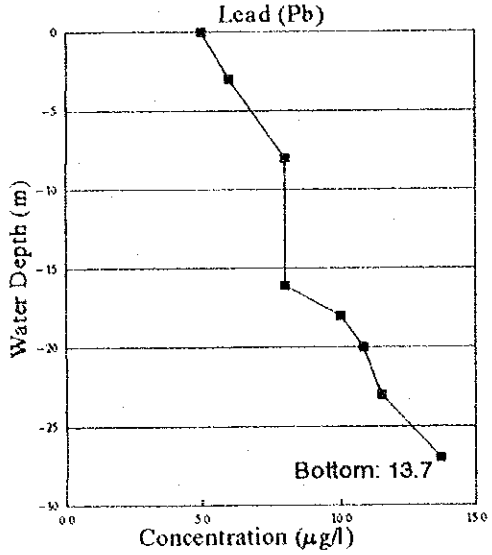


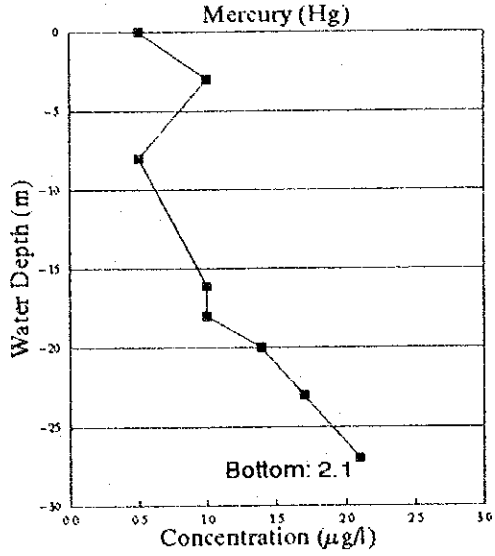



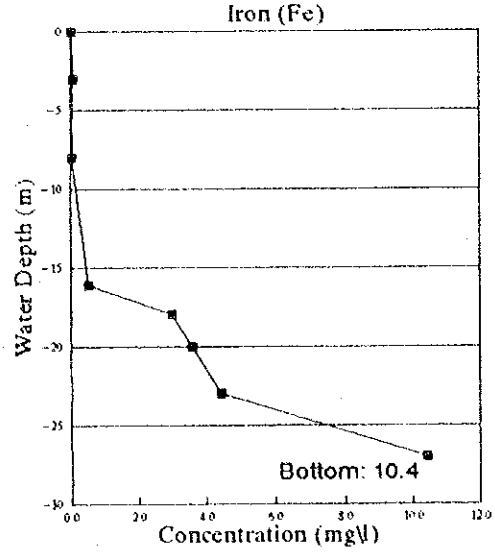
Distribution of pollutants in the Inner Lake of Katina
Metals : Predicted concentrations in the water at the lake bottom, 27m depth

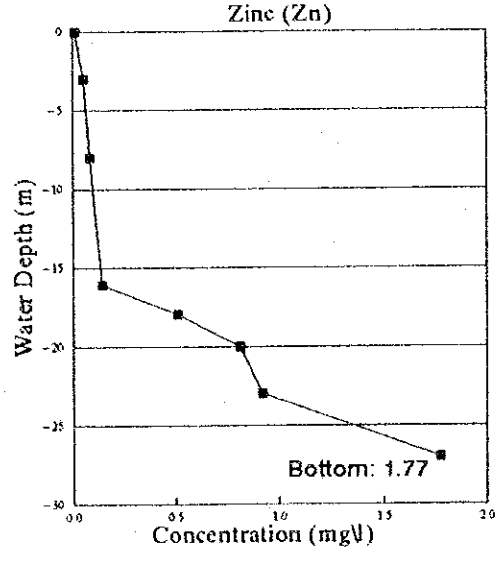


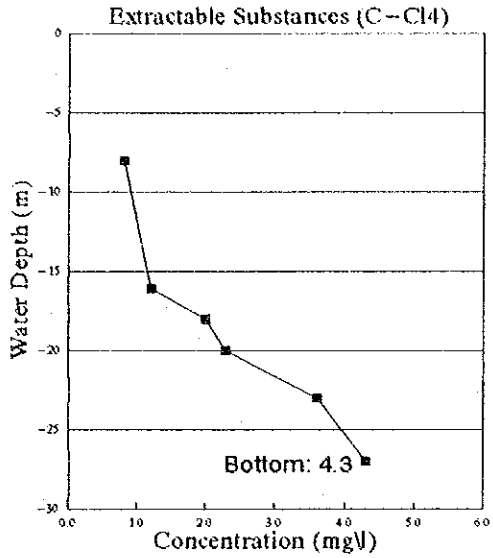



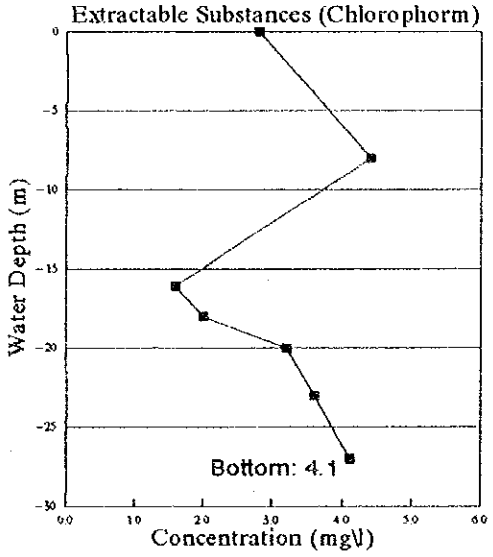



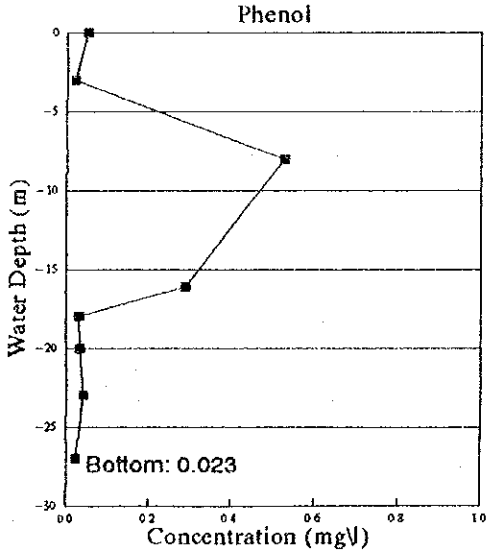



Distribution of pollutants in the inner Lake of Katina
Organic compounds : Predicted concentrations in the water
at the lake bottom, 27m depth

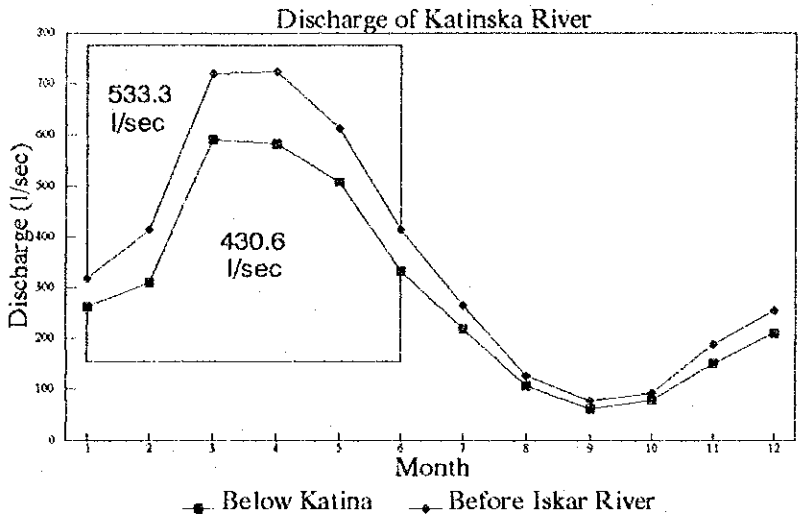


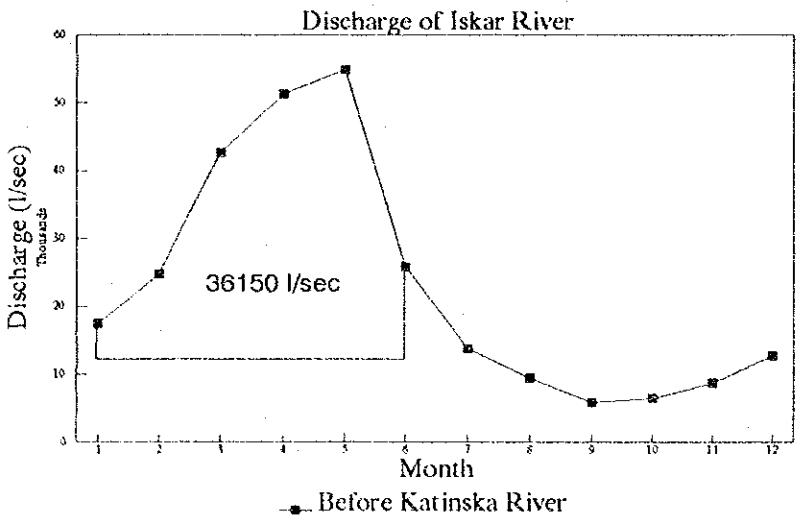



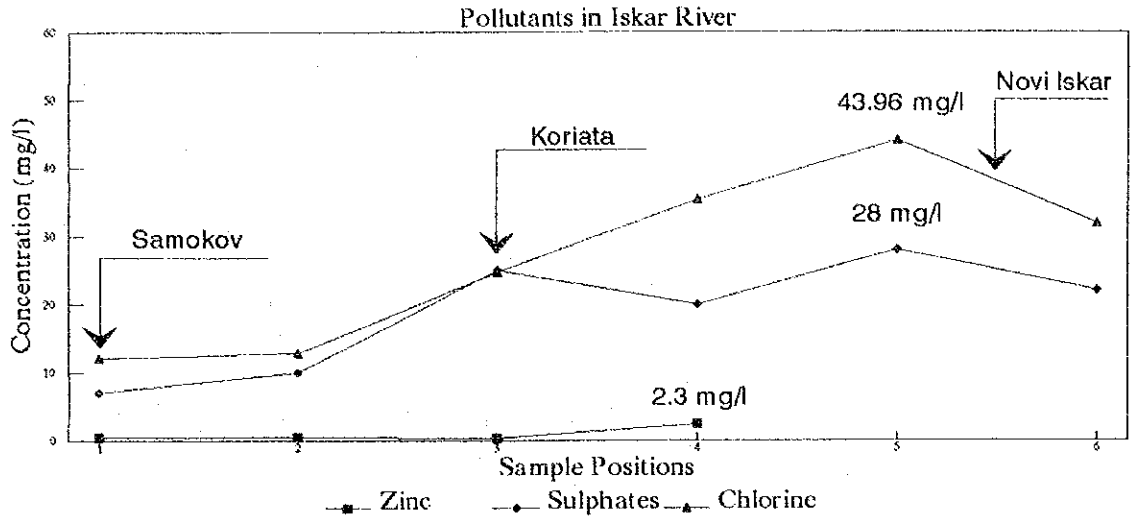
Discharge of Rivers in the Katina region

(Figures in the graph refer to the mean discharge during the months January to June)

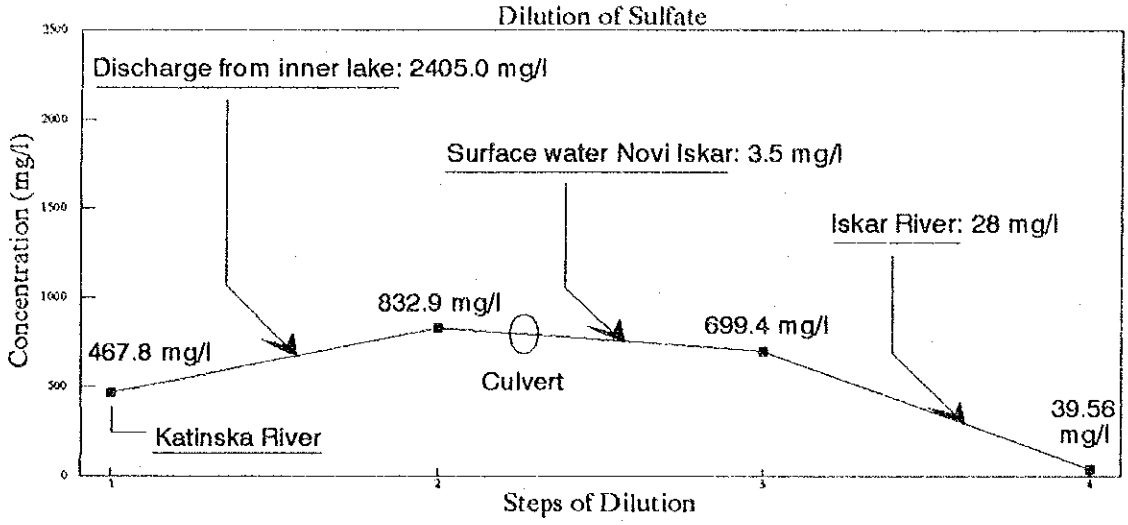


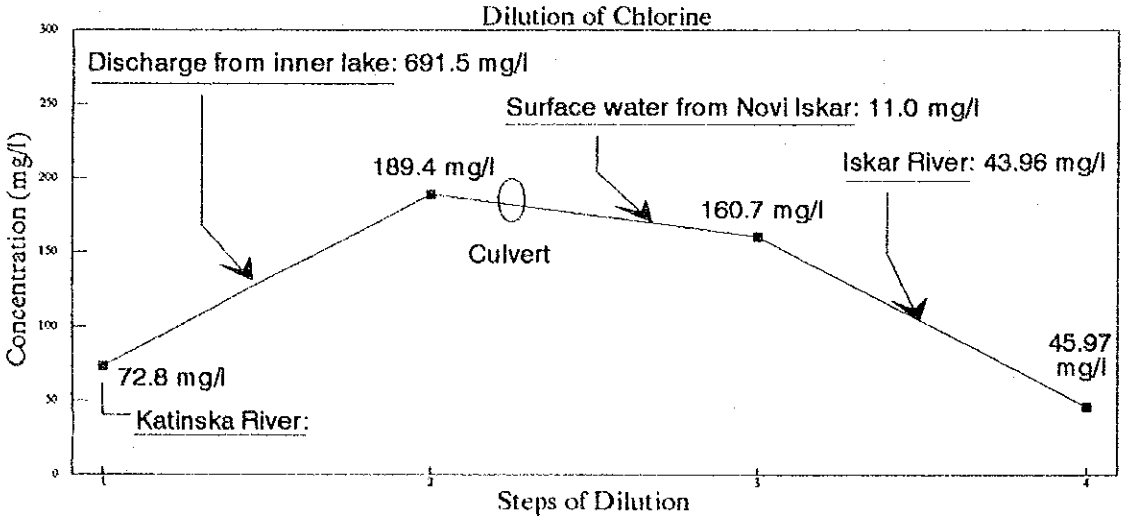



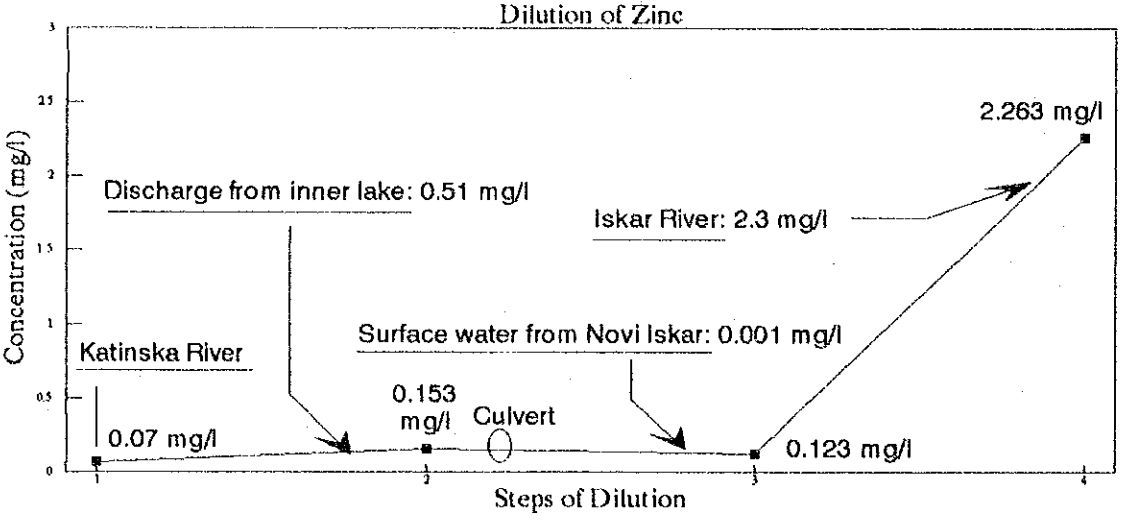
Concentrations of Pollutants in Iskar River at various sample positions : Sulphates, Chlorine and Zinc



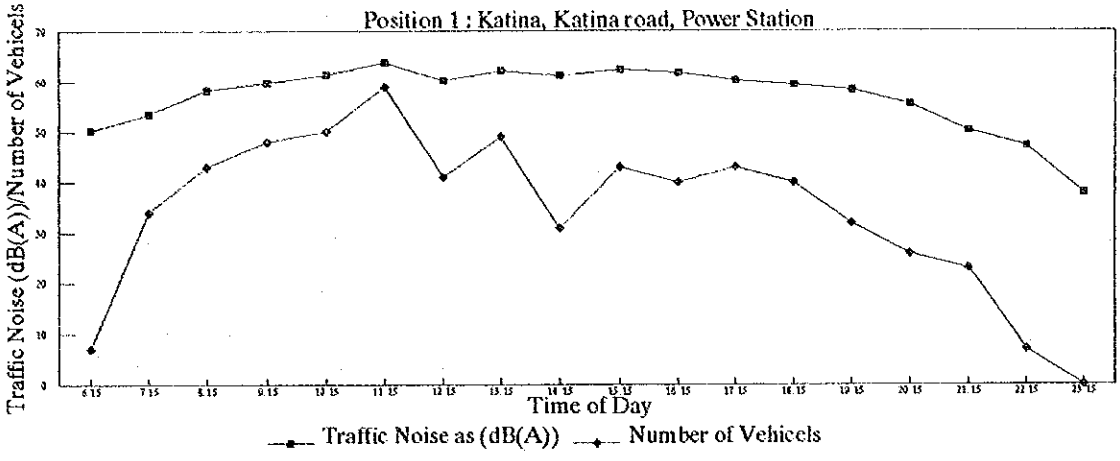
## Dilution Steps for Water discharged from Katina future Disposal Site

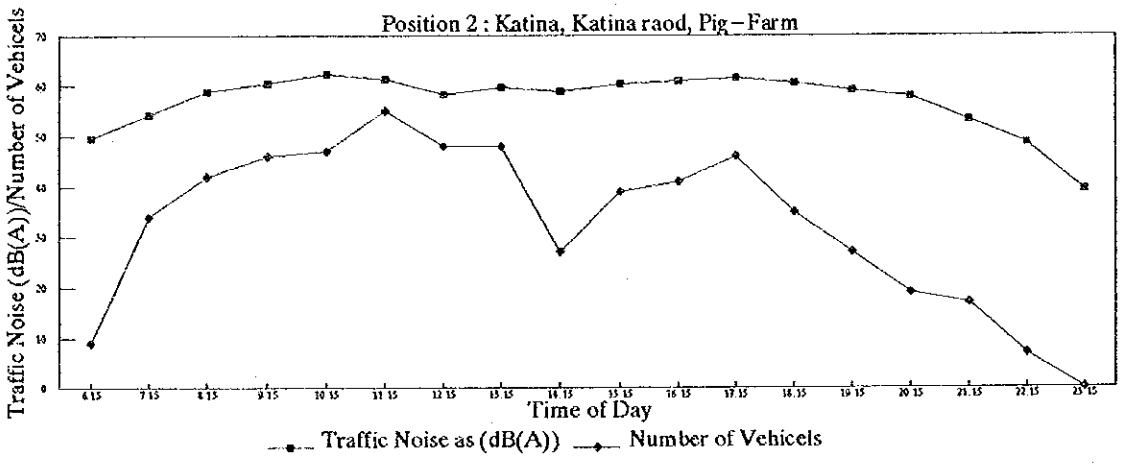


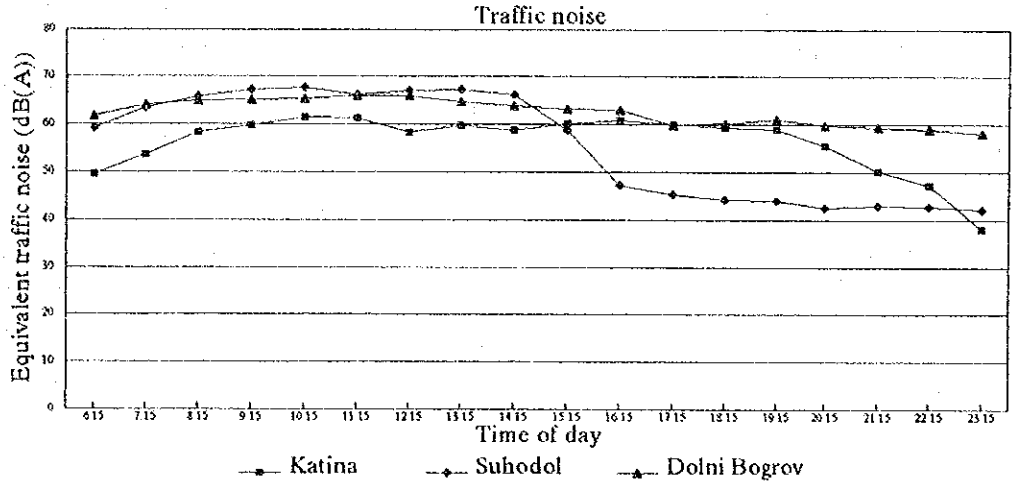
## Katina Traffic – Noise Analysis



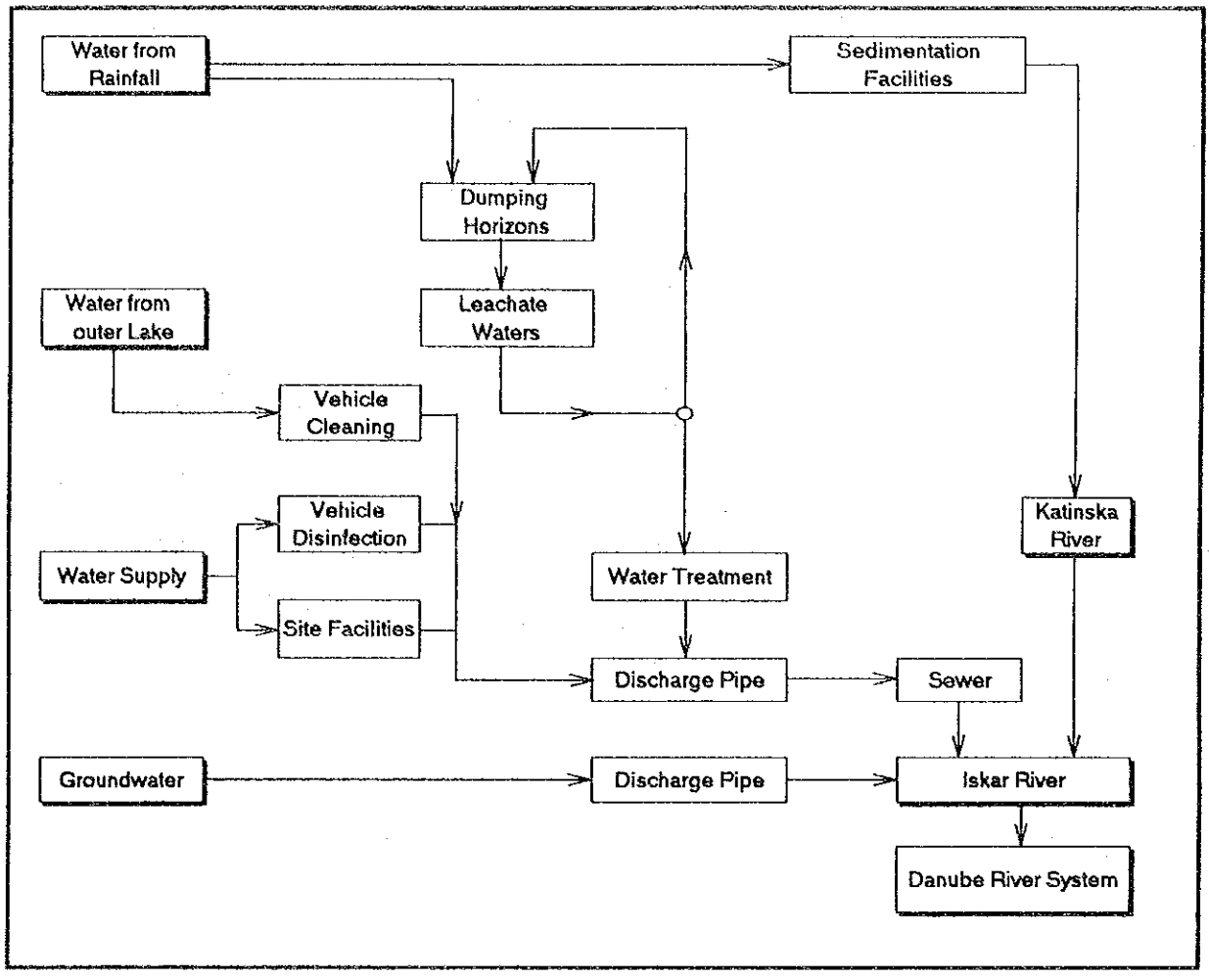



Comparison of Traffic – Noise at three different sites :

Katina – Suhodol – Dolni Bogrov



8.3 Figures

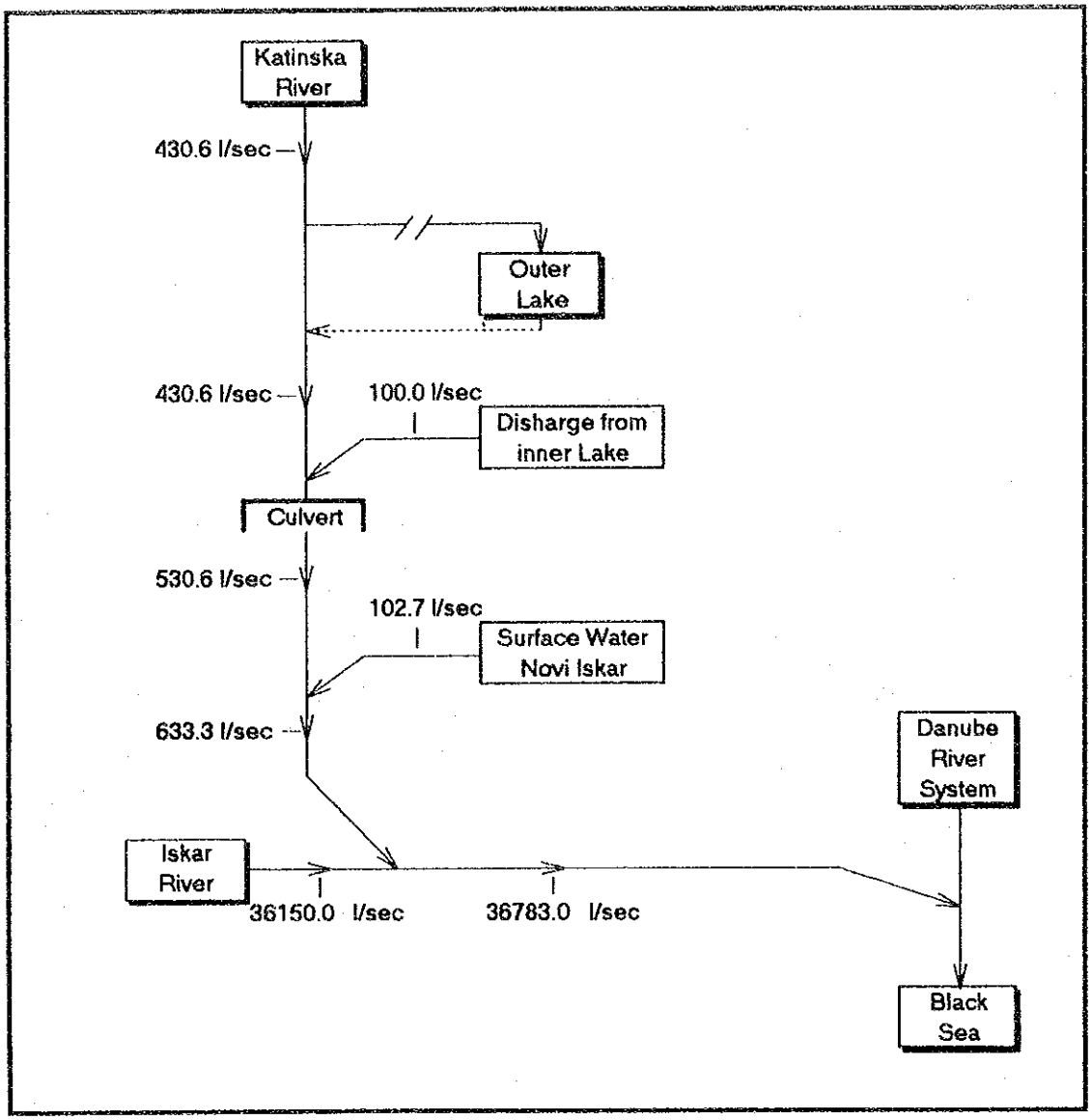



Flowchart of water systems at KATINA future disposal site (in operational stage)

Left side : Waters occuring within the site

Middle : Principle systems within the site

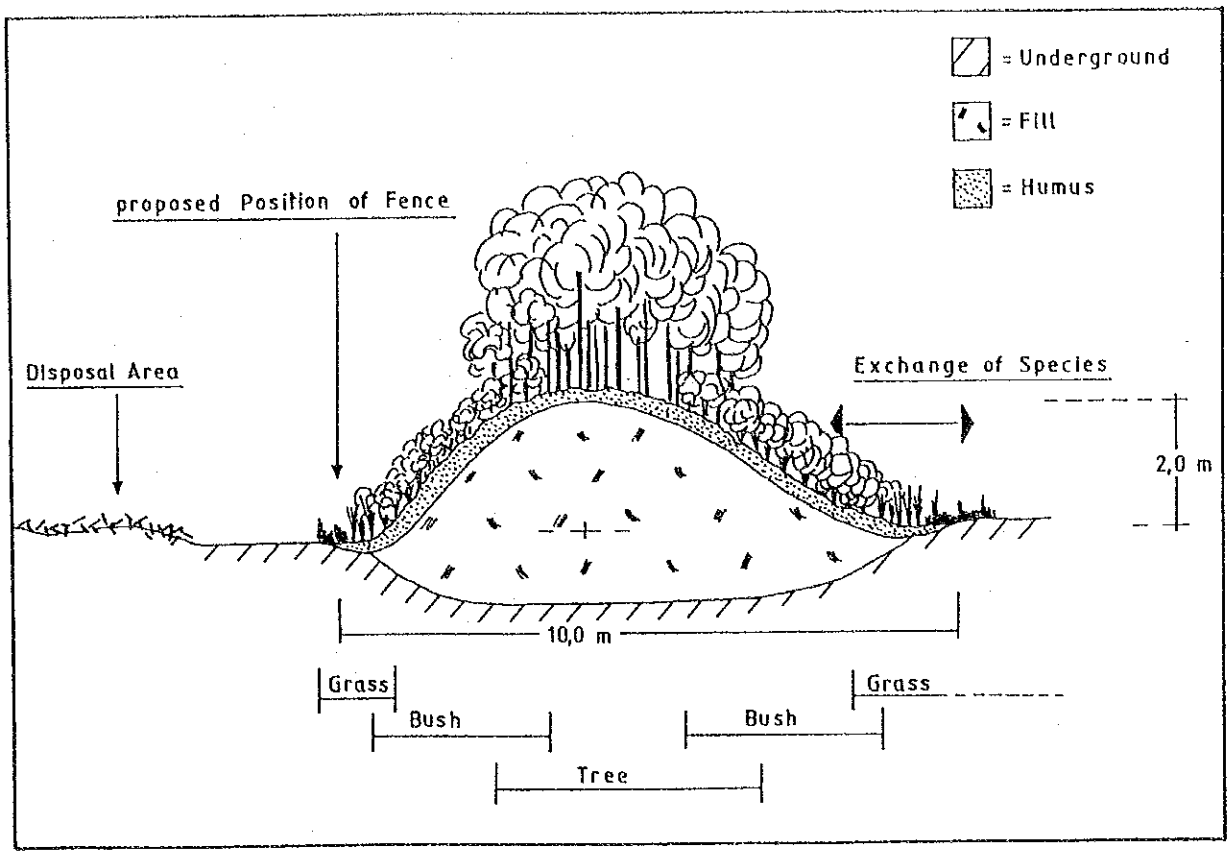
Right side : Adjacent natural water flows




**Flowchart of water discharge in the KATINA region (in constructional stage)**

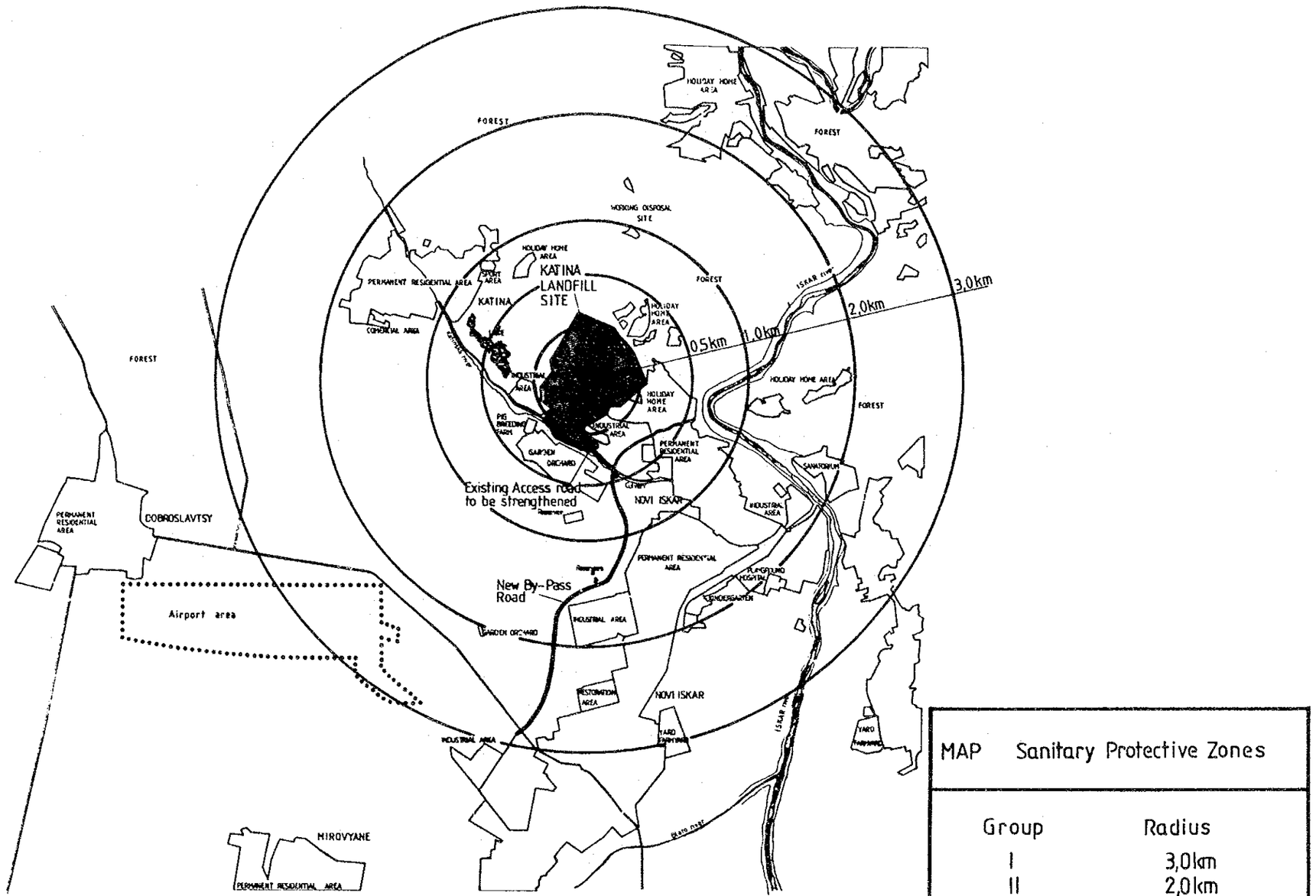
Katinska river bypass into outer lake closed

Discharge of inner lake waters 100 l/sec




Schematic view of statuory tree and bush screen

8.4 Maps




MAP Sanitary Protective Zones

| Group | Radius |
|---|---|
| I | 3,0km |
| II | 2,0km |
| III | 1,0km |
| IV | 0,5 km |

( SOURCE; MINISTRY OF HEALTH ORDINANCE Nº 7/ 25.05 1992)

N

Scale 0 1000m
200 400 600 800

| Type of area | ZONES I (r:3.0km) | II (r:2.0km) | III (r:1.0km) | IV (r:0.5km) |
|---|---|---|---|---|
| Residential | | | | |
| Permanent | | | | |
| KATINA | x | x | x | – |
| NOVI ISKAR | x | x | x | x |
| Holiday homes | | | | |
| KATINA | x | x | x | – |
| NOVI ISKAR | x | x | x | x |
| Vlado Trichkov | x | x | – | – |
| Industrial | | | | |
| KATINA | x | x | – | x |
| NOVI ISKAR | x | x | x | x |
| Varia | | | | |
| KATINA | | | | |
| Sport ground | x | x | x | – |
| Commercial | x | x | – | – |
| Disposal sites | x | x | x | – |
| NOVI ISKAR | | | | |
| Garden orchard | x | x | x | x |
| Reservoirs | x | x | x | – |
| Restoration | x | – | – | – |
| Hospital | x | x | – | – |
| Sanatorium | x | x | – | – |
| Kindergarten | x | x | – | – |
| DOBROSLAVTSY | | | | |
| Military zone | x | – | – | – |
| Agricultural | | | | |
| Arable land | x | x | x | – |
| Farm Yard | – | – | – | – |
| Pig Farm | x | x | x | x |
| Natural | | | | |
| KATINA Lake | x | x | x | – |
| KATINSKA River | x | x | x | – |
| ISKAR River | x | x | x | – |
| Forests | x | x | x | x |

Sanitary Protective Zones around KATINA future disposal site and encompassed areas ( "r": radius; "x": encompassed by SPZ; "–": not encompassed by SPZ)

8.5 Photographs

PHOTO NO. 1 : KATINA, entire site with inner lake

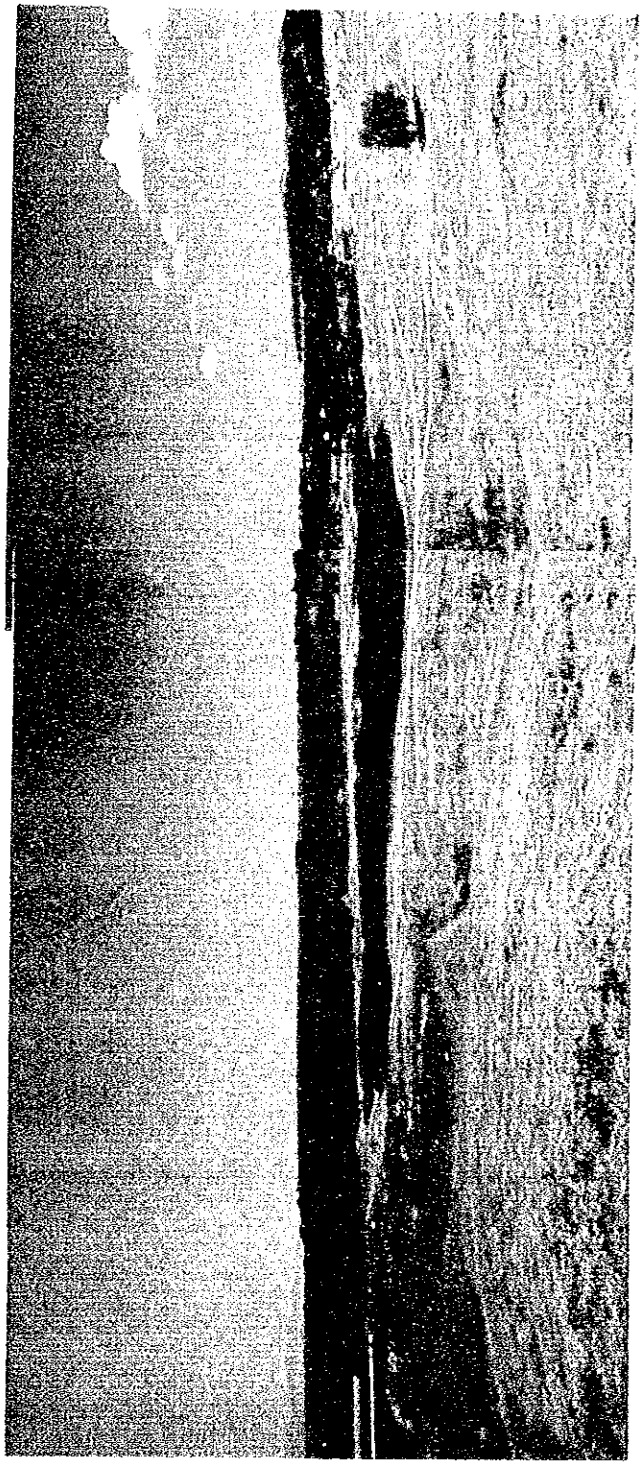


PHOTO NO. 2 : KATINA, outer lake area

PHOTO NO. 3 :
SUHODOL, surface leachate

PHOTO NO. 4 : SUHODOL, surface leachate sedimentation area

PHOTO NO. 5 : DOLNI BOGROV, view to the north

PHOTO NO. 6 : DOLNI BOGROV, dumping ground with adjacent pool

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