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E545

WETLANDS RESTORATION AND POLLUTION REDUCTION PROJECT

GEF TF 024837

ENVIRONMENTAL ASSESSMENT

SOFIA, 2002

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I. INTRODUCTION

The Government of Bulgaria has received a GEF/World Bank project preparation grant (PDF B) for the preparation of a Wetlands Restoration and Pollution Reduction Project in the Danube Region. Two wetland sites will be restored within this project: Persina Marshes on Belene Island and Kalimok-Brushlen Marshes east of Tutrakan. Restoration is expected to result in enhanced nutrient uptake in the wetlands ecosystems and thus purification of Danube waters, revival of valuable biodiversity and increase of fish populations of local economic importance. Within the project preparation grant, the Ministry of Environment and Water has delegated to HPC-Bulgaria a technical study for the design of wetland restoration models, which should provide for the optimal achievement of the above benefits, carefully balanced against acceptable land use changes. A draft report on proposed restoration options has been submitted by HPC-Bulgaria. The present Environmental Impact Assessment study reviews these proposed restoration options; identifies their positive and negative impacts; recommends the most acceptable options, their improvement, as well as mitigation measures as necessary.

Importance of the project

In 1990-1991 there was established the Environmental Program for the Danube River Basin as a "preemtive measure to prevent river Danube and Black Sea water pollution from reaching catastrophic proportions". It was initiated as a result of sustained co-ordination between the riparian states, international organizations, the United Nations Development Program (UNDP), Global Environmental Facility (GEF), the EU, international financial institutions and international and local Danubian NGOs. Co-ordination of these governments and organizations is through the Task Force, which oversees programs, decision making and implementation.

The aims of the program were set out as:

(i) Reduce the impact of River Danube pollution on the Basin's ecosystem and the Black Sea.

(ii) Improve the availability and quality of water in the Danube River Basin.

(iii) Established control of hazards resulting from accidental spills.

(iv) Develop regional water management co-operation.

The United Nations development Program (UNDP) and GEF commissioned a major report "Evaluation of Wetlands and Floodplain Areas in the Danube River Basin" as a part of the Danube Pollution Reduction Program (PRP). This report, published in May 1999, provided the first comprehensive and systematic evaluation of the existing extent of natural floodplains in this international river basin. The study found that out of a total historical floodplain area of 41,605 km^2 only 7,845 km^2 remained – a remarkable loss of over 80%. Based on this evaluation the report recommended 17 wetland/floodplain sites for rehabilitation taking into account their ecological importance, their nutrient removal capacity and their role in flood protection. Only two of the sites fall within the Bulgarian sector and both have been selected for this project.

The project forms part of a national action plan for the conservation of wetlands and is of particular importance for two reasons. Firstly it represents the first government proposal to restore former Bulgarian wetlands. Secondly, in addition to restoring the biodiversity of bird, fish and plant life it should contribute to the natural self-cleaning capacity of the river by nutrient trapping and pollution reduction and thus, in a small way, assist Bulgaria's national and international commitments to reducing transboundary pollution of the river and the Black Sea.

Since this is the first project of its kind, it is particularly important that it should be well designed, environmentally sound and socially acceptable so that it can function as a model for

similar developments in the future. In order to achieve this a sound management and monitoring plan will be essential.

Wetlands provide habitats of great importance to wildlife, especially birds whose migrations follow the river and which are dependent on marshes and reed beds for their breeding and resting-places. Likewise, there are a number of fish species whose breeding success depends on such wetlands. The importance of these wetlands cannot be overestimated - for example Belene Island was at one time the most important breeding area for several now threatened species of birds (Red List). Following draining of the wetlands by construction of dikes, drainage channels and pumping stations in 1949 there began a steady decline in breeding colonies of birds. According to the Bulgarian Society for the Protection of Birds (BSPB) in 1967 there were still a total of around 10,000 breeding pairs but by 1980 this had declined to 1,000 and, by 1985 to fewer than 100 pairs. Since 1995 only a few non-breeding birds have been seen.

Finally, it should be emphasized that wetlands comprise unique and disappearing ecosystems that contribute enormously to the biodiversity and richness of our environment. They are essential components of the migratory routes of many threatened species of birds providing resting-places along their which are now becoming almost too far apart.

Background of wetlands restoration

The conservation and restoration of wetlands in Bulgaria is particularly important for the following reasons:

(i) The small number and area of natural wetlands preserved at present as a result of some geographical and climatic characteristics of the country and most of all - due to targeted human interventions in the natural systems;

(ii) They are of vital importance to biodiversity and are particularly interesting from a scientific point of view;

(iii) A considerable number of natural and biological resources are regenerated and preserved in lakes and marshlands: fish, mussels, reed, curative mud, salts etc. The bottom sediments contain valuable information about the vegetation which grew in the vicinity of wetlands thousands of years ago;

(iv) Wetlands provide essential environmental services such as retention/reduction of nutrients and respective decrease in water and sediments pollution, as well as groundwater recharge.

The restoration of wetlands in the short and long term has ecological, aesthetic and economic benefits. Until recent years, wetlands in Bulgaria were considered wasted arable land, breeding grounds for mosquitoes, sources of diseases, etc. The 1920s saw the first large-scale drying-up of marshes. After World War II the destruction of marshes, mostly the ones in the Danube riverside, became a widespread phenomenon. Almost all marshes along the Bulgarian stretch of the Danube were dried up with the exception of Sreburna, Maluk Preslavets and Garvan, as well as a few wetlands, which failed to be drained, and continued to exist under deteriorated conditions. The dykes built along the rivers prevented them from flooding and the regulation of riverbeds destroyed almost all meanders that were of paramount importance to the flora and fauna. The large-scale drainage activities resulted in the destruction of almost all Bulgarian wetlands.

The development of industry and the irrational use of water resources led to pollution of a large part of water bodies. Sometimes excessive use of fertilizers and pesticides in farming in many places in the country caused eutrophication of a number of water bodies and the Black Sea Basin.

As a result of all this the territory of Bulgaria contains few wetlands and moreover, there is, in almost all of them, a serious anthropogenic impact.

The main outcome of the restoration of these wetlands will be greater biological diversity, especially of species of great conservation importance and larger fish populations. The significance of marshes that can be flooded by the river to the reduction of the pollution of the Danube (decrease in nutrient load, etc.) will be another outcome.

Bulgaria has bound itself to international commitments to implement a number of ratified conventions and international documents directly or indirectly related to the issue of wetland protection and restoration such as *the Convention on wetlands of international importance especially as waterfowl habitat (the Ramsar Convention), 1971; Convention on co-operation for the protection and sustainable use of the Danube river, 1994; Convention on the protection and use of transboundary watercourses and international lakes (Helsinki, 1992); Convention between the Government of the Republic of Bulgaria and the Government of Romania on environmental co-operation, 1992; The 1992 Convention on biological diversity; Convention on the conservation of European wildlife and natural habitats (the Bern Convention); Convention on the conservation of migratory species of wild animals (the Bonn Convention), 1979 (amended 1985,1988); Convention concerning fishing in the Danube water, etc.*

Bulgaria, as one of the riparian states alongside other states and international bodies, was instrumental in the setting up the Environmental Program for the Danube River Basin in 1990-91. Another interesting initiative was the work of the Bulgarian Society for the Protection of Birds (under the aegis of BirdLife International) to identify 50 Important Bird Areas (IBAs) throughout Bulgaria, of which 12 (including the project sites) are located along the Danube.

In recent years the Ministry of Environment and Water has been pursuing a reassessment policy of priorities in terms of conservation of numerous unique natural sites thus contributing to Bulgaria's joining the global process of adopting a new attitude towards nature, and ensuring its sustainable development and enrichment.

With Bulgarian environmental legislation aligned to EU standards, a number of regulations have been adopted in relation to environmental protection and the conservation of biological diversity.

A national action plan to preserve the most important wetlands in Bulgaria has been developed in view of their international significance.

II. BACKGROUND

Research Team

The environmental assessment of the Wetland Restoration and Pollution Reduction Project was carried out between June-September 2001 by the following team of experts:

1. Stela Liubenova Ivanova – licensed expert in environmental impact assessment
2. Miroslava Guneva Nikolova - licensed expert in environmental impact assessment
3. Siyka Vasileva Georgieva - licensed expert in environmental impact assessment
4. Stoyan Dobrev Mihov – ichthyologist

II.1. DANUBE RIVERSIDE AND ISLANDS

The Bulgarian bank of the Danube is 471.45 km long (from the Timok River to the Silistra Border) and runs from the 374.2 to the 845.65 river km from the mouth of the Danube.

The bank is narrow and steep in many places. It is several kilometers wide in certain places and flanks relatively large lowlands, which were periodically flooded. To prevent the lowlands from being flooded by the high water level of the Danube, earth dykes were built.

Of all islands in the Danube, 57 are within Bulgarian territory covering a total area of 115 sq. km. The largest one is the Belene Island (Persina). The Danube islands are elongated and constantly changed by the dynamics of the water and sediments. They consist of sand and gravel sediments and are related to the flood terrace of the Danube. Most of the islands are 1-2 m. above the average water level of the river, some are 3 m. above this level, and the highest one is Belene Island, which is 6 m. high.

II.1.1. LOCATION OF PROJECT AREAS

Belene Island is the largest Bulgarian island on the Danube and is 15-16.5 km. long. It is located upstream from the town of Svishtov, between the 577 river km and 560.5 river km from the river delta (the town of Sulina). The island divides the river into two arms – northern and southern, where a number of smaller islands are located. The northern arm of the Danube is a navigation route and is of great significance to international transport. The southern and narrower arm is barred by a pontoon bridge, there is an underwater barrier, and that is why it is accessible only to small boats and some bigger vessels.

The Tutrakan Marsh Lowland, herein referred to as Kalimok-Brushlen after the names of the two most famous marshes in the past, is situated between the towns of Rousse and Tutrakan. The most important area is the one between the village of Riahovo and the town of Tutrakan that is bounded by the villages of Babovo, Brushlen, Tsar Samuil and Nova Cherna. This area is situated between the 458 river km and 434 river km of the Danube. It is 24-25 km long and occupies an area of 3,500 ha.

II.1.2. LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

The legal provisions regulating matters related to the management and structure of the territory are set out in the Constitution and laws of the Republic of Bulgaria.

The Constitution of the Republic of Bulgaria sets forth the general principles and obligation related to the environmental protection and conservation; maintenance of the ecological balance nature; and reasonable use of the country's natural resources.

Bulgaria is in the process of transposing the European directives in its legislation. Most significant are the EU Directives 79/409/EEC (on protection of birds) and 92/43/EEC (on habitats) directly related to the conservation and management of these wetlands.

II.1.3. SUPPORTING INFORMATION

(i) Bibliography and maps used. (See Addendum No. 5 –*Bibliography*);

(ii) Technical research for the design of restoration of the wetlands of Belene Island and Kalimok-Brushlen carried out by HPC Sofia Company, AQUATEST a.s. – Prague. (Draft Final Report dated November 2001);

(iii) Field research on the water of the Danube - July 3-13, 2000 – Executive Environmental Agency;

(iv) Integrated research on project areas carried out by the experts conducting the environmental assessment;

(v) Field research on project areas (August of 2001) including a physical and chemical analysis of water samples in project areas (See Addendum No. 7 – *Physical and Chemical Analysis of Water Samples*)

II.2. PROPOSED ALTERNATIVES

The technical research for the project on the restoration of the wetlands of Belene Island and Kalimok-Brushlen was carried out by HPC – Sofia in collaboration with AQUATEST a.s. – Prague. The two areas, which are the subject of this environmental impact assessment, are as follows:

- Belene Island, which is 15 km long. The wetland planned to be restored encompasses the eastern part of the island and covers approximately 2,500 ha.
- Kalimok-Brushlen floodplain covers 3,500 ha. and is bounded by the Danube River in the north, the road from the town of Rousse to the town of Tutrakan in the south, a country road connecting the villages of Babovo and Riahovo in the west. In close proximity to the boundaries of this second area are the villages of Riahovo, Babovo, Brushlen, Nova Cherna and the town of Tutrakan.

Both wetlands have been drained in the past with the construction of drainage systems and dikes along the Danube bank and the island of Belene. Due to the hydrogeological conditions of the sites, parts of the wetlands continued to exist and have a high potential for restoration.

The lowest flood level scenario for the two areas is considered unacceptable in view of the small flooded area. The highest flood level scenarios are believed to have an insufficient number of days per annum in which there may be natural flooding at this maximum level (no reason for less possibility for natural flooding to the mid levels), and most of all – due to the complex land use and ownership of lands affected at this flooding level.

For Belene Island the selected flood level is 20.0 m, and for Kalimok-Brushlen Wetland – 14.0 m.

A number of possible options concerning restoration work to achieve the selected level have been considered: five options for Belene Island and three options for Kalimok-Brushlen.

II.2.1. BELENE ISLAND

Alternative 1. If a level of 20.0 m is reached by a flood, the flood area will be 1,562 ha the average depth being 0.35 m. The total volume of water in the flooded areas in the periods of flooding

to level 20.0 m will be 4.96 million cubic meters and the water retention period will be 10-14 days.

Two sluices with adjacent inlet channels will be built in the Danube dyke for the water to enter the water areas in the south of the island, at the 570.5 river km (item A of the appended diagram) and at the 567.6 river km (item B).

The entire flood land will be drained via two outlets in the east of the island – an existing outlet at the 561.5 river km (item D) and a new one at the 561.0 river km (item E). The sluices will help regulate the water level in the wetlands.

Alternative 2. Alternative 2 suggests that the number of sluices built and their location is the same as in Alternative 1 but the western boundary of the flood land will be an internal dyke. Thus, the flood area will be 1,289 ha. with an average depth of 0.36 m, 4.66 million cubic meters total volume of water in the periods of flooding to level 20.0 m, and a retention period of 10-14 days.

Alternative 3. Alternative 3 is analogous to Alternative 1, but the area will let water from the north, instead of from the south and two sluices will be built for this purpose: at the 569.3 river km (item F) and at the 567.2 river km (item G).

Alternative 4. Alternative 4 is analogous to Alternative 2 but the area will let water from the north, instead of from the south and two sluices will be built for this purpose: at the 569.3 river km (item F) and at the 567.2 river km (item G).

The four options include the destruction of the Persina-2 Draining Pumping Station (DPS).

Additional provision is made for the construction of a pumping station for the pumping of water into the wetland during the periods of low Danube water levels, without specifying any technical solutions: number of pumps, flow, workdays per year, etc.

Alternative 5. Alternative 5 is, in reality, a different scenario since the proposed flooding level is 21 and not 20 m, as in the four alternatives described above. The flooded area would be maximal (almost half of the island), and the western arable part of the island will be protected by means of internal dykes.

II.2.2. KALIMOK-BRUSHLEN

Alternative 1. If a flood reaches the selected level of 14.0 m, the flood area will be 1,585 ha. with an average depth of 0.32 m, 5.07 million cubic meters total volume of water and a retention period of 14 days.

Water will enter the area that can be flooded via three sluices in the Danube dyke and will be further regulated by two sluices in internal dykes.

- a sluice at the 451.75 river km (item A) – new;
- a sluice at the 448 river km (item B) – reconstruction of an existing sluice of Main Drainage Canal 1 (MDC-1) for DPS II;
- a sluice at the 442 river km (item C) – reconstruction of an existing channel to the inflow channel for the destroyed pumping station which pumped water to the fisheries;
- a sluice in the internal dyke at item G;
- a sluice in the internal dyke at item F.

MDC-1 will be connected to MDC-2 so that MDC-1 can cover the entire area.

The flood land will be drained via a sluice at the 436 river km (item E) – reconstruction of an existing sluice for DPS III.

Alternative 2. Alternative 2 is based on Alternative 1 but water overflow is limited by protecting dykes to the west and to the south.

If a flood reaches a level of 14.0 m, the flood area will be 1,044 ha. with an average depth of 0.42 m, 4.36 million cubic meters volume of water and a retention period of 10-14 days.

Alternative 3. This alternative suggests that 10 separate open water areas be created through the deepening of existing low areas in the terrain, with a hydraulic connection among them. The surface of each of these open water areas will be 13 to 75 ha. and water depth - 2-2.5 m. Water will enter the deep areas via a lock at the 451.75 river km (item A) and will flow into the Danube at the 436 river km (item E).

The existing draining pumping stations will be destroyed in all three options. It is indicated that additional amount of water could be pumped but here, just as it was with Belene Island, no specific technical solution has been proposed.

We are generally in support of the two flooding levels, 20 m for the Belene Island and 14 km for Kalimok Brushlen. Without being critical, we are of the opinion that the presented alternatives are in a rather preliminary stage and are not adequately justified to merit solid preference. However, most acceptable from the point of view of the environment are alternative 4 (Belene island, with the water of the Danube entering from the north and with inner protective dykes) and alternative 1 for Kalimok-Brushlen (because of the largest area for restoration, but it requires many improvements of the technical project).

III. ANALYSIS OF CURRENT SITUATION. FORECAST AND ASSESSMENT OF EXPECTED IMPACT OF THE PROJECT ON ENVIRONMENTAL COMPONENTS

III.1. INFRASTRUCTURE

III.1.1. EXISTING INFRASTRUCTURE

III.1.1.1. Belene Island

The land expected to be flooded is 538-2,440 ha. The following facilities were built on the project territory under consideration:

- Protecting dykes in the Danube– the entire island has been dyked;
- A draining system, including Persina-2 Draining Pumping Station with two 250 kWt vertical pumps and drainage canals;
- Farm buildings (Sheep farm);
- Access roads;
- External power supply;
- Drinking water source – a Ranney well.

In relation to the draining system of Belene Island we have only the data from the on-site inspection, which do not give a full picture of the buildings and equipment built.

III.1.1.2. Kalimok-Brushlen

The land expected to be flooded is 444-2,819 ha. The following facilities were built and operate in the area that may be flooded in the future or are in close proximity to it:

- Protecting dykes in the Danube;
- Brushlen Irrigation and Drainage System (IDS);
- Water supply wells;
- Fish ponds;
- Pig farm;
- Roads;
- Power cables.

III.1.1.3. Protecting Dykes in the Danube

The area which is the object of this inquiry is protected against high water levels of the Danube by the so-called "Danube dykes" from the village of Riahovo (15+545 river km) to the town of Tutrakan (41+113 river km) downstream the Danube. The dykes were built in 1945-1950 and protect 6,489.4 ha. of arable land and the adjacent villages and towns against being flooded.

The dykes have a trapezoidal section with the following basic elements:

- width of the dyke at the top – from 2.80 to 4.20 m.
- upstream batter – from 1:1.50 to 1:5.50;
- downstream batter – from 1:1.5 to 1:5.

According to the data given by Irrigation Systems EAD – Rousse, the level of the dyke is 18.11 to 20.74 high.

Platforms were built in five places – the dykes are used as a road connection among the facilities in Brushlen IDS.

Our observations and the talks with the local people have shown that the condition of the dykes is not good, unlike that on Belene Island. They have been super-graded and repaired in some locations but are not properly maintained in general. Also, in and below the dykes there are many holes of burrowing animals, mostly badgers, foxes, rodents etc. which increase the infiltration at high river water. Presently we do not have detailed data to allow for accurate assessment of the condition of the dykes and of the risk of floods. In any case, we need to fill the gaps in our knowledge in order to recommend measures for strengthening and rehabilitation of the dykes in this project area.

III.1.1.4. Brushlen IDS

Brushlen IDS unites two systems – irrigation and drainage one.

The drainage system consists of:

- Draining pumping stations (DPS): Riahovo DPS, DPS II-a, DPS II, - Kalimok DPS and DPS III (Tutrakan);
- Main drainage canals (MDC): MDC – 1 and MDC -2;
- P – 1 Outlet Channel;
- Tarchila – 1 and Turchila-2 Drainage Canals;
- Collectors;
- Monitoring wells;

The origin of the underground water that is in the lowlands is:

- filtrated water from the Danube;
- infiltrated water from the rainfall in the lowlands.

Water infiltrates in the entire territory of the lowlands and there is filtrated water within a certain distance from the Danube.

Riahovo IDS was built between the village of Riahovo and Babovo and was set into operation in 1969. It gets water from MDC – 1 and re-pumps it into the Danube at the 462 river km. It drains around 840.4 ha. The pumping station has two 24 NDN pumps with the following performance:

- Q=1,100 l/sec H=1.3 MPa N=160 kWt;

The pumps start operating at a maximum water level of 12.50 m and stop operating at a minimum water level of 12.00 m.

IDS II-a was set into operation in 1952 and is designed to drain about 1,780.8 ha. It gets water from MDC – 1 and re-pumps it into the Danube at the 458 river km. The pumping station has three 24 NDN pumps with the following performance:

- Q=1,000 l/sec H=1.3 MPa N=180 kWt;

The pumps used to start operating at a maximum water level of 14.65 m and stop at a minimum water level of 12.00 m.

The pumping station was destroyed and has not been operational for 10 years. Part of the equipment was saved and stored.

IDS II (Nova Cherna) was set into operation in 1950. It gets water from MDC – 1 and re-pumps it into the Danube at the 448 river km. It drains around 1,463.6 ha. The pumping station has:

- two 24 NDN pumps with the following performance:
  - Q=1,000 l/sec H=1.3 MPa N=160 kWt;
- four Vero Mavag vertical pumps with the following performance:
  - Q=750 l/sec H=0.7 MPa N=60 kWt;

The vertical pumps are not working.

- two ANDRITZ pumps with the following performance:
  - Q=2,000 l/sec H=0.7 MPa N=200 kWt;

The pumps start operating at a maximum water level of 12.60 m and stop when water level drops to 11.60 m.

Kalimok IDS was destroyed and the equipment was dismantled. It was set into operation in 1971. The pumping station had two 24 NDN pumps with the following performance:

- Q=1,300 l/sec H=0.7 MPa N=200 kWt;

Kalimok IDS used to re-pump water from MDC – 2 into the Danube at the 440 river km.

IDS III (Tutrakan) was set into operation in 1952. It gets water from MDC – 2 and re-pumps it into the Danube at the 436 river km. It drains around 1,463.6 ha. The pumping station has:

- two ANDRITZ pumps with the following performance:
  - Q=2,000 l/sec H=0.7 MPa N=200 kWt;
- two 24 NDN pumps with the following performance:
  - Q=1,300 l/sec H=1.3 MPa N=160 kWt;
- two Vero Mavag pumps with the following performance:
  - Q=750 l/sec H=0.7 MPa N=60 kWt;

The pumps start operating when water level reaches 12.80 m and stop when water level drops to 11.80 m.

The draining pumping stations are situated in a lengthwise succession from west to east.

Water is taken to the draining pumping stations via a system of drainage canals which is connected to MDC – 1 and MDC –2.

All drainage canals have a trapezoidal vertical section and are not coated. Only P-1 channel has been coated with reinforced concrete slabs from 0+000 to 0+500 km.

Brushlen Drainage System includes:

- MDC - 1 with basic specifications:
  - Total length L= 16,890 m.;
  - Bottom width of the channel B=5.00 – 8.50 m.

- Total height of the channel H=3.00 – 3.65 m.

➢ MDC – 2 with basic specifications:

- L=13,930 m B=3.00 m H=3.50 m

➢ P – 1 Drainage Canal with basic specifications:

- L=2,040 m B=0.80 – 1.00 m H=2.00 – 3.90 m

➢ Collecting drainage canals to MDC – 1 with B= 1.00 m,

- H=1.50 – 2.50 m and L=6,150 m

➢ Collecting drainage canals to MDC – 1 with B= 2.00 m,

- H=2.50 – 3.50 m and L=7,240 m

➢ Tarchila – 1 Drainage Canal with basic specifications:

- L=5,970 m B=0.80 – 4.00 m H=2.20 – 3.50 m

➢ Tarchila – 2 Drainage Canal with basic specifications:

- L=5,530 m B=1.75 m H=2.50 m

➢ Collectors to MDC – 2 with total length of 5,110 m.

When matching the capacity of drainage canals to the amount of underground water the run-off of the irrigation system was added.

159 monitoring wells, situated evenly in the drained area, were built to monitor the level of underground water.

The irrigation system in the territory under consideration consists of:

(i) irrigation pumping stations – PS 23 and PS 24;

(ii) sprinkling pumping stations – Nova Cherna – 1 SPS;

(iii) distribution channels – P-3, P-4, P-4a and P-5;

(iv) compensating basin for Nova Cherna – 1 SPS;

(v) irrigation fields.

PS 23 is a floating pumping station, built on the Danube at the 458 river km in the Kaleto Area in close proximity to the villages of Riahovo and Brushlen.

PS 23 is the first step of Brushlen Irrigation System. Currently it has 11 NDN pumps with the following basic performance:

- Q=500 l/sec H=1.0 MPa N=60 kWt;

The pumping station was built in 1951. It gets water from the Danube at the 458 river km. It feeds water to P-2 Channel and supplies water to PS 24 via P-3 Channel. PS 23 also includes an electric substation and a building for the personnel.

There is an opening in the dyke having 3 sluices, which are 1.50 m in width, for gravity irrigation water feed when the river water level is high.

PS 23 feeds water to the land of the villages of Brushlen, Goliamo and Malko Vranovo, Stambolovo, Kosharna, Borisovo and Nova Cherna. The irrigated land is municipal and private. 6,000

ha. can be irrigated. The on-site inspection (July 2001) discovered that an agreement related to the irrigation of 160 ha. had been concluded.

PS 24 was built about 1 km west of the village of Brushlen. PS 24 was designed to be a lifting pumping station – it gets water from P-3 Channel and feeds water to P-4, P-4 and P-5 Channels and supplies water to PS 25, PS – 25a, etc. PS 24 has 12 pumps:

- one 16 NDN pumps with the following performance:
  - Q=500 l/sec H=1.0 MPa N=75 kWt;
- three 24 NDN pumps with the following performance:
  - Q=1,100 l/sec H=2.6 MPa N=250 kWt;
- four 24 NDN pumps with the following performance:
  - Q=1,300 l/sec H=2.6 MPa N=400 kWt;
- four 24 NDN pumps with the following performance:
  - Q=1,400 l/sec H=2.1 MPa N=475 kWt;

The pumping station was built in 1951 and reconstructed in 1964. It feeds water to 28,905.8 ha. of irrigated land.

Nova Cherna – 1 SPS is a sprinkling station designed to irrigate via sprinkling 387.8 ha. of irrigated land. It gets water from a compensating basin (P-4 Channel). Nova Cherna – 1 SPS has four 130 BC – 70 pumps with the following performance:

- Q=80 l/sec H=8.0 MPa N=160 kWt;

Nova Cherna - 1 SPS was built in 1991. It gets water from P-4 Channel (compensating basin) and feeds water to Nova Cherna – 1 Irrigation Field (IF).

Distribution Channel - P-3 starts from a manhole of PS 23 and feeds water to PS 24. The channel is 4,476 m long. It was coated almost entirely, only the last 506 m were not coated and were simply dug in the soil. It is intended to distribute 9,500 l/sec.

P-4 Channel starts from the manhole of P-5 Irrigation Channel and feeds irrigation water to the Nova Cherna Hydro-technical Unit (HTU). The channel is 4,260 long, has a trapezoidal section and was coated. It is intended to distribute 800 l/sec.

There is a compensating basin built in P-4 Channel before Nova Cherna – 1 SPS. The compensating basin is a widening of the channel. It has a trapezoidal vertical section with the following basic parameters:

- bottom of the channel 10 m;
- batter 1: 1.5;
- depth of water in the channel 1.30;
- length 390 m;
- backwater volume 5,840 cu. m.

P-4-a Channel starts after a manhole of PS 24 and feeds irrigation water to the adjacent 504.8 ha. of irrigation land around the village of Brushlen. The channel has a trapezoidal section, was coated and is 5,553 m long. It is intended to distribute 1,000 l/sec.

The following equipment supports the distribution irrigation channels: bridges; return siphons; water dividers; gates; passenger bridges; water outlets; shafts.

The current stage of inspection did not specify the number of the pieces of equipment that are related to the territory under consideration.

The condition of the operating pumping stations is satisfactory. The pumping units were installed 40-50 years ago but they operate only a few months in the year and are well maintained.

The coating of the irrigation is in good condition.

Out of the five draining pumping stations only three are operational at present.

The accumulated sediments in the drainage canals are systematically cleaned up. At the time of the inspection there was intense excavation to clean up the MDCs and other channels in the central and eastern part of the project territory.

III.1.1.5. Water Supply Wells

The underground water in the terrace of the Danube is a water supply source for a number of population centers in the northeast of Bulgaria.

Northeast of the village of Riahovo there is a group of 6 Ranney wells, which after the Babovo PS feed 1,380 l/sec of drinking water into the Danube Water Supply System.

Six more wells with a total capacity of 2,200 l/sec were intended to be built east of the existing ones but they had not been built. Under the existing sanitary protection zone (SPZ) according to Bulgarian drinking water supply regulations (there are two types of SPZ) plan, Zone I covers 4,701.4 ha. around the wells, Zone II borders on the dyke to the south and covers 99.4 ha.

The villages of Brushlen, Goliamo and Malko Vranovo have a water supply from local sources of water – water catchment and tube wells.

Some 3 km east of the town of Tutrakan there are 5 Ranney wells, of which three are operational and feed around 300 l/sec to the Tutrakan Water Supply System, which covers 15 population centers including the village of Nova Cherna, the town of Tutrakan and the pig farm situated northeast of the village of Nova Cherna. Zone I of the three operational wells covers 2.5 ha. The sanitary and protection areas around the sources of water do not meet the requirements of Regulation No. 3 of the Ministry of Environment and Water, the Ministry of Public Health and the Ministry of Regional Development and Public Works dated October 16, 2000.

III.1.1.6. Nova Cherna Fish Ponds

The largest fishponds in Bulgaria, covering a total of 520 ha., were built in the Tutrakan Marsh in 1981. The high cost of maintaining the necessary water exchange forced the government to close down the ponds. Currently the fishponds are covered with reeds and the fish feeding facilities have been abandoned and degraded.

III.1.1.7. Pig Farm

It is situated northeast of the village of Nova Cherna and has not been operational in recent years. According to data received on the site, it is expected that the farm will begin to breed pigs in the autumn of 2001. The projected capacity of the pig farm is 25,000 pigs. About 8,000 pigs are expected to be bred. There is a mechanical wastewater treatment plant built at the pig farm (screens, settling tanks and putrefaction beds).

III.1.1.8. Roads

The territory under consideration has several types of roads that are used by the population:

(i) **country roads** – they connect the villages in the area to the Ruse-Tutrakan-Silistra Road. They are asphalt roads and are maintained by the local traffic authorities;

(ii) **access roads** – they were built to provide access to the facilities of Brushlen DIS. They are asphalt roads and are some 2.5 m wide;

(iii) **field roads** – mainly dirt roads that provide access to arable land;

(iv) **tracks to the boat docks** along the Danube – village of Nova Cherna.

III.1.1.9. Power Cables

There is an external power supply for the population centers, pumping stations (draining, irrigating and water supply pumping stations) and the pig farm. Depending on the capacity built, there are electric switchgear kiosks or electric substations to the pumping stations.

III.1.2. Facilities to Be Affected by the Proposed Restoration of Wetlands

The restoration of wetlands should be within acceptable limits, that is the creation of prerequisites for flooding part of Belene Island and Kalimok-Brushlen at the so-called "cherry" water level (high water levels in spring) should not pose a danger of flooding any adjacent population centers and facilities that will remain operational after the restoration of the wetlands.

III.1.2.1. Belene Island

The restoration of the wetlands of Belene Island should be done in a way guaranteeing that the prison facility built in the west of the island and its supporting engineering structure will be preserved.

The facilities whose operation concerns the entire island are:

- protecting dykes in the Danube;
- drinking water source – a water supply well with a pumping station.

The protecting dykes in the Danube should not be destroyed. If Zone I of the drinking water source would be flooded, then there should be constant access to the well and constant power supply. There is no risk of flooding of the drinking water source but the maintenance personnel may have difficulties in accessing it.

The facilities that are situated in the area under consideration for flooding but are related to the prison are:

- farm buildings for the sheep farm;
- access roads.

The facilities whose operation may be affected by the restoration works are:

- Persina – 2 DPS;
- drainage canals to the pumping stations;
- access road to the pumping station;
- power supply of the pumping station.

The protecting dyke in the Danube should be preserved. The farm buildings to the sheep farm may be moved to a suitable place subject to discussion with the Ministry of Justice. Persina – 2 DPS can stop operating and be destroyed.

A flood scenario at a water level of 20.00 m was selected **for Belene Island** with possible options:

Proposed flood options are:

- flood an area of 1,562.2 ha. in options 1 and 3 and 1,289 ha. in options 2 and 4.
- build 2 inlets to let water from the Danube to the wetlands – 2 locks in the dyke in the Danube: in the south end of the island in options 1 and 2 and in the north one in options 3 and 4.
- build an outlet in the east of the island in all the four options.
- build a protecting dyke along an existing road, which will be 1,990 m long 20.50 m high to restrict flooding to the west – options 2 and 4.
- The four options under consideration suggest that Persina – 2 DPS and the sheep farm buildings should stop operating.

The proposed destruction of the facilities involves dismantling equipment and tearing down buildings. At this point of research no estimate has been made whether the equipment could be used for other facilities. The amount of waste has not been calculated, nor has a site been selected where it could be disposed of.

III.1.2.2. Kalimok-Brushlen

The necessary amount of soil for building the internal protecting dykes has not been estimated nor have any potential quarries been searched for Kalimok-Brushlen. The facilities whose operation may be indirectly affected by the affected by the restoration works are:

- protecting dykes in the Danube;
- irrigation pumping stations PS 23, PS 24 and Nova Cherna – 1 SPS;
- P-3 distribution channel connecting PS 23 and PS 24;
- water supply tube wells and PS related to them;
- roads connecting the facilities to the road network in the area;
- external power supply of the pumping stations;
- pig farm.

The facilities listed above should not be flooded or destroyed. The ways in which the connecting roads and the external power supply cables run may be changed. The facilities whose operation may be directly affected by the restoration works are:

- draining pumping stations;
- drainage canals;
- access roads to pumping stations;
- external power supply of the pumping stations;
- fish ponds.

Depending on the selected area of the wetlands and the water level in them, the pumping stations, which will remain to be operational, will be determined. If necessary, the construction of new draining pumping stations and drainage canals for them will be proposed.

All working pumping stations should have connecting roads and external power supply.

The long-time use of the fishponds has proved them to be inefficient and they are not used at the moment.

The research carried out by HPC – Sofia and AQUATEST – Prague selected a flood level of 14.00 m on the basis of a hydrological analysis of the water of the Danube and the possibility of a longer-lasting overflow. After the conditions of the terrain, the existing facilities and land ownership were taken into consideration, three flood options were proposed:

Alternative 1 – gravity flooding to the selected level via four locks in the dyke in the Danube: two new and two existing ones for DPS II and Kalimok DPS. This type of flooding will concern in part or in whole:

- P-3 Channel which is the connection between irrigation PS 23 and PS 24 and this will make it impossible to feed irrigation water to a large part of the Brushlen Irrigation System located south of the area under consideration.
- DPS II-a is flooded. The pumping station was destroyed but this was not part of an approved project. The pumping station may have to be reconstructed.
- MDC –1 and MDC – 2 are flooded. DPS II and DPS III should stop functioning as drainage pumping stations.
- the land will be drained at DPS III (Tutrakan). For this purpose the existing sluice will be reconstructed and the land south of the dyke should be protected against any high water level of the Danube.
- two new sluices in the internal dykes will be built to regulate water in the wetlands.

The flood area is 1,585 ha. with an average water depth of 0.32 m.

Alternative 2 – this alternative is analogous to Alternative 1 but flooding is limited to the west and south areas of the protecting dykes.

This solution moves the flood area some 10 km east of P-3 Channel which will make it possible to continue to operate the irrigation pumping stations PS 23 and PS 24. If necessary, DPS II-a can be activated.

The flood land is 1,044 ha. with an average water depth of 0.42 m.

Alternative 3. The third alternative proposes the construction of 10 artificial lakes with an open water space varying from 13 to 75 ha., water depth of 2-2.5 m. and hydraulic connection between them. Water will come from the Danube at a point, which is some 12 km. east of PS 23, will pass through all the lakes and flow back into the river at DPS III. This solution makes it possible:

- to have water areas that are adequately situated and do not affect any buildings or equipment of Brushlen IDS and private property.
- not to disrupt the operation of the irrigation pumping stations.
- to activate DPS II-a, if necessary

The flood land in Alternative 3 will be the smallest. The considerable depth of the individual deep-water areas will require large-scale excavation activities.

Just as it was with Belene Island, the proposed destruction of the facilities in these options involves dismantling equipment and tearing down buildings. At this point of research no estimate has been made whether the equipment could be used for other facilities. The amount of waste has not been calculated, nor has a site been selected where it could be disposed of. The necessary amount of soil for building the internal protecting dykes has not been estimated nor have any potential quarries been searched for.

III.1.3. FORECAST OF EXPECTED IMPACT

The restoration of wetlands will render half of the draining system built on Belene Island, the better part (over 80 percent) of Brushlen Draining System, and part of (around 20 percent) of Brushlen Irrigation System useless. Large hydrotechnical facilities will be destroyed and this will affect not only the flood land but also the area, which is in close proximity to it. No economic evaluation of flooding-related activities such as maintenance, electricity and benefits has been made. Many of the hydrotechnical facilities are in poor state of repair or destroyed (particularly those connecting to the fish farm in Kalimok-Brushlen). From the viewpoint of the drainage system, the restoration of wetlands will lead to reduced maintenance expenses, including reduced consumption of electric energy.

The restoration of wetlands may increase the filtration of water into the soil, respectively the level of underground water. Riahovo DPS and Persina – 1 DPS will get an additional load and this may require installation of new groups of pumps or construction of new DPSs.

The construction work will result in large quantities of building and vegetation refuse. There will be large-scale excavation and filling activities related to the construction of temporary and permanent waste grounds and quarries will be searched for to provide soil necessary for the internal dykes. Currently, neither sites for waste dumping, nor suitable quarries have been searched for.

According to preliminary estimates of the amount of harmful substances in the soil in the area that will be flooded and of potential preventive measures, the water quality of drinking water sources is not expected to get worse after the restoration of the wetlands.

The proposed flood levels take into account population centers and populated areas. Some of the options envisage construction of internal protecting dykes.

As far as the destruction of buildings and equipment is concerned, the proposed options concerning Belene Island are equivalent.

III.2. ATMOSPHERIC AIR

III.2.1. CLIMATE

The climate of the area of the banks of the Danube from Svishtov to Silistra which are part of the territory of Northern Bulgaria is determined by the influence of its specific geographical situation, namely by the Danube banks, the absence of any barrier to the North for cold Northern and Northeastern winds, the common transfer of air mass for the country and the typical air currents for the river valleys. These basic features of the geographical situation of the city are not only reflected on climatic elements, but are also felt in the ecological situation of the studied area.

The climatic characteristics of the territory are based on the results of the observations in meteorological stations in Svishtov, Rousse and Silistra. Here we find included the main climatic elements, which exert their influence on the ecological conditions, on the impact pollutants of the environment, together with the transboundary transfer of atmospheric pollutants. As is well known, on Romanian territory, 12 km northeast of Silistra, and close to Calarași, there is a large metallurgical combine, a chemical plant opposite Rousse, and the Zimnicea sugar plant opposite Svishtov.

From a climatic point of view the observed region falls in the Danubian subregion of the moderate-continental climatic subregion.

The openness of the area and the absence of mountains ringing it allow the free transfer of arctic air mass from the northeast, in particular during the winter.

This in particular finds its reflection over the climate, making it close to a continental climate.

January is the coldest month of the year, July the warmest.

The relative air humidity corresponds to that of moderate geographic attitudes.

The region is characterized by considerable turbulence of air masses. Quiet weather amounts to 27-30% of the weather round the year.

The region has slightly expressed inversions in temperature.

Average wind speed is comparatively high in relation to other regions in Bulgaria. The climate of the Danubian river basin is one of the most important factors for the biology of the river basin and island vegetation. Its combination with the water regime of the Danube, which to a considerable extent affects the microclimate and relief of the banks and the islands, determines the duration of flooding and the level of subterranean waters.

The difference in geographical latitude between the most northern point of the Danubian river basin at Silistra and that of its most southern point, Svishtov, is slight and it determines the inconsiderable climatic differences. The climate is moderate continental, with a hot summer and a comparatively cold winter.

III.2.1.1. Air Temperature

The temperature regime of the studied territory is closely dependent on radiation conditions and circulation processes. The analysis of the data of mean monthly temperatures shows that January is the coldest month and July - the warmest. Mean annual temperature for Silistra is 11.6 ^{0}C to 12.1 ^{0}C, for Rousse the higher value of the mean temperature for the country (10.5 ^{0}C).

The appearance of extreme temperatures of atmospheric air depends on a specific geographic situation, relief, altitude above sea level, the character of strata below the surface and atmospheric circulation. For the studied territory the absolute maximum temperature was recorded in August (41.0 - 43.0 ^{0}C). The absolute minimum is between -27.7 and - 32.0 ^{0}C. The amplitude of temperatures is also a factor affecting diffusion of atmospheric pollutants. Its highest values were observed in the warm six months of the year. Temperature is one of the most important factors determining the nature of air masses, and exerts its influence on the changes of the remaining meteorological elements, one of the most variable meteorological values. It depends on the geographic altitude of a locality, on altitude above sea level, on specific terrain features, air currents etc.

The region along the Danube is characterized by a specific temperature regime because of its low altitude a.s.l.; moreover it is open to the cold northeastern air masses, while Stara Planina and the Rhodopes block the Mediterranean influence. These factors, together with a number of others create the conditions for very high temperatures in summer and low temperatures in winter (table 2). The vegetation period includes the months of April, May, June, July, August, September and October.

The analysis of data recorded over many years establishes that the mean annual temperature in the examined region is approximately 11.7 ^{0}C, while the mean monthly temperature during the vegetation period is 18.6 ^{0}C. What is typical for these mean annual and mean monthly temperatures is that during the vegetation period they are lowest in Silistra and Vidin and increase in

Svishtov and Rousse. A tendency emerges towards a rise in air temperatures in the more eastern parts of the Danube region, moreover above all during the spring and summer months when the mean meteorological data shows that the lowest temperatures for the country were measured in winter - January was the coldest month (-1.4 to -1.8 ^{0}C). The warmest summer month is July with mean temperatures 22.8-24,1 ^{0}C. In the Danube region autumn is warmer than spring. High annual amplitude was also measured in Svishtov (25.5 ^{0}C) and Rousse (25.6 ^{0}C), which is typical of continental climate. The regime and duration of the periods with mean 24 h temperatures above 5,10 and 15 ^{0}C is extremely important for the development and growth of forest vegetation, shrubs and grasses. So are the total temperatures for the separate thermal boundaries.

The duration of the period including the days with air temperature above 5 ^{0}C is almost 8 months, while the active vegetation period with average 24h temperatures above 10 ^{0}C were 6 to 7 months. The third period with mean night air temperatures above 15 ^{0}C is a period of ripening, i.e. lignification of tissues of forest vegetation, which continues between 5 and 5,5 months.

When an assessment of temperature is made, it is essential to determine an average date and a final date of the last spring day, and the first cold day in the autumn, as well as the average duration of the weather without any frost (table 3).

The dates of the last spring day or the setting in of the first autumn frost are also important.

Table 1: Air Temperature (References - Climate, Vol.3 - air temperature, soil temperature, frost -1983)

Station	By months												Vegetation period Av. Daily Monthly Temperature	Mean annual temperature
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
A. Mean 24 h temperatures - mean monthly and annual air temperature														
Svishtov	-1.8	0.7	5.6	13.0	10.3	21.5	23.9	23.2	19.0	12.8	7.0	1.2	17.97	12.0
Ruse	-2.1	0.7	5.6	13.0	18.1	21.8	24.1	23.6	19.2	13.0	7.1	1.2	18.62	12.1
Silistra	-1.7	0.8	5.3	11.8	17.3	20.8	23.0	22.4	18.2	12.6	7.1	1.5	17.83	11.6
B. Extreme temperatures -average monthly maximum air temperatures														
Svishtov	0.5	4.0	10.1	18.1	23.4	26.7	29.1	28.7	24.5	18.1	10.5	3.7	-	16.4
Rousse	1.0	4.5	10.8	18.8	24.1	27.5	30	29.8	25.7	19.1	10.9	4.3	-	17.2
Silistra	1.2	4.3	9.9	17.3	22.9	26.3	28.8	28.6	24.4	18.2	10.9	4.6	-	16.4
Monthly and annual maximum air temperature														
Svishtov	19.4	22	32.2	33.1	37.5	38.6	39.4	43.0	40.0	35.6	27.4	23.0	-	43.0
Rousse	19.8	22	29.8	34.6	37.7	38.6	40.5	42.5	41.9	36.2	28.0	22.6	-	42.5
Silistra	19.1	21	31.4	34.8	36.4	37.7	38.2	41.0	38.4	35.2	27.7	21.5	-	41.0
Mean monthly minimal air temperature														
Svishtov	-5.5	-3.1	1.5	7.7	12.9	16.4	18.2	17.4	13.4	8.2	3.8	-1.8	-	7.4
Rousse	-5.5	-3.0	1.6	7.5	12.6	16.1	18	17.2	13.3	8.2	3.5	-1.7	-	7.3
Silistra	-4.9	-2.8	1.2	6.7	12	15.5	17.5	16.7	12.9	8.1	3.8	-1.3	-	7.1
Monthly and annual absolute minimal air temperature														
Svishtov	-28	-25.5	-14.2	-1.8	3.5	7	11	6.8	2.7	-2.7	-16.5	-22.5	-	-28
Rousse	-27.7	-26.4	-18	-2.8	2.4	6.6	9.1	9.0	0.8	-3.5	-11.7	-19.5	-	-27.7
Silistra	-32	-23.1	-12.7	-3.5	1.0	5.5	10	4.9	1.0	-4.2	-13	-22	-	-32
Mean monthly 24 h amplitude of air temperature														
Svishtov	6.0	7.1	8.6	10.4	10.5	10.3	10.9	11.3	11.1	9.9	6.7	5.5	-	9.0
Rousse	6.5	7.5	9.2	11.3	11.5	11.4	12.0	12.6	12.4	10.9	7.4	6,0	-	9.9
Silistra	6.1	7.1	8.7	10.6	10.9	10.8	11.3	11.9	11.5	10.1	7.1	5.9	-	9.3

The mean meteorological data recorded over many years has established that during the winter season for the regions of the studied sites temperature fell below 0 ^{0}C Celsius. The lowest temperatures for the country were recorded during the winter - January was the coldest month (-1.4 ^{0}C to - 1.8 ^{0}C). The warmest summer month was July with mean temperatures 22.8 - 24.1 ^{0}C.

In the Danube region autumn is warmer than spring. High annual amplitude was also measured in Svishtov (25.5 ^{0}C) and Rousse (25.6 ^{0}C), which is typical of continental climate. The regime and duration of the periods with mean 24 h temperatures above 5,10 and 15 ^{0}C is extremely important for the development and growth of forest vegetation, shrubs and grasses. So are the total temperatures for the separate thermal boundaries.

The duration of the period including the days with air temperature above 5 ^{0}C is almost 8 months, while the active vegetation period with average 24h temperatures above 10 ^{0}C were 6 to 7 months. The third period with mean night air temperatures above 15 ^{0}C is a period of ripening, i.e. lignification of tissues of forest vegetation, which continues between 5 and 5,5 months.

When assessing temperature the respective average final date of the last spring and the first autumn frost is of particular significance (table 3). Also the dates of the last spring or beginning of the first autumn frost are important.

Table 2: Frost-free period (Climatic reference - Vol.3, 1983)

Station	Last frost			First frost			Average duration of frost free period in days
	Earliest date	Average date	Latest date	Earliest date	Average date	Latest date	
Svishtov	4.III	28.III	27.IV	7.X	11.IX	2.XII	227
Rousse	5.III	24.III	19.IV	13.X	14.XI	27.XII	234
Silistra	4.III	29.III	18.IV	10.X	10.XI	8.XII	226

III.2.1.2. Rainfall

Rainfall is an important climatic element, affecting the purity of the atmospheric air, the quantity and quality of waters. The specific geographical features, the transfer of air masses and their transformation is reflected in the type of rainfall, the quantity of rainfall and its distribution. The average annual total of rainfall for the studies region (500 mm - Silistra, 543 - Svishtov, 586 - Rousse, 611 - Tutrakan) is below the average for the country (640 mm).

The maximum for the total of rainfall for the Danubian region is June. Drought sets in August-September, which is decisive for the early cessation of vegetation in tree vegetation.

The quantity of rainfall along the Danubian region is lowest in comparison with the remaining part of the country.

The regime of rainfall along the Danube banks has a marked continental character. The maximum is in June, the minimum in February.

From a climatic point of view the Danube region belongs to one of the driest parts of Bulgaria. Rainfall is on average about 84-86% of the average rainfall for the country.

In July and August there is string fall in the level of the water in the Danube and the summer heat sets in, resulting a radical change in the ecological situation. For the vegetation period the average total of rainfall is 318 mm and the average number of days with rainfall is 37. This the most marked continental climate in Bulgaria, typical for the Danubian plain.

Table 3: Rainfall

	Svishtov station	Rousse station	Silistra station
Mean quantity of rain per year in mm	540	562	520
Mean monthly total of rain during the vegetation period in mm	51.31	54.35	48.53

Table 4: Mean monthly total of rainfall mm/m^2 (Climatic reference - rainfall)

Station	Months												winter	spring	sum-mer	fall	Per year	Veg.. per
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
	Vegetation period																	
Svishtov	39	32	35	48	67	70	51	37	37	39	44	44	115	150	158	121	543	51.31
Rousse	44	36	39	52	64	80	60	45	37	36	46	46	125	155	187	119	586	54.35
Silistra		43	38	50	70	72	58	53	46	39	53	50	105	122	159	113	500	48.53
Tutrakan*	40	43	38	50	70	72	58	53	46	39	53	50	132	158	183	138	611	55.42

**Reduced period of action*

The average monthly distribution of rainfall quantities is important from an economic and ecological point of view. The highest quantities of rainfall is in June, July, and May, the lowest rainfall in February, September, March and October.

III.2.2. SPECIFIC PHENOMENA AFFECTING THE ENVIRONMENTAL SITUATION IN THE DANUBE LANDS AND THE THEIR VEGETATION

The icing of the river Danube is the result of the temperature fluctuation characterized by great phase instability both in time and duration. Ice flow is observed in December and March – freezing of the river in December and February and melting and clearing of ice in January and March.

Ice persists for 91 days and the ice flow lasts 74 days. The average annual probability for the occurrence of ice in the Bulgarian section is 82%. A significant influence on ice formation is the specific location of the Iron Gate section, where the river bed is narrowing and the ice flowing from the middle section of the river Danube is arrested before the sluice facility, causing the formation of new ice in the lower section of the Danube under local conditions and reduced speed of the river flow. During intensive melting flooding occurs along the Bulgarian side of the riverbank, which is caused by the water inflow formed in the upper and middle section of the Danube. Within the period of 8 days on average after the ice melts, the river Danube is cleared from ice.

Another hazardous natural phenomenon typical of the Danube region is landslide processes. During the dry summer and autumn period landslide along the Bulgarian bank of the Danube normally lose their intensity and new landslides develop after the rapid snow melting. The majority of landslides along the Danube bank originate from the past, whereas the newly formed ones appear less frequently. Linear-bloc and circus type landslides are predominant. They are located in terraces mainly in the high and medium portions of the Danube bank. The great length of the river and its watershed with an area equal to 1/12 part of Europe are responsible to a great extent for the extremely specific environmental character of its neighboring lands. Meteorological phenomena occurring far from Bulgaria (snow melting in the Alps and Carpathians, rainfalls in Central Europe) cause frequent and prolonged inflows of tremendous water volumes, resulting in typical inundation in summer and later periods, creating almost everywhere optimal condition for the settling and growth of water-loving vegetation, the reproduction of thermopile species of fish, and feeding and reproduction of waterfowl. The river's impact on the microclimatic charac-

teristics of islands and riverside areas is particularly strong. An immense amount of gravel and sand regularly carried by the river's waters are settling when encountering even the smallest obstacle in their way. Sometimes settled sediments create a small island that might exist for only one season or several years.

III.2.3. SOURCES OF ATMOSPHERIC POLLUTION AND THEIR POTENTIAL IMPACT ON THE PROJECT AREA.

Sources of air pollution in the region of the island of Belene are located in the Bulgarian cities of Nikopol and Svishtov, and the Rumanian cities Turnu Măgurele and Zimnicea. Due to the predominant west winds the most significant pollution source is the nitrate fertilizer plant in Turnu Măgurele (about 25 Km. to the west) with major emissions of nitrate oxides, ammonium, and sulfuric dioxide. The other major pollution source is the Sviloza chemical plant in Svishtov, 4 Km. to the east with most hazardous emissions of mercaptans and other organic compounds, is not of great significance because of its considerably reduced production and the less frequent east winds. Almost entirely out of operation are the industrial enterprises in the Bulgarian city of Nikopol.

The industrial enterprises in the biggest Bulgarian city of the Danube – Rousse (about 35 Km. to the southwest) are influencing the second project are – Kalimok – Brushlen, as well as the Romanian cities of Giurgiu (about 35 Km. to the southwest) and Oltenița (8 Km. to the northeast).

As mentioned above, west winds are predominant in the two regions. No specific studies of the transport of pollutants (particularly nitrogen and phosphorus) by the atmosphere and rainfalls into the water have been made in these parts of Bulgaria. Thus the amount of nitrogen in particular, falling out into the surface waters through atmospheric settling is unknown. Moreover, a source of serious air pollution with ammonia nitrogen exists in the region of the island of Belene – the fertilizer factory Turnu in the town of Turnu Măgurele in Romania. No data concerning the impact of acid rains in both regions could be found.

III.2.4. POSSIBLE PROJECT IMPLEMENTATION RESULTS

We believe the restoring of wetlands (marshes) in the two territories (no matter which one of the alternatives) will lead to a certain microclimatic change: reducing heat in summer and some increase of air humidity. This change will be insignificant and will be manifest in a very narrow area in the immediate vicinity of the wetlands.

During the construction period certain amounts of dust and waste gases from the machines will be generated. At the present stage of the study no exact estimation of the emissions can be made. However, these would not represent a serious risk for the local population, biodiversity and infrastructure.

It is not clear to what extent the atmospheric deposition of pollutants and nutrients (nitrogen and phosphorus) will influence the restored wetlands. This will be taken into consideration in design of the monitoring system – to monitor of nitrogen and phosphorus balance within these ecosystems.

III.3. SURFACE WATER AND GROUND WATER

III.3.1. THE RIVER DANUBE

The river Danube is second biggest in Europe. Its springs from the Schwarzwald mountain and is 2850 km. long. It flows through Germany, Austria, Slovakia, Yugoslavia and into the Black Sea forming a delta.

Major tributaries in the region of Bulgaria are Lom, Ogosta, Iskar, Vit, Osam, Yantra, and Roussenski Lom. Bulgaria and Romania are located in the southeastern part of Europe, around the Black Sea, i.e. in the lower stretch of the river Danube. Their common border is 631.3 km long, of which 420 km along the midstream of the Danube.

The two states experience intensive pollution of the Danube water, which is generated at its upper sectors.

The Danube hydrographic area includes 49630 km^2 or 42.3 % of the territory of Bulgaria.

Main tributaries - water catchment areas: Ogosta - 3154 km^2; Iskar - 8646 km^2; Vit - 3225 km^2; Osam - 2824 km^2; Yantra - 7869 km^2; Roussenski Lom - 2974 km^2.

Surface waters are affected by factors, such as the afforestation, amount of precipitation, and the anthropogenic impact on nature.

The zone adjacent to the Danube consists of flooded low lands and plains - 10 - 12 km. It has a moderately continental climate. Precipitation is 673 mm on the average ranging from 450 to 1200 mm. Hydrological conditions are subject to a considerable anthropogenic impact.

The level mode of the Danube is very complicated as the river flows through different climatic zones and along its route receives tributaries with varying characteristics of supply. In its upper sector, the river Danube is fed by water originating from alpine glaciers and rainfalls. In its middle section the river receives waters from the big rivers Tisza, Sava, Drava and Morava, which have a significant influence over the Danube. In the area of the lower Danube all rivers springing from Stara Planina and the Danube lowlands flow into the river. Due to intensive snow melting the outflow maximum in the Bulgarian section of the river is in April. The abundant supply from rainfalls during the following months in the upper and middle sections of the river brings about an increased monthly outflow also in May. After May the outflow is reduced. The maximum outflow with a probability of an increase of 1 % is about 18000 m^3/sec.

The minimum outflow of the river Danube in the lower Danube basin is changed by 2379 m^3/sec at Silistra. This slight increase of the minimum outflow can be explained by the greater subterranean supply of alluvial waters in the widely developed inundation terrace of the river Danube at its lower section. Despite the fact that the Bulgarian riverbank is higher than the Romanian one, in the event of a more significant increase of the river level floods occur and in order to prevent them many protective dykes have been built along the Bulgarian bank of the river.

Table 5: Average duration of inundation (in days)

Hydrometric Station	At km.	Elevation base of water level recording	Average level in cm.	Meters above the average level					
				0 (average level)	+1	+2	+3	+4	+5
				Average period of inundation					
Svishtov	554.3	15.10	357	179	117	61	24	6	0
Rousse	495.6	11.99	387	179	118-115	61	25	4	0
Tutrakan	433.0	8.99	367	-	-	-	-	-	-
Silistra	375.5	6.50	343	183	115	57	17	1	0.0
Average for the Bulgarian river bank				178±0,9	112±1.4	56±1,6	21±1,0	2±0,4	
Standard deviation				± 3.4	±5,2	±6.2	±3,8	±1,6	
Variation coefficient (VC,%)				± 2,0	±4,6	±10,7	±17,2	±80.0	

Statistical Accuracy				1.000	1.000	0,920	0,730	-	

Table 6: Duration of inundation

Section of Danube	Meters above the average level						
	-1	0	+1	+2	+3	+4	+5
Average period of inundation							
Annual							
Novo Selo-Silistra	250	178	112	56	21	2	0
Vegetation period							
Novo Selo-Silistra	137	102	67	36	14	2	0

III.3.2. SEDIMENTS (ALLUVIA)

Of particular interest are the sandy fine-grade sediment strips along the riverbank and the mainland. They settle every year from the flowing waters and are formed below and around the average level. After the flow-off these strips are covered by self-sprouting willows and are elevated each year increasing the area of the islands.

The areas of ditches along the river dyke are inundated according to their depth. However, the water stays still for a longer period.

Soils are of alluvial character and morphology with a variable mechanical composition of the alluvial layers (at the surface the mud mechanical fraction is always predominant). The mode of water inundation results in a variable character of the alluvial materials and their size. In the zone of lasting inundation and in the lowest sections of the terrain fine-grade mud-like alluvia are settling. In the zone of inundation of medium duration and in the medium-level parts of the terrain medium-sized sandy and slimy alluvia and in the zone of brief inundation and in the highest terrain sectors - the coarsest grained sandy alluvia. The formation and distribution of the soils typical for each inundation zone corresponds to this mode of settling.

III.3.3. GROUNDWATER

Along with relief and water inundation, groundwater is the third significant factor determining the soil water mode as an element of the habitat of vegetation along the Danube basin. Studies have shown that groundwater are highest (about 100-200 cm from the surface on the average during the dry summer period) in the zone of long-lasting flooding and wet meadow soils; they are medium (about 250-300 cm from the surface) in the zone of medium-duration water inundation and alluvial-meadow soils; and lowest in the zone of short period water inundation and alluvial soils (about 400-450 cm from the surface on the average). Groundwater in the highest riverside sections of the terrain, and respectively with the carbonate black-earth soils practically does not occur. On the other hand, the capillary rising of soil humidity originating from the groundwater reaches the surface in the first case, up to 50-60 cm from the surface in the second, and 80-150 cm in the third case. Movement of humidity in depth down to 30 - 60 cm was found during the dry period depending on the soil type. A source of this descending humidity are rainfalls and the residual moistening of the surface soil layers after the flowing off of the inundation waters.

A detailed hydrogeological study to take place during the project phase is absolutely required. It is very important in order to evaluate the risks for ground water impact on agricultural land, risk areas, possible marshes and salination of soils.

III.3.4. SOIL HUMIDITY

The soil humidity in the habitat resultant of the inundation along the Danube riverside during the dry summer period of the vegetation season is considerable. However, as a consequence of the

two-way movement, the humidity within the different soil types has its own specific characteristics. Alluvial soils are fresh and moderately humid. Humidity in the surface layers is about 24.23 % and decreases to 10.03 % on the average in the lower layers, increasing anew in depth to 18.15 % on the average. Alluvial and meadow soils are characterized as ranging between fresh and humid and have a water mode similar to that of alluvial soils. Moisture content in the upper humus layer may reach 14.26 % on the average and increase again in depth to 16.11 % on average. The highest wetting occurs in meadow and swampy soils. Unlike the first type, it changes slightly in depth (from about 32.41% to 28.33 %). Carbonate black earth soils are least moistened during the dry months of the vegetation period. The content of soil moisture is evenly distributed along the soil profile - from 6.10 - 7.03 % to 9.68 - 16.03 % on average.

Taking into account the soil moistening mode and the specifics of water inundation, the conclusion might be drawn that terrains in the zone of medium inundation are fresh to humid, whereas those in the zone not subject to inundation are dry.

III.3.5. WATER QUALITY AND POLLUTION SOURCES

The sites in question are located on the banks of the Danube. The Danube river meets the Bulgarian water quality standards (Regulation № 7/1986 and Order RD-272/03.05.2001 of the MoEW on Classification of Surface Water Bodies in Bulgaria. All data from the recent years (National Eco-Monitoring System, International Program on the Danube) have shown certain trends toward improvement of the quality of water in the Danube. This is mainly due to the economic crisis in both Bulgaria and Rumania. The monitoring points nearest to the Belene island are near the town of Nikopol (upstream of Belene island) and near the town of Svishtov (downstream of Belene island; the only monitoring point in serving the Kalimok-Brushlen area is the one downstream of the town of Rousse. The monitoring points near the town of Svishtov and downstream of the town of Rousse are part of the international Danube monitoring network. For example, the concentrations in 1999 measured for the main parameters in both these points are as follows (in mg/l): suspended solids (SS) 18 – 38, ammonia ($N\text{-}NH_4$) 0.01 – 0.28, nitrate ($N\text{-}NO_3$) 1.0 - 2.59, phosphates ($P\text{-}PO_4$) 0.08 – 0.36, total phosphorus (P) 0.14 – 1.36, BOD_5 2.55 – 5.4, COD (Cr) 10.7 – 21.5. It can be seen from this data that the quality of water in the Danube is in a good condition. However, the biggest problem for the quality of water remains the accidental pollution – mainly oil spills and, less frequently, accidents such as the cyanide pollution of the river Tissa and of the Danube from the Rumanian mine Baya Mare.

III.3.6. POLLUTION SOURCES AFFECTING THE PROJECT AREAS

III.3.6.1. Belene Island

There are no significant pollution sources directly affecting both project areas. For the island of Belene these are the manure volumes from sheep breeding farms (400 sheep and 200 lambs) property of the prison, which are openly deposited on the terrain. They are located in the neighborhood of prison facility No. 2, situated between the three marshes: Martvoto, Peschina and Doulyova Bara. This is organic pollution source, which should be taken into account in the planning of restoration works. The remaining waste waters originating on the island from a cattle-breeding farm (200 cattle), household sewerage from the prison, diffused pollution from agricultural areas etc. including a small number of goats (55 goats), rabbits (100 rabbits) as well as ducks (100 ducks) discharge directly or are filtered through drainage channels connected to drainage pumping stations Persin 1 and 2. Considerably greater concentrations of nitrogen and phosphorus were found during a study of discharge channels undertaken by our team at both pumping stations. A potential source of nitrogen compounds pollution for the island of Belene is the fertilizer works in Turnu Măgurele. According to data provided by the Environment Executive Agency, Sofia, considerable pollution of the Danube water was registered during the year 2000. The indices were: Nitrogen Ammonia ($NH_4\text{-}N$) - 21.7 mg/l; Nitrogen Nitrite ($NO_2\text{-}N$) -

0.15 mg/l; Nitrogen Nitrate (NO_3-N) - 19.7 mg/l. These values were very high for a river with the size of the Danube, which made the Ministry of the Environment and Water Resources submit a Note of Protest to the Romanian government. Despite this heavy loading of the river with nitrogen, due to the massive dilution of the Danube waters and the distance of more than 20 km (self-purification processes) we consider the fertilizer works in Turnu Măgurele to be only a potential source of nitrogen pollution. High nitrogen and phosphorus concentrations in the river Danube have never been found in the area of the island of Belene itself. The monitoring station at the city of Svishtov (some 10 km downstream from the island of Belene) to the International Program for the river Danube has not been included in the analysis as we believe that the data are not representative for the project territory because of the fact that the station measures and records the impact of the city of Svishtov, the Sviloza chemical plant and pollution resulting from the Svishtov port.

III.3.6.2. Kalimok and Brushlen

The only pollution sources on this territory are diffuse and related to agriculture (growing of maize, tobacco, etc.) and extensive stock breeding (goats, cattle, sheep). It should be noted that no problem of excessive use of fertilizers exists in the country and both project areas. This is a result of the economic crisis and the high price of artificial fertilizers. Potential pollution sources can be the cities Rousse and Giurgiu. Their impact is local in principle and does not approach the project territory because of the great dilution and the self-purification processes. The pig farm at the village of Brushlen is not functioning at present, but if it is again put into operation, it might affect the project territory, because of the discharge of partially treated waste water in the river Danube (only mechanical treatment is applied).

III.3.7. AMBIENT WATER QUALITY

The state of water quality in the Danube is established by a database of the National Monitoring System, as well as water research data, related to a number of studies, programs, projects (local and international) etc.

The studies on water quality of the Danube are also subject of a number of international programs and projects. The objectives and criteria in the sphere of water quality of the river Danube are currently in a realization stage in accordance with the Danube River Protection Convention.

Bulgaria and Romania were the first countries along the river Danube to start in 1996 exchange of data on the quality of the river Danube water in line with international standards.

The activities within the framework of the Bucharest Declaration (1985) are related to the Program for the Environment in the Hydrographic Basin of the Danube from 1991 The activities include a development in stages of a transnational monitoring system on the Danube, a guaranteed quality of the data - international intercalibration programs, putting into operation of a system for public information about any accidental pollution.

The water quality of the Danube River meets the Bulgarian environmental standards. Nevertheless, the major problems of the river Danube are related to the fact of introducing great amounts of nutrients (nitrogen, phosphorus, etc.) leading to algae 'blooms' in the river and in the Black Sea.

A number of local pollution sources exist along the river Danube, the so-called hot spots, creating a risk for disturbance of the environmental balance in individual stretches of the river, pollution with toxic substances in the bottom sediments, suspended solids, water organisms, etc. Point sources along the Bulgarian section are the sewer systems discharging industrial and household wastewater of individual towns and villages. In the area of Belene Island such are found in Svishtov (industrial plants including the Sviloza chemical plant and household waste waters), in

the area of Kalimok-Brushlen, wastewater from Rousse (oil refinery, power station, food industry, leather, textile, machine building companies etc), as well as household waste waters and sewer systems for waste water from Tutrakan (industrial and household wastewater), as well as from Silistra - industrial plants including LPK Silistra (fiberboard production), the food industry and household waste water.

Diffuse sources of pollution (mainly organic substances and nutrients): stockbreeding farms, (cattle, pig, sheep, etc.), fertilizing with nitrogen and phosphorus of agricultural land, erosion, air pollution resulting from nitrogen emissions from power plants and household heating.

The military conflict in Yugoslavia, the environmental crisis caused by cyanide pollution from the Baya Mare mine in Romania, increased the public interest in the environmental problems of the river Danube and led to the undertaking of a number of complex studies of the water in the individual sections.

The state of emissions along the river Danube at present and in the area of the considered projects has been determined on the basis of drawing up inventory lists, analyses and evaluation of the existing information about the state of the water of the river Danube.

Data on the state of the river Danube at the stations of the national monitoring system: the river Danube after Svishtov, Rousse, Tutrakan and Silistra.

Regular observations of the qualitative and quantitative characteristics of the river water along the Bulgarian bank of the river are made by means of the stations for observations and control, which are part of the national system for environmental monitoring. Aimed at assessing the background state of the river waters and their alteration as a result of antropogenous or natural impact. The monitoring stations regularly measure 24 physical and chemical water quality determinands (pH, BOD_5, dissolved oxygen, oxygen saturation; COD, dissolved solids, suspended solids, conductivity; sulfate ions, chlorine ions, ammonia-, nitrite- and nitrate nitrogen; phosphates etc. In some of the stations a number of specific indicators are measured in addition, namely: metal ions, oil products, detergents, pesticides, etc.

The assessment of surface water quality is carried out on the basis of Regulation No. 7/1986.

In addition to the physical and chemical monitoring, biological surface water monitoring is also undertaken. An express technique is applied, related to determining of macro-invertebrate indicator taxa according to a five-degree scale, recording the result of the integral impact of pollutants on the basis of bio-indicators leading to lasting alterations of water quality for a long period of time.

The investigation of bottom sediments reveals a high presence of metal ions.

- The water and sediment quality of the Danube river were assessed by an expedition working from the 3 July to 13 July 2000 – organized by the Executive Environmental Agency under the Ministry of Environment and Water. The main objectives of that study was:
  - To assess the nutrients (nitrogen and phosphorus) in the river water as well as the general physicochemical parameters (dissolved oxygen, pH, electrical conductivity, and transparency).
  - To analyze of the heavy metal content in the bottom sediments and water samples in those river sections where such pollution is to be expected.
  - To analyze the heavy-metal bioaccumulation in fishes.
  - To survey rare waterfowl colonies on islands in Bulgarian territorial waters.
- A field study of waters in areas of the project areas - August 2001

Integrated studies were conducted in the project areas. Water samples from individual points in the project areas were studied between August 3 and August 6, 2001. The results showed that the remaining wetlands feature frequently deteriorated environmental conditions with frequently occurring hypoxia, blooming of algae and high content of nutrients as compared to the Danube. The present marshes are subject to severe degradation.

The results of the study are presented in Appendix No. 7: Physical and Chemical Analysis of Water Samples

III.3.8. ANALYSES AND DATA EVALUATION

III.3.8.1. Water quality

Physical and chemical parameters - All of the studied physical and chemical indicators (pH, conductivity, temperature, dissolved oxygen, oxygen saturation, COD, BOD_5, Ammonia nitrogen (NH_4-N); Nitrite nitrogen (NO_2-N); Nitrate nitrogen (NO_3-N) and orthophosphates (PO4) at the stations in Novo Selo near Silistra do not exceed the Maximum Permissible Levels (incl. the areas of environmental assessment) of the emission standards set forth in Regulation No. 7 (State Gazette, No. 96/12.12.1986), and meet the requirements of the planned 3rd class with the exception of ammonia nitrogen, which is sporadically exceeded in individual stretches. The results of the studies of the Bulgarian section of the river show a negligible influence of the tributaries on the Danube River water quality along the Bulgarian part. The pollution impact of Bulgarian tributaries is very low because of a big self-purification capacity of the Danube.

- Water samples analyzed in terms of indicators, such as: cadmium (Cd), lead (Pb), copper (Cu), Zinc (Zn), arsenic (As), chromium (Cr), nickel (Ni), iron (Fe), manganese (Mn), cobalt (Co) along the entire river Danube were found to be many times below the maximum permissible levels of surface waters according to Regulation No. 7.

- **Sediment quality (bottom sediments)** The following sediment parameters were analyzed (all-round study of EEA in 2000, for the following metals):

  - Lead (Pb) - Values exceeding 20 mg/kg (3-4 times) were recorded along the entire length of the river Danube including the sections after Nikopol, Rousse and Silistra.
  - Copper (Cu) - Values exceeding 20 mg/kg (2-8 times) were recorded in the middle of the Danube River including the sections after Nikopol, Rousse and Silistra.
  - Zinc (Zn) - No cases of values exceeding 500 mg/kg were registered.
  - Manganese (Mn) - Values exceeding 500 mg/kg were registered in the river section after Nikopol - Turnu Măgurele and Silistra (up to 1.75 times the target limit).
  - Chromium (Cr) - Values exceeding 3 times the standard of 20 mg/kg were found after Nikopol - Turnu Măgurele and Silistra.
  - Nickel (Ni) - Nickel values exceed 20 mg/kg and reach the maximum value - 66 mg/kg at Silistra.
  - Cadmium (Cd) - Values exceeding 3 times the standard of 0.5 mg/kg were recorded in the river section after Nikopol - Turnu Măgurele and Silistra.

A conditional comparison with average values set forth in line with the International Danube Program was made concerning the indicators along the Bulgarian section of the river Danube and the study conducted by EEA.

Results of measured indicators show excessive amounts of Pb, Cu, Zn, Cr, Ni, and Cd in sediments.

Conclusions

- The waters of the river Danube entering Bulgarian territory are carriers of a considerable volume of pollutants.
- The main sources of pollution in the Bulgarian section of the river Danube are related to transboundary pollution - the Timok river polluted by the Bor mines in Yugoslavia, the Turnu Măgurele fertilizer plant opposite Nikopol, etc.
- Certain slight rise of the level of predominantly organic pollution is found on the Bulgarian bank of the river after the sewerage discharge of towns and villages including Svishtov, Rousse, Tutrakan and Silistra, carrying pollutants from household and industrial wastes, as well as the inflow of the Iskar and Yantra tributaries.

III.3.9. TRANSFORMATION OF WATER POLLUTANTS

The concentration of polluting substances changes as a result of hydrodynamic, physical and chemical, biological and biochemical processes taking place in the receiving river. An important part is played by the oxidizing and restoring processes, absorption and desorption, and the formation of insoluble compounds. The transformation processes of organic compounds are an important factor influencing the state of water ecosystems. As a result of self-purification processes, organic substances undergo qualitative changes, which are mostly harmless. Biochemical oxidation of organic substances takes place in two phases: carbon -dioxide and nitric. During the first phase, organic compounds of carbon dioxide are decomposed and during the second one processes of decomposition of organic nitrogen - ammonification and nitrification take place as a result of the functioning of heterotrophic bacteria. Nitrification is a process of biochemical ammonia ions being oxidized to nitrites and nitrates by autotrophic microorganisms. In the absence or presence of a minimum content of oxygen in the water, denitrification processes may develop. Intermediate products are nitrites and nitrogen oxides, of which N_2O is mostly emitted in the air. Nitrates are usually reduced to molecular nitrogen.

The non-transparency of water has a considerable impact on the primary occurrence of denitrification processes.

The dynamics of nutrients depends on both the seasonal alterations and their content in the river waters. Nitrogen reduction in wetland zones can be assessed after the processing of a sufficient amount of information which will be collected from own monitoring data during operation in wetland zones.

The expected reduction of nitrogen pollutants in the waters of the river Danube resulting from the wetlands restoration is insignificant.

Phosphorus is found in water areas mostly in the form of inorganic phosphorus compounds. Organically bound phosphorus occurs in dissolved state as phosphate in the organisms or sediments. Bacteria and plant organisms as a phosphorus source use dissolved inorganic phosphate compounds in the form of dissociated ions. Dissolved and organically bound phosphate is turned in orthophosphate during the process of phosphatization. In many instances the absorption of organic carbon compounds in the river ecosystems can be realized only in the presence of nitrogen and phosphorus.

Phosphorus reduction in wetland zones is expected to be minimal in terms of its contribution to the reduction of the total volume of nutrients in the waters of the Danube.

III.4. WASTES

Household, building, industrial and hazardous wastes are generated on the territory of the considered areas:

- **Household waste** (code 20.03.01) generated by visitors to the area, by the human settlements, the prison in Belene (the island of Belene), workers during the construction and development of the wetland zones, etc.

In the studied territory there is no waste landfill. Unofficial dumping sites exist close to settlements on the borders of the examined territory. A pig-breeding complex has its own waste use facilities, which however require additional study.

- **Construction waste** (code 17.07.01) mixed

In the course of construction in the wetlands buildings are envisaged to be pulled down. Equipment from pumping stations will be dismantled together with power lines to pumping stations, At this phase of study the quantities of building material have not been established, as the alternative for flooding has not been chosen. Neither have landfills for construction waste been determined. All alternatives envisage a large amount of digging and excavation work. This will result in large quantities of construction waste and vegetation residues waste. The landfills for this waste have not been decided yet, neither the quantities of excavation work.

- **Production waste**

Construction waste will be generated in the course of construction operations from the maintenance of the machines and facilities. It would consist of:

- Metal parts of the iron for reinforced slabs; machine parts; parts of steel ropes etc. They will be gathered in containers and given to licensed companies for regeneration.
- Worn-out automobile tires (code 16.01.03) - worn-out car tires are gathered in containers and sent for regeneration.

- **Hazardous waste**

Hazardous waste will be generated in the course of construction work by building machines and transport vehicles.

- Used lubricants and oil products (code 13.01.00) - the change of oil will be done in a mechanical workshop and given to a licensed company for regeneration.
- Exhausted batteries (code 16.06.01) will be sent to a licensed company for regeneration. The quantity of hazardous waste is minimal.

III.5. LANDS AND SOILS

According to the geographical classifications the studied territory falls in the Carpathian-Danubian soil region, the Lower Danubian soil subregion with the Danubian Dobrogea (Dobrudzha) province.

The soil formation process in flooded riverbanks and islands runs over the sediments of the river and under the influence of moisture hydrophilic tree vegetation, shrub vegetation and graminous vegetation. Water flooding and subterranean waters exert adecisive impact on the formation of soil with an intrazonal character of the range. In accordance with this the Danube banks and the islands have formed the following soil types: alluvial types, alluvial meadow types, meadow-swampy types with different transitions between them as well as carbonate smolnitza (vertisols, FAO).

III.5.1. TYPES OF SOILS

According to the Legend of soils of FAO (1988,1990) the following types of soil occur on the island of Belene and the Kalimok-Brushlen complex:

III.5.1.1. Order - soils, not connected with zonal climatic conditions.

Fluvisols (FAO, 1988) (formerly referred to as alluvial soils)

Fluvisols are in an initial phase of soil formation, have only an A horizon, below it lie sedimented layers of sand. In the development of a soil profile they evolve in chernozem or smolnitza (Mediterranean black soil). Alluvial soils are mineral and are characterized by lithological layers and an uneven distribution of the humus in depth in the section.

Specific features:

- They are always found in the flood plain and the first terrace above of the river;
- They have shallow groundwater, from 1 to 3 m. deep, depending on the river regime;
- They are subjected periodically to flooding and further sedimentation with a new alluvium;

In their mechanical composition they are sand-gravel to slightly clayey. They are light, well aerated and with good humidity from the adjacent groundwater and are easy to cultivate. The carbonate content in these soils varies widely and is linked to the origins of deposit.

The soil reaction is acid pH in water 5.0, which for such ozonal soils is due to chemical pollution. Their great filtration capacity is a condition leading to the possibility for quick pollution, above all of waters. This calls for the need of special monitoring for the introduction of a sanitary regime.

The humus layer is between 30-50 cm thick. Its content varies between 1.5 to 6% in the virgin soils, and 1 to 3% in cultivated soils.

According to their suitable for agriculture they fall in a high class - Class S_1. According to their humus content in the surface horizon they fall in Class 3 medium humus content with 60 bonitet points, bonitet category 5, soil which are used for all types of crops in the given climate.

These features make them suitable for agriculture and vegetable production, horticulture and pastures. Their high filtration capacity allows quick pollution, above all with waters and dissolved fertilizers, pesticides, applied in agricultural production, together with pollution from transport, industrial pollution, etc.

Forest vegetation properties Alluvian soils are suitable for some tree species, which make highly productive river-edge forests. Under natural conditions meadow vegetation can grow, together with water vegetation such as *Festuca pratensis, Poa sylvatica, Lollium perenne, Plantago lanceolata, as well as Salicaceae, Alnus glutinosa, Ulmus campestre, Populaceae* etc. The high productivity of these soils is due above all to the favorable water regime.

Gleysols (FAO, 1988)

These are soils, which have a heavy excess of water. They are found in the lowest points of the microrelief in the area of the river banks and the drained marshes along the Danube, terrain which have no drainage, and the zone of no movement in the river water accumulation. They are characterized by a well-shaped genetic and morphological profile. Vegetation detritis decomposes slowly, and the mineral part of the soil is the place of chemical reduction processes. The high groundwater table determines a process of transition toward gleysols along the entire depth

of the whole profile. The mechanical composition is heavy, with large grain and fine grain mechanical fraction prevailing. The humus horizon is always with clay and varies in thickness from 35 to 135 cm. The humus content in the upper horizons reaches about 3.70%, the nitrogen content up to 0.35%. Humidity is evenly spread and changes greatly at depths - on average from 31.41 to 28.33 %. Subterranean waters are highest; on average about 2.2 m to 2 m from the surface throughout the drought summer period.

Marsh soils fall in the bonitet group of land not suitable for amelioration, bonitet category 10, with a bonitet ranging from 0 to 10. When these soils are subject of complex melioration, they can be attributed to bonitet category 6, III bonitet group - quality land.

From an ecological point of view marsh soils are a component of the richest dryland ecosystems. With the existing water regime they are not suitable for agriculture. Amelioration greatly changes their character and the results are frequently unfavorable.

Forest vegetation features - they have a high potential and small yield. These soils have many nutrients in a form, which cannot be used by plants and an excess of water. Their potential cannot be realized owing to the absence of air. With the draining of the marshes, these soils become very fertile. Poplars and willows grow very well on the site of the former wetlands along the Danube and have high productivity.

III.5.1.2. Order - soils with visible surface accumulation with basic organic material.

Vertisols (FAO, 1988,1990) – smolnitza, chernozem

Vertisols are characterized by a considerable mezo- and macro fauna (earthworms, insects, etc), their profile has a wealth of passages, and at depths over 1,5 m in horizon C it is the place of dwellings of small mammals, filled with material from horizon A. Their structure is from grainy to large grain aggregate along the whole structure, has a specific form of sedimentation of hard concretions and pseudo-mycelium.

The mechanical composition of the humus horizon is lightly sandy-clayey. It has a good structure and porosity from 64% to 46%. A regular increase in its clayey occurs from the Danube. The humus layer is between 60 cm and 86 cm thick. The soils are rich in nutrients. Humus content is on average up to 2.53% in the horizon, N content up to 0.14%. Soil reaction varies from a weak acid to alkaline pH >6. Vertisols have the capacity to retain humidity and have water reserves, which provide plants with water to the end of the summer, when irrigation is necessary.

According to their suitability for cultivation they fall in the Class high S_1 and good S_2, erosion control function, carbonates and deflation. According to their humus content in the surface horizon they fall in Class 3 - middle humus with 7--90 bonitet points, bonitet category 2-3. These soils are used for all types of crops in the Bulgarian climate. Vertisols are fertile soils, suitable for the growing of wheat, barley, maize, sunflower, and pulses.

Protection of vertisols requires anti-erosion measures, crop rotation, against water erosion and wind erosion, restoration measures and maintenance of their optimal structure, balanced use of fertilizers.

Forest vegetation features - the high carbonate content has a negative effect on the growth of forests. Soil fertility considerably in increased with the introduction of compost and other organic fertilizer and through irrigation. The shortage of acceptable iron, suitable for the vegetation comes from the blocking effect of calcium and is the cause of chlorosis which attacks *Robinia*, black locust (*Ailanthus altissima*), the hazelnut, the ash tree, the maple.

Alluvial meadow soils followed by alluvial soils and meadow swampy soils and a small amount of carbonate vertisols occur on the territory of Kalimok-Brushlen.

The separate soils are more or less over the same area on the islands. Meadow swampy soils, approximately 38% and alluvial soils - 29%.

III.5.2. THE EXISTING SITUATION

III.5.2.1. Belene Island

The lands on the eastern part of the island, which will be affected by the flooding, are chiefly woods, pastures and marshes. Another parts are field and part of the infrastructure of the prison. Also on the island there are livestock and pig farms. Pastures in the buffer zone of the reserve are used for grazing of sheep and cows. Part of the area has been afforested with hybrid poplars, which after reaching the necessary maturity are cut, and new plantations made. The western part of the island of Belene has fields and artificial poplar plantations.

The report should mention that these two areas are located in recently designated protected areas.

III.5.2.2. Kalimok-Brushlen

In the past the Kalimok and Brushlen marshes were entirely flooded together with the low-lying area around the river. The wetland zones periodically flooded marshes were 3500 ha. Generally the area was used for fishing and livestock breathing. Draining of the Danubian marshes began in 1952. The direct link with the Danube was cut and a system of dykes (begun as early as 1945) and drainage canals were built. Much of the flooded land became cultivated areas. Part of the earlier marshes remained as wetlands without a direct link with the Danube.

Fishponds, approximately 520 ha. began to build in 1981 around the Tutrakan marsh. Owing to financial problems, fish production ceased in 1993. At present the fishponds are closed. Part of the drained basins on the western side were cultivated, pastures are mowed, grazing of domestic cattle is done elsewhere.

South of the eastern part of the fishponds, which effectively constitute wet meadows, end in a marsh.

After 1990, only part of the irrigation and draining system is maintained which has led to the abandoning of agricultural land. Part of the area around the Brushlen marsh has a soil with excessive groundwater.

The area in the region fall into several categories - arable land; abandoned fields; meadows and pastures; forests; marshes and fens; an area occupied by canals, and roads; the terrain for fishponds etc.

Ownership over the land is mixed. There is state-owned land, land which is property of the municipality and private property.

The territory bordering on the marshes consists of private land and municipal land and is used for agriculture. The marshes fall in the state owned land and many of them are overgrown with reeds.

At present when the canals are being cleaned the sediments and waste products are heaped on both sides of the canal. There is no solution of the problem where they should be deposited. (Thus there is a need to identify a waste dump).

III.5.3. WATER REGIME OF SOILS

Flooding begins from the end of the winter period and continues to mid May - early June when the water reaches its maximum. The zones of continuous flooding consist of:

- A zone of continuous flooding - areas up to the 2 meter isoline measured from the mean level of the Danube. This is characterized by the flooding during the year, which lasts for the longest period - throughout the vegetation period when the waters do not move or move very slowly. This zone consists of 2 subzones:
  - The first flooding subzone, which includes the area falling up to the 1 meter isoline, measured from the mean level of the Danube. Flooding is continuous for 4-6 months and is characterized by stagnant water in closed terrain and the slightly sloping ground of the terrain.
  - Second flooding zone, which includes the area between the first and second meter isoline, measured from the mean level of the Danube. Flooding is continuous from 2 to 4 months. Drainage of water is slow through the lower lying gullies in the terrain towards the river. The soils are meadow swampy, as well as transitional soils towards alluvial meadow soils.
- A zone of flooding of medium duration - the third flooding terrace, which includes the area between the second and third meter isoline, measured from the mean level of the Danube falls here. Flooding lasts from one to two months. Water masses do not stay long, but are constantly moving from the higher parts of the terrain to the lower ones. The soils are alluvial meadow soils and in part transitions towards alluvial and meadow soils.
- The zone of brief flooding which covers the are between the three-third and fifth meter isoline measured from the mean level of the Danube. The duration of flooding is shortest, the water move all the time very quickly. This zone has the following subzones:
  - The fourth flooding subzone, which includes the area between the +3 and +4 meter isoline, measured from the mean level of the Danube. Flooding is for the shortest period, 1 to 2 months and water is drained very quickly.
  - The fifth flooding subzone, which includes the area above the +4 meter isoline, measured from the mean level of the Danube. For practical purposes there is no flooding here. It only occurs at exceptionally high waters for a very short time. The terrain of the zone consists of drained alluvial soil.

Carbonate chernozem, which is never flooded, occurs over the terrain, above the +5 meter isoline in the peripheral parts of the river line.

Spits of small-grain sediments are deposited annually by the floodwater and are formed along the banks of the river. When the waters withdraw they are covered with willows which increase the area of the islands.

The areas consisting of ditches along the dyke are flooded according to their depth and the waters remain for a long period.

III.5.4. GROUNDWATER

Groundwater is a factor of importance for the habitats along the Danube. It varies as follows:

- 100-200 cm. from the surface during the drought period in the zone of continuous flooding and meadow swampy soils.
- 250-300 cm. The zone of flooding of medium duration and alluvial meadow soils.
- 400-450 cm. in the zone of brief flooding and alluvial meadow soils.

No groundwater has been observed in the carbonaceous chernozem soil.

Considering the regime of soil humidity and the character of flooding, meadow swampy soils are the most unfavorable habitat for vegetation from the point of view of ecological requirements for fast growing water-loving tree species, especially poplars.

Habitats of plants growing on alluvial and in particular alluvial meadow soils are the most suitable for intensive poplar and willow forestry.

III.5.5. IRRIGATED AND DRAINED AREAS

The studied territory consists of parts of irrigation and draining systems. In order to protect the island of Belene from high waters, dykes surround the whole island. Drainage canals and pumping stations have been built in order to bring down the level of groundwater in the cultivated lands.

Kalimok-Brushlen occupies part of the territory of the Brushlen Irrigation and Drainage System. The plain is protected from the high waters of the Danube by the so-called Danube dykes. A system of drainage canals and the respective pumping stations has been built for drainage. The irrigation of 290,935 ha. arable lands come from water pumped from the Danube.

III.6. PLANT AND ANIMAL KINGDOM, PROTECTED AREAS

III.6.1. CHARACTERISTICS OF THE STATE OF DOMINANT AND THREATENED PLANT SPECIES

III.6.1.1. General characteristics - the current status

According to the forest vegetation regional planning (Zahariev et al.) the river area and the Danube islands fall in the Misia forest vegetation region. Concerning vertical regional planning the Danubian lands are at the lower end of the plains and hilly belt and in particular in the subbelt of flood plain and riverine forests. In their nature this area consists of flood terraces, alluvial plains, the islands on the Danube and its tributaries. Considering forest vegetation conditions beyond the structure and the content of nutrients it is important to consider the level of subterranean waters and the duration of flooding from the river. Ice flow in winter and landslides on the Bulgarian side of the riverbank is one of the specific natural phenomena related to the ecological regime of the Danubian land and vegetation.

The relief of the Bulgarian side of the riverbank along the Danube is characterized by its step-like forms, which are gradually or steeply lower than the protection dyke towards the river. Any considerable increase of the level of the Danube causes flooding. Many dykes have been built in order to avoid flooding. Flooding usually begins towards the end of the winter period and continues till mid-may - beginning of June when the water level reaches its maximum. At high waters, which have flooded higher ground trees and shrubbery, serve as a buffer.

One of the consequences of periodic flooding is the shortening of the vegetation period. Usually the development of vegetation along flooded areas begins only after the withdrawal of the waters. The continual flooding reduces productivity of tree vegetation. Even the willow (*Salix alba*), the species that endures most of these conditions in the presence of frequent and continual flooding has a slow growth, changes its habitus, making curved and irregular forms.

North American poplars are particularly sensitive to considerable flooding; they suffer in stagnant waters and subsequently die of various diseases on the bark, most typical of which are *Dothichiza populea* and *Cytospora crysesp.* The species *Populus x euramericana cv* which owing to its shallow roots system and wide crown tends to incline and create changed plantations.

The basic species of the flood plain are willows, poplars, common oak, and less frequently the ash tree, the elm (*Ulumus*), the wild pear (*Pirus communis*), a number of shrubs and liane species. The most widespread and ecologically best adapted to growth conditions in these land are

the willows. The white willow (*Salix alba*), the almond willow (*Salix triandra L*) and the purple willow (*Salix purpurea Linei*) are most important. Of the poplars most characteristic is the white poplar (*Populus alba L*) and the black poplar (*Populus nigra L*). These species successfully endure the long flooding, the mechanical pressure of the water and its suppressive action. Poplars and willows have evolved to adapt to a shortening of the vegetation period during the continuous flooding and through compensation to speed up their growth after the water withdraws. Moreover, willows and partly poplars breed partly vegetatively which allows every organ covered by earth to appear as a separate plant later. These specific features and some other biological qualities determine them as pioneer species in the formation of the islands and the banks of the Danube.

III.6.1.2. Habitats

Forest vegetation potential of habitat depends on three factors - soil, soil moisture and duration of flooding. This was the basis of the classification of habitats along the Danube river (lands situated at the mea continuous annual level of the Danube) in 1970.

Typical Danube willow habitat - SD_4 (First ecological complex) - The typical Danube willow habitat is situated in the zone of continuous flooding (4-6 months), overwet meadow soils, whose state, owing to the shallow groundwater and the continuous flooding has deteriorated water and physical properties. They include the area between the mean level and the 1 m isoline measured at the mean level of the Danube;

Danube willow-poplar (transitional) habitat S_3 (Second ecological complex) occur in the zone of continuous water flooding (2-4 months). They include the lands, situated between +1 and the 2 m. isoline. The soils are marsh meadow with a transition to alluvial- meadow. The mean level of groundwater throughout the year at a depth of 1-2 m, and during the drought period during the summer up to 3.5 m;

Typical Danube poplar habitat - D_{2-3} (Third ecological complex) - The typical Danube poplar habitat is situated between +2 m and +3 m in the zone of medium continuous flooding (1-2 months), over alluvial-meadow soils, rich and thick. The annual average groundwater table is 2-3 m., subsiding during the summer up to 4.5 m;

Drained Danube poplar habitat - S_2 (Fourth ecological complex) - The typical Danube poplar habitat is situated over an area between +3 m and +5 m isoline in the zone of brief flooding (up to 1/2 a months). Soils are alluvial. The mean level of groundwater is 3-5m falling during the drought period to 7 m.

Typical drained Danube poplar habitat - D_2 (Fifth ecological complex) - include the drained area after the building of the protection dykes and include formerly flooded lands. They are similar to riverine habitats, however there is no flooding. Soils are marsh meadow, rich in nutrients, and compact. During the spring groundwater are close to the surface or above it, however during the second half of the year they fall and depend on the level of the Danube.

It has been established (Fakirov et al 1985) that in the afforested Danube river stretch 75 % of the forest area are poplars, and 22% of natural willow forests, while only 3% are other broad-leaved, i.e. poplar and willow occupy almost all the afforested area of flooded and drained habitats.

III.6.1.3. Pioneer phytocenoses

Poplars and Willows (Salicetum et Populetum mixtum)

The origins and formations of pioneer phytocenoses of poplars and willows are connected with the emergence of alluvial sediments over open sand banks which are periodically flooded, cov-

ered with deposits, washed away, and create conditions for the formation of a specific ecotope. Favorable conditions emerge for the growth of poplars and willows. In the first year the sediments are covered with sprouts. Only the sprouts, which survive the second flooding, can form a plantation. Towards the third year plants in the plantation have deep roots and reach a height up to 2.5 m, which ensures their further development and existence. After the third year natural plantations can survive the changing regime of flooding.

Around the fifth and sixth year of the pioneer phytocenoses active differentiation of the stems begins and in the course of years large *Salix Alba L.*, *Salix triandra L.*, *Populus Alba*, *Populus nigra L.* associations are formed.

Grass cover

A grass cover appears on the spits before the sprouts of poplars and willows, however limited in species and small area it covers. In the beginning there is almost no grass cover. Later, one or two months after the formation of the sprouts pioneer species such as *Gnaphalium uliginosum*, (at the highest parts of the sediments) and *Scirpus lacuster L.*, *Nasturtium amphibium R Br.*, *Scirpus michelianus L.*, *Panicum crus-galli L.*, *Polygonum sp., sp. RutexRutex hydrolapatum Huds.*, *Bidens triparitus L.*, *Raphanus raphnistrum L.*, etc. During the second and third year of the life of the cenoses, regardless of the mixing of tree species, there occurs a rapid increase of individual *Scirpus michelianis L.* and *Scirpus lacuster L.*

III.6.1.4. Plant communities

Saliceta Plant communities

Saliceta Plant communities are most common. The cenoses of these cenoses are basic for flood land, 63% of hem are young and reaching maturity. Their main species is *Salix alba L.* It is the dominant species in the cenoses and forms the first floor. *Salix triandra L.* occurs everywhere. With time the participation of *Salix triandra L.* continues decreases and after reaching 10 years they no longer remain. *Salix alba L.* and *Salix triandra L.*, sustain continuous flooding best, hence their greater distribution.

Salix triandra L., and *Salix purpurea L.*, are in some case confectors with their forms, in others assectators, i.e. they are accompany the plant community, or a regular elements, however not dominant species in willow communities.

Shrubs and semi-shrubs, associated in willow communities are represented chiefly by *Rubus caeisus L.*, *Amorpha fruticosa L.*, *Crataegus monogina L.*, *Cronus sanguinea L.*, *Viburnum opulus L.*, *Ligustrum vulkgare L. Evonymus europaeus L.*, *Tamarix pallasii Desv.* and to a small extent *Rhamnus frangula L.*, which are spread out among the community. This vegetation forms the synusia, the second floor in the cenoses. The quantities of the species vary.

Grammineous vegetation is varied and typical for flood lands. These are chiefly resistant species, sustaining continuous flooding, heavy soils, with heavy humidity of dry sands. The typical forest grammineous species are absent. Grasses usually for low, relatively thick, frequently thinned ground floor or a higher and thinner second floor with a height up to 1.0-1.5 m.

Scirpus lacuster L., Nasturtium amphibium R.Br., Scirpus michalianus L., Panicum cris-galli L., Polygonum sp., Typha sp., Rumex hydrolapatum Huds, Bidens tripartitus L., Salanum ducamara L., Raphanus raphanistrum L., Carex acutiformis Ehrh., Lysimachia vulgaris L., Calamagrostris epigeios L., Mentha aqautica L., Agrostis alba L., Euphorbia palustris L., Phragmites communis Trin., Chenopodium polyspermum L., Althea offcinalis L., Urtica dioica L., Cyperus glomeratus L. etc are typical for the Saliceta formations.

Salicetum albae plant communities

Salicetum albae is a quick growing species, which occupies rivers banks and low marshy land. It is not demanding, however it prefers marshy land and fertile sand-clayey and clay-alluvial soils. *Salicetum albae* can live up to 80-100 years.

The lower limit of distribution of the white willow is at -0.6 to + 0.4 meters, which means that it is around the average level of the water. If the sprouts survive the first and second year, the formation of pioneer phytocenoseses of poplars and willow begins and after the sixth year the initial phase of development and formation of white willow communities.

With time habitats rise which leads to a change in the floristic composition of phytocenoseses and the associations of white willow. They assume the following ecologo-cenotic order:

- Salicetum albae et triandrae juvenilum association
  - *Salicetum albae nudum nasturtiosa – crypsidosum*
  - *Salicetum albae rubosum* (variants with *Polygonum hydropiper* and *Urtica dioica*) association
  - *Salicetum albae amorphosum (fruticosa)* association.

Specific features of the willow associations - a relatively brief existence of the communities and close link with the habitat. These communities have a protective function as they occupy the banks of the islands, protect the bank from being washed away and destroyed.

The formations of flood forests of Salix alba are very important for the economy. They not only are a source of timber, but they perform many specific social, landscape, flood water retention and anti-erosion functions for the banks. They are also of major importance as biodiversity habitats.

Populeta plant communities

Today populeta plant communities are less frequent. Many of them were cut and uprooted. Only *Populus nigra L* and *Populus alba L* exist in small copses. In the internal flood forests they occur most often in groups among natural willow dendrocenoseses. The following type of natural poplar communities occur:

Populetum nigrae Rubosum

Populetum nigrae Rubosum occupies Danubian habitats of willows and poplars situated between the +1 and +2 meter isoline mean annual level of the Danube. They develop over wet layer meadow swampy soils moving towards alluvial meadow soils. In the composition of the tree floor *Populus nigra* prevails mixed with *Salix alba L* and *Populus alba L*. The species endures continuous flooding.

Robus caesius L. form a low floor of shrubbery with a constant cover. Separate individuals of *Cornus sanguinea L. Evonymus europeus L., Viburnum opulus L.*, also occur. The grammineus floor consists of *Elytrigia repens L., Calamagrostis epigeios Roth., Artemisia vulgaris L., Equisetum arvense L., Aegopodium podagraria L.*, and others.

Populetum albae rubosum

Populus alba L. prevails in the cenoses, appearing in the higher parts, where the water stays for a shorter period. The participation of *Populus nigra L.* and *Salix alba L.* is limited. Separate individuals of *Pyrus communis L., Quercus robur L., Alnus glutinosa Gaertner*, also occur, sometime forming a partially formed second floor. *Cornus sanguinea L.* dominates in the shrubs floor.

Evonymus europeus L., Viburnum opulus L., Crategus sp,. Acer tataricum L., also fall here. Of the creepers in this type, forest *Humulusupulus L.,* and *Vitis solvestris Gmel* are also found.

III.6.1.5. Belene Island

The project includes the restoration of the wetlands over the eastern parts of the island of Belene - the part of the Persinsky Marshes Reserve. These wetlands were determined for restoration on the basis of their potential to capture nutrients and their value as a natural environment for biological diversity.

The island is 14.5 km long and in area over 45 sq.km. Three large connected wetlands are situated in its interior - Martvoto, Peschina, Doulyova bara, while in the lower lying eastern part of the island is the Persina-Iztok nature site. At its western end a common channel drains into the Danube. They are 1 - 2.5 m deep, and during the summer parts of them dry up. The bottoms are filled with silt.

Belene is characterized by tree vegetation and shrubs, *Salix alba L., Salix trriandra L.,* and *Salix purpurea* being of primary importance. Of the poplars typical are *Populus alba L.,* and *Populus nigra L.*

The Salicetum albae rubosum association is a Climax association, occupying the eastern part of the island. In most cases this stage is degraded, which has not yet reached its phase of climax and is represented by associations (*Salicitum euphorbiosa-rubosum*), with prevalence in the undergrowth Euphorbia *lucida, Rubus caesius,* and *Salicetum altoherbosum,* where *Rubus caesius* has a secondary role, and various grammineus plants prevail.

A large part of the island is covered with *Agrostis alba* and *Cydonum dactilon* in the highest parts of the island and *Sirpus michelianus.*

A small forest of *Salix alba,* without undergrowth *Salicetum albae nudum* is situated near the Peschina marsh, while in the northern section of Martvoto blato - the association *Salicetum purpureae;* on the parts along the banks of the island - there are dense growths of Salicetum triandrae.

The vegetation of the marshes is quite specific. The banks are overgrown with *Typha latifolia, Sparganium ramosum, Alisma plantago-aquatica, Sagitaria sagifolia, Butomus umbelatus* etc. Typical marsh communities develop in the marshes

The cenoses of *Azolla filiculoides* are typical for Martvoto blato, together with the association of *Myriophyllum.* The association is over a comparatively large area (O.8 - 1 ha). The composition of the association is built on a comparatively small number of plants - *Salvina natans, Potamogeton pectinatus, Potamogeton crispus, Trapa natas,* Nympgoides *flava, Lemna minor, Myriophyllum vertililatum, Ceratophyllum demersum, Nayas minor.*

Other typical wetland communities develop, incl. that of Nymphaea alba, the marsh of Dyulova bara being the largest site of the community. The formation of *Nyphur lutea* is developed in Martvoto blato, *Potomogeton natans* in deeper parts, together with *Nympgoides flava* and *Trapa natas* in the shallower parts.

The association of *Oenanthe aquatica* has been studied in Peschinsko blato marsh with an area of 3.8 acres. The cenoses occupy the peripheral part of the marsh. Together with Oenanthe aquatica, with smaller numbers, or separate individuals of *Sium latifolium, Butomus umbellatus, Salvina natas, Lemna minor,* etc. also are found here. The rare fern *Marsilea quadrifolia* grows in Peschina.

Agricultural areas occupy the western part of the island.

Marsh vegetation

Marsh vegetation, described in 12 associations, occurs chiefly in the Martvoto blato marsh. (Kochev, Yordanov, 1981).

Some of them consist only of rare or threatened species *Nyphaea alba L., Nuphar lutea L., Trapa natas,L., Nymphoides flava.* Besides these species *Marsilea quadrifolia,* together with *Valisneria spiralis*, the water ferns *Azolla fuliculoides*, *Azolla caroliniana, Salvinie natans*. Underwater vegetation is represented by a mixed community - *Potamogeton fruitans*, *Ceratophyllum demersum*, *Potamogeton trichoides. Potamogeton crispus*, *P.fluitans*, *P.pectinatus* and other also occur.

Today the whole complex of marsh species has been destroyed or is very degraded.

The association of *Trapa natans* is almost completely lost; the species *Nuphar lutea L., Nymphaea alba L., Marsilea quadrifolia, Valisneria spiralis* are almost extinct.

Martvoto blato marsh is no longer a permanent marsh, but a periodically flooded territory, with different periods of drought.

Dyulova bara marsh is practically non-existent, only small ponds remain.

The Peschina marsh is overgrown by *Typha augustifolia*, *Phragmites australis*, and *Shoenoplectus lacustris*. A small cenosis exists of *Nymphoides flava* in the open water area.

III.6.1.6. Kalimok-Brushlen

In the past the Tutrakan floodplain was 25 km long and 2-3 km wide. The Danube and the Tarchil (Maratin) rivers, which run through the middle of the plain to the northwest, played an important part in its drainage. Throughout the spring flooding, besides draining, it also deposited sediments over large parts of the plain. The lowest parts of the wetland or floodplain were in the western and eastern ends, where there were larger open water surfaces known as the Brushlen marsh (in the west) and the Belitsa marsh or otherwise known as Kalimok in the east.

In the 50s they were drained, together with almost all other marshes along the Danube. Kalimok was turned into a fishpond - one of the largest in Bulgaria. It retained its role as a wetland in spite this, for instance the former Brushlen marsh, in spite of it being drained, has very high groundwater. In the spring they cause flooding, and practically the central part is the deepest one, with large beds of reed and cattail. Besides that this area is not suitable for agricultural activity, its nature conservation value has been impaired.

The largest areas on the plain are occupied by the communities of reeds and cattail, the surface of the marshes are covered by various hydrophite phytocenoses such as that of *Nymphea alba, Trapa natas, Nymphoides peltata.*

Although they are situated in the same floodplain, the two marshes are far from one another and have their characteristic features.

Kalimok marsh

The main wetland habitats preserved are the areas of the abandoned fishponds. Almost their entire surface is covered with marsh vegetation with several prevalent species: Typha *augustifolia*, *Typha latifolia*, *Typha laxmani*, together with *Schoenplectus lacusttris*, while the banks of the basins and the dykes are overgrown by *Phragmites australis.* In the open water area the following species are most common: *Hydrocharis morsus ranae, Nymphae alba*, *Nymphoides peltata*, *Trapa natans* etc. Along the banks of the drainage canals, besides the reed massifs, at separate locations it is overgrown with willows (*Salix sp.*). various types of sour grasses grow on the

meadows, and at the periphery *Schoenoplectus litoralis*. The territory between the fisheries and the river constitutes a flooded forest of willows (*Salix sp*) with a rich undergrowth of climbers and temporary water bodies. Besides *Nymphae alba*, there seven other species included in Bulgaria's Red Data Book (1984) occur in the wetland area: *Urticularia vulgaris, Marsilea quardrifolia, Nuphar lutea*, etc. (Koutsarov et al. 1997).

Canals are also suitable for water vegetation. A large part of them were until recently covered with phytocenoses of *Nymphaea alba,* however part of the community was destroyed with the cleaning of the canal.

The functioning of the fishponds and the maintenance of the fish pond facilities, together with climatic change brought to the quick degradation of these water bodies. Only for several years the ponds were overgrown with reed and cattails, and some willows have spread. At present the greater part of the region represents large reed beds and mass of cat's tails.

Brushlen marsh

In the past it had a bigger open water body although the open water body was smaller than the Kalimok marsh. In the periphery there were large reed massifs, which are now turned into arable land and low-grade pastures, frequently flooded in spring. In the deepest parts, in spite of the presence of drainage canals, residual water remains to the end of the summer, together with dense marsh vegetation - reeds and cat's tails.

The land around the marsh is practically not suited for agriculture.

III.6.1.7. Species included Bulgaria's Red Data Book

Bulgaria's Red Data Book includes the following species,

Isolepis supine L, family Cyperaceae; a threatened species, Belene, Allium anulosum L., Liliaceae, a rare species, along wetlands along the Danube, Corispemum marschalli Stev., Chenopodiaceae, a rare species of the group of islands around Belene; Nuphas lutea L., Nymphaeaceae, a threatened species, Belene marshes, Kalimok-Brushlen, Nymphaea alba L., Chamaecytisus danubialis Vel., Fabaccae, a rare species, Kalimok-Brushlen, Trapa natans L., Trapaccae, rare Tertiary relict, Belene, Nymphoides peltta S.G.Gmel.), Gentianaceae, a rare species, Callitriche stagnalis Scop., a rare species along the Danube, Callitrichaceae, Utricularia vulgaris L., Lentibulariaceae, a rare species, a rare species, in marshes, and slow running waters., Senecio paludosus L., Asteraceae, a rare species along the Danube.

III.6.1.8. Resources

At present people living the plain collect fish, snails and some herbs such as *Symphytum officinale L., Althea officinalis L.*. With the restoration of the wetlands, some of the sites will be destroyed, however new sites will be created and the general availability of the economic resources (herbs, snails, and game) will increase. Stable populations could be ensured for many moisture loving herbs such as *Mentha aquatica,* M. longifolia, *Symphytum officinale L, Urtica dioica, Sambucusebulus, Iris pseudocorus, Galium verum, Gratiola officinalis,Valeriana officinalis, Oreganum vulgare, Hydrocharis morsus-ranae, Malva sylvestris, Sambuccus nigra, Persicaria hydropiper, Rorrpa sylvestris.* The enormous quantities of reeds in the floodplains are also a resource, which should be used. Chiefly small dairy farmers use part of the sour grass for fodder. The use of these resources should be regulated and limited. The use of game resources should also be subject to control. The population of some animals - jackals, wild boar, hooded crows should be regulated, as at present their numbers are too high and they are a threat for rare and threatened species. The legislation for the regulation of protected areas should be respected.

In the future better use could be made of resources such as frogs, reeds, floating water vegetation, and zooplankton.

In the course of construction work many of the habitats would be destroyed. Vegetation is a flexible material and under favorable conditions it will be restored quickly.

III.6.2. CHARACTERISTICS OF THE SITUATION OF THREATENED SPECIES. A PROGNOSIS AND ASSESSMENT OF DOMINANT SPECIES

III.6.2.1. Belene Island

The existence of preserved and generally unaffected plant formations, as well as the existence of marshes determines the formation of a specific and varied fauna. A number of representatives of invertebrate fauna are found here, such as Apus cancriformis, which develop early in spring in shallow flooded areas. Ichtyofauna is varied.

The following rare amphibians in Bulgaria have been observed in the restoration area: Pelobates syriacus balcanicus, Triturus cristatus, and the reptiles, where two types of water snake prevail Natrix natrix and Natrix tessellata.

The importance of Belene as an ornithological site is exceptional. Of the 104 bird species established here, 21 are included in Bulgaria's Red Data Book, 44 are species of European significance (SPEC) (Tucker, Heath, 1994) and 3 species are included in SPEC1, 7 in category SPEC2, 16 species -SPEC3 and 18 species in category SPEC4.

Marshes in the island are among the few nesting sites of the pygmy cormorant (*Phalacrocorax pygmeus*), the spoonbill (*Platalea leucorodia*), *Anser anser, Netta rufina, Anser strepera, Anas querquedula, Anas clypeata, Aythya niroca, Aythya ferina* etc. (Ivanov, 1993). According to the author the first two species plus the shiny Ibis (*Plegadis falcinellus*) have not been established as nesting for Bulgaria. The island is an important habitat for the sea eagle (*Haliaestus albicilla*), and the colonies of cranes are among the largest in Bulgaria. The main species are*: Ardeola ralloides, Egretta garzetta, Nycticorax nycticorax*. Smaller numbers are nesting of *Ardea purpurea, Ardea cinerea* etc. Occasional colonies exist of the Great cormorant *Phalacrocorax carbo. Chlidonia hybrida* nests on the leaves of water lilies, and less frequently Larus ridibundus. It is here that *Podiceps griseigena* has its largest colony in Bulgaria. During the autumn migration (provided the marshes have not dried out), there are considerable concentrations of black storks (*Ciconia nigra*). Small numbers of *Crex crex*, which is a threatened species nest here. During migrations this is the place to see Acrocephalus paludicola. Some raptors nest in the willows (*Bubo bubo, Strix aluco*).

The region has its specific fauna of mammals: *Capreolus capreolus, Mustela nivalis, Vulpes vulpes*, a great variety of rodents *Rodentia* etc, There have been recent reports of jackal (*Canis aureus*) and large numbers of wild boar (*Sus scrofa*).

III.6.2.2. Kalimok Brushlen

Kalimok station to the Zoological Institute to the Bulgarian Academy of Sciences began to operate effectively in 1994. The principal focus of its activities was problems related to the local bird fauna and partially to the flora and Lepidoptera. NGOs and amateur bird environmentalists effected monitoring in the wetland. So far, the following groups were studied in detail: amphibia - 100 %; birds - 95 %, fishes - 80 %, mammals - 60 %. The flora was studied to about 60 %.

Status of environmental protection: Ramsar Convention; Bern Convention, Bulgarian Red Book; IUSN Red List; Corine Site. Birds are the largest group of fauna having environmental protection status.

Species	IUSN- Red List	Ramsar Convention	Bern Convention	Bulgarian Red Book
	Vulnerable Low risk			
Birds	37	32	141	59

According to the studies of Koutsarov, Zehtindjiev, Yankov, Marinov and Kourtev (1997), the Kalimok fishponds are some of the internationally significant habitats for waterfowls. 183 bird species were found on its territory. 60 of them are included in the Bulgarian Red Book, and 103 are species of European conservation importance (Koutsarov et al., 1997), (SPEC) (Tucker, Heath, 1994) and 4 species are classified under SPEC1 class, 12 - under SPEC2; 3 under SPEC3, and 35 under SPEFC4.

These territories are of worldwide significance for Aythya *nyroca* and as a place for rest for the pelican *Pelecanus crispus*, and during the winter season and the time of migration - also for the small cormorant *Phalacrocorax pygmeus*, *Anser anser*. They are also the locations for wintering of *Turdus pilaris*. Big concentrations of several species of water loving birds, including *Branta ruficollis*, *Anser Albifrons*, etc. (Koutsarov et al., 1997) can be seen in the winter season.

During the period of nesting, the following bird species can be observed: Ixobrychus *minutus*, *Nycticorax nycticorax*, *Platalea leucorodia*, *Coturnix coturnix*, *Cordicas garrulus*. Greatest is the number of the following bird species: *Chlidonias hybridus* - 20-450 pairs;) *Coturnix coturnix* - 40 - 100 pairs; *Nyctocorax nycticorax* - 30 - 50 pairs. According to (Koutsarov et al., 1997), the area is a characteristic base for one pair of *Haliaeetus albicilla* too.

During the period of migration, most numerous bird species are: *Ciconia ciconia*- 10,000 – 15,000 birds, *Nycticorax nycticorax*, - 100 - 750, *Plegadis falcinnellus* - 300 - 500 birds, *Platalea leucorodia*, - 14 - 100 birds, *Phalacrocorax pygmeus* - 3 - 220 birds.

Most numerous wintering species are: big white goose - *Anser albifrons* - 3000 - 5000 birds; *Turdus pilaris* - 500 - 200 birds; *Anser anser* - 300 - 500 birds, *Branta ruficollis* - 120 - 200 birds.

Four of the mammal species occurring in the fishponds are included in the Red Book of Bulgaria: *Pungitus platygaster*, *Pelebates syriacus balcanicus*, *Lutra lutra*, *Vormela peregusna*, and the medical leech - the biggest population in Bulgaria.

III.6.2.3. Species included in the Bulgarian Red Book

The following species, typical for the project areas, are included in the Bulgarian Red Book (without the fish species).

Pelobates syracus balcanicus Karaman, family Pelobatidae, endangered subspecies, greatly vulnerable by antropogeneous impact along the river Danube, the island of Belene, *Podiceps nigricollis Brehm*, *Podicipedidae*, endangered species along the river Danube; *Podiceps Griseigena Boddaert*, *Phalacrocorax carbo L*, *Phalacrocoracidae*, *Phalacrocorax pigmeus Pall.*, *Botaurus stellaris L*, *Ardeidae*, *Ardea Purpurea*, *Platalea leucocordia L*, *Threskiornithidae*, *Plegalis falcinellus L*, *Ciconia nigra L*, *Ciconiidae*, *Branta ruficolis Pall*, *Anatidae*, *Anser anser L*, *Cyngus olor Gm. Tadorna ferrunginea Pall*, *Aythya ferina L*, *Aythya nyroca Guld*, *Pandionidae*, *Haliaeetus albicilla L*, *Accipitridae*, *Aquila pomarina*, *Circus Cyaneus L*, *Crex crex L*, *Rallidae*, *Tringa tetanus L.*, *Charadriidae*, *Tringa octopus*, *Larus ridinundus L*, *Laridae*, *Sterna albifrons Pall*, *Sternidae*

Lutra lutra fam. *Mustelidae* endangered of extinction, *Vormela peregusna Guldenstaedt*, fam. *Mustelidae* endangered species; *Cricetus cricetus L.*, fam. *Cricetidae* endangered species; *Meso-cricetus newtoni nehr.*, fam. *Cricetidae* - a rare species.

III.7. FISH PRODUCTIVITY AND FISH RESOURCES OF THE MARSHES ALONG THE RIVER DANUBE

Table 7: Catches in Srebarna Lake

	1942		1952	
Species	**kg**	**%**	**kg**	**%**
1. Carp	54000	41.5	1.5	-
2. Various	43000	33.1	1565	79.8
3. Bream	11000	8.5	-	-
4. Pike	10000	7.7	373.5	19.1
5. Golden carp	7000	5.4	-	-
6. Sheat fish	5000	3.8	6.1	0.3
7. *	-	-	14.1	0.7
Total	**130000**	**100%**	**1960.2**	**99%**

In December 1952 – 3 years from the dredging of the Sreburna lake and from the complete termination of the connection to the Danube, with an area of approximately 200 ha. – a new fishing test had been made with the results that 1,960.2 kg of fish had been caught in ten full working days using a net (unfortunately, no data such as net selectivity, length and size are available). With some assumptions (the taking into account of the catch decline curve, the fact that fishing had been banned in the lake, the winter etc.), an approximation is possible to the effect that the annual catches would amount to 6 – 7 tons or 0.3-0.4 kg/ha, which is 50 - 60% of the catches in 1942, and in view of the fact that the main species (approximately 80%) are now small-size species of low value, it can be said that the Sreburna lake has lost its fishing significance completely in ten year's time.

No integrated studies for the fish-breeding capacity in the Sreburna reserve have been made during the recent years.

Table 8: Species in the Sreburna Lake in 1952

No.	Species
1	*Abramis brama*
2	*Abramis sapa*
3	*Aspius aspius*
4	*Blicca bjokerna*
5	*Carassius carassius*
6	*Chalcalburnus chalcoides*
7	*Cyprinus carpio*
8	*Leuciscus idus*
9	*Rhodeus amarus*
10	*Rutiolus rutilus*
11	*Scardinius erythrophtalmus*
12	*Tinca tinca*
13	*Misgurnus fossilis*
14	*Silurus glanis*
15	*Esox lucius*
16	*Perca fluviatilis*
17	*Lepomis gibbosus*
18	*Neogobius fluviatilis*

According to information provided by Ivan Todorov, a fisherman from Belene, some of the people maintained and caught fish in the so-called "fisheries" of Belene, and during the 1980s (1982-1984) they caught 35 tons of fish (total catch) basically carp and pike, and individual sheat fishes and tench. Only large fish was caught, while the small fishes (mainly Rudd, and possibly) were left to the herons, and this fact might serve as an indication that the entire catch has been 34 tons. Data on fish productivity in some coastal wetlands show similar figures to those along the river Danube.

The fish productivity in the Mandra Lake from eleven years (from 1946 till 1956) showed an average catch of 172.5 annual tons. For an area of 1082 ha at that time, that makes 1.594 kg/ha. One should remember, however, that 33 % of the total amount caught was of Gray mullet of 0.526 kg/ha, which is a species migrating in the sea. Without migrating species the amount is 1.068 kg/ha.

The catch from the lake of Bourgas (Vaya), which in the past was a brackish lake but after human regulation has now become a freshwater wetland, was 1.087 kg/ha on the average in 1999, and this is the actual productivity of a seacoast marsh without migrating species.

It is not recommendable to compare with internal water reservoirs and fish ponds (even along the Danube River) because the results could be very misleading: a large part of the reservoirs are very deep and belong to other types of ecosystems, and fish there is frequently bred artificially. Therefore such fish ponds cannot be used for comparison as food and fish stocks are not introduced in a natural way, the efforts for the catch are less strenuous, and a greater amount than normally is caught.

III.7.1. FORECAST ON FISH PRODUCTIVITY AND ICHTHYOFAUNA COMPOSITION

The species composition of the ichthyofauna in the restored marshes does not depend or is dependable only to a small extent on their area (within the limits according to the different scenarios), the productivity of an unit area is also dependable on a more intensive exchange and flow of water from the Danube. The main determining factor is the link with the main water source - the Danube, namely:

- At how many places will the dyke be cut, what length, width and depth. The variant of destroying the dyke does not exist.
- The sluice regime: how long will they be open and throughout which season. The variant of removing the sluices does not exist.
- What kind of water regime will be maintained: would the marshes be allowed to dry up?

III.7.1.1. Belene Island

Owing to the close proximity of the river to the marshes there are excellent conditions for the entry of fish in the marshes. If a favorable hydrological regime is maintained, fish productivity may reach up to 40 kg/acre. Carp, catfish and pike are the dominant species. Species variety could be richer than that at Kalimok-Brushlen owing more to the chance for species to come from the Danube. Probably the number of species will range between 25 and 27. At present the wetland has no fish fauna of its own, so future fauna would be formed mainly of species coming from the Danube. In this way the typical wetland species would be restored very slowly following a natural process. So perhaps it would be necessary to introduce fish artificially - golden carp.

III.7.1.2. Kalimok Brushlen

In the presence of a wide opening and connection, as early as the first year carp, catfish, pike would come in. Nevertheless it would be necessary to have an open connection between the Danube and the wetland for at least 2 or 3 months during the breeding period. It would be best if the

wetland is linked with the Danube at least two places and the canal should be as short as possible and as wide as possible. This should be done to avoid the unnecessary presence of poachers, movement of people and work with machines. In this case fish productivity of the wetland can reach up to 32 kg/acre; naturally full productivity should be expected between 5 and 10 years after flooding when the fish fauna will be established. It would be good if for the first 3 years no fishing is allowed, so that the restoration process would take the correct course. Species composition would be approximately 20-25 species. The prevailing species would be the valuable carp, pike, and probably catfish. The state of the population of the weather fish, nine-spined stickleback, and golden carp should be expected to be good.

It is only under these conditions and with this variant that fish resources would be sufficient to justify the organizing of fishing cooperative. The matter is discussed in the section on fisheries. In the absence of a direct link or the opening of such a link in an unsuitable period (June-March) or if hydrotechnical facilities of the canal pumps, the height of the sluices are not properly planned fish fauna will be very poor and close to that which exists at the present moment. In this case what could happen could be that we would find ourselves of the situation of Sreburna in 1952. The production rate would be 0.3-0.4 kg/ha for species of low economic value, the dominant species would be white beam and goldfish, with massive spreading of roach and stone morocco, and perhaps the only economically valuable species would be pike. The rare golden carp and the nine-spined stickleback would disappear, while the population of the weather fish would be very low. The species composition would be about 15 species in a markedly unbalanced situation with the overdomination of one or two species.

In this case the formation of a fishing co-operation will not be profitable.

III.7.2. SUGGESTIONS OF FLOODING PERIODS

It is necessary to mention that the first or second year the restored wetlands will not realize their full nutrient removal capacity because of the potential biodegradation of existing terrestrial vegetation. It is possible the total nutrient levels of the project area to remain stable or even a little bit increasing. In fact a real nutrient reduction may be expected at the beginning of the third year until the ecosystem will stay in a very specific dynamic equilibrium.

That process will intensify unless the reed is mowed down, taken out and becomes flooded before it sprouts. Furthermore, the process of the natural succession of wetlands will become faster which will inevitably require quick intervention for their hollowing out.

Table 9: Evaluation of the suggested flooding options for Kalimok-Brushlen

Period	Advantages	Disadvantages	Suggestion
Variant 1 March-June	The waters are high. Almost all wetland species mate March - July - they will be able to prepare for the mating season.	It is possible that an explosive release of nutrients can take place exactly in the phase of small larvae.	Advisable
Variant 2 July-September		The waters are low, the intense decomposition of the overflowed biomass due to the high temperature and the great amount of already grown vegetation will start immediately and will certainly lead to the complete dying out of the fauna.	Not advisable
Variant 3 September-March		There are no species coming in from the Danube and spending the winter in the marshes. The amount of accumulated vegetation biomass is greatest. At low temperatures and low oxygen rate the decomposition will be latent and will cause a dying out in the water-body with the first warming up of the water.	Not advisable

- The reed should be taken out and be flooded before it sprouts. In order to stop the sprouting of reed the water-body should be at least 120 cm. deep, below that depth the reed grows unhindered.
- No drying up should be allowed in either of the two project areas, which despite being a natural process has an extremely unfavorable effect on the local ichthyofauna. Even if the locks are closed when the Danube is low by means of the hydraulic connection, the water will infiltrate through the sandy soil and disappear- the only solution is to dig out artificially channel-like ditches in the lowest part of the island, the depth of which will correspond to the lowest levels of the Danube in order to guarantee even during the greatest drought the survival of typical inhabitants of stagnant waters, the restoration of which from the Danube is difficult and depends on accidental factors.
- Free access of the fish to the wetlands should be provided during the highest waters when it spawns, otherwise their significance as spawning sites for the Danubian types of species will be compromised.
- The fish should be given the opportunity to withdraw to the Danube at the end of autumn. The wetlands do not offer condition for the fish to spend the winter - most of them will completely freeze for two months.
- It should be investigated whether during the flooding and the subsequent decomposition, the abundant and rich in allelopathic compounds Indigo plant *(Amorpha fruticosa)* on the island of Belene and in Kalimok-Brushlen might release poisonous substances into the water. If there is such a possibility, it should be mechanically eliminated before each flooding.

III.7.3. ICHTHYOFAUNA OF THE KALIMOK-BRUSHLEN MARSH STRIP

No published data are available.

During the expedition on defining the monitoring species which did not have as its purpose the stock-taking of the ichthyofauna, 16 species were identified but their number probably goes up to

20. The Dominant species were the *(Leucaspius delineathus)*, the roach (*Rutilus rutilus*) and the Crucian Carp *(Carassius gibelio)*.

III.7.4. ICHTHYOFAUNA OF THE WETLAND ON BELENE ISLAND

Special investigation about fishing and the species on Belene Island has not been carried out. During the expedition only a Crucian Carp *(Carassius gibelio)* was caught and two representatives of *Leucaspius delineatus* only in the canal collecting drainage waters. The marshes were entirely dried out, and there was water only in the deepest parts of the collecting drainage channel. There was no water in the "Guard". Dominant species - the silver carp.

Table 10: Ichthyofauna of the Kalimok-Brushlen wetland strip

Ichthyofauna of the Kalimok-Brushlen canals	Ichthyofauna of the canals on Belene Island
1. *Abramis brama*	1. *Carassius gibelio*
2. *Carassius carassius*	2. *Leucaspius delineathus*
3. *Carassius gibelio*	
4. *Cyprinus carpio*	
5. *Leucaspius delineathus*	
6. *Pseudorasbora parva*	
7. *Rhodeus amarus*	
8. *Rutilus rutilus*	
9. *Scardinius erythrophthalmus*	
10. *Misgurnus fosilis*	
11. *Gobitis sp.*	
12. *Esox lucius*	
13. *Lepomis gibbosus*	
14. *Perca fluviatilis*	
15. *Proterorhinus marmoratus*	
16. *Pungitius platygaster*	

III.7.5. FISHING

III.7.5.1. Description of the existing destructive fishing practices in the area

Fishing is almost not practiced in the existing wetlands. Mainly amateurs with sports fishing rods go fishing. Fishing is not among the factors, which presently threaten the ichthyofauna or are influencing it somehow; the reason is in the lack or the small quantity of types of objects of fishing. In case of a "zero" restoration scenario fishing will diminish even more its negative influence after the disappearance of the few remaining species of economic significance which occur nowadays.

The negative practices spread among fishermen in neighboring water-bodies (mainly the Danube) are fishing during the closed season, fishing with trawls, catching undersized fish, fishing with explosives. Due to the lack of data for the stock of fish it cannot be claimed that there is an extreme overfishing, especially considering the small catch fishermen have had in recent years.

Those fishing practices in the Danube have been mentioned as far as it is possible to transfer them to the restored water-bodies, although fishing in lake or marsh conditions is quite different from that in the Danube.

- fishing with trawls - it is used only in the conditions of the Danube by catching big rheophil species mainly sturgeon, which do not occur in marshes - it is not a threat for the restored marshes.

- explosives - in the conditions of the shallow wetland, fishing with explosives is ineffective and extremely dangerous - it is not a threat for the restored marshes
- catching undersized fish - a real danger
- fishing during the closed season - a real danger
- extremely great catch - a real danger

These practices have been discussed on condition that the restored wetlands are intended to be treated as ecosystems with sustainable development of their resources. If no utilization of the resources is intended and the system functions as a strict reserve in which all human intervention are prohibited, then all fishing practices are prohibited as having a negative influence.

Table 11: Species included in 2000 IUCN Red List inhabiting the Danube and its related water-bodies

1. *Acipenser guldenstaedti*	EN A2d	
2. *Acipenser nudiventris*	EN Alacde+2d	
3. *Acipenser ruthenus*	VU Alc+2d	
4. *Acipenser stellatus*	EN A2d	
5. *Acipenser sturio*	CR A2d	
6. *Huso huso*	EN A2d	
7. *Alosa pontica*	DD	
8. *Aspius aspius*	DD	++
9. *Carassius carassius (European subpopulation)*	LR/nt	++
10. *Chalcalburnus chalcoides*	DD	
11. *Cyprinus carpio (River Danube Subpopulation)*	CR A2ce	++
12. *Gobio albipinnatus*	DD	
13. *Gobio kessleri*	DD	
14. *Misgurnis fossilis*	LR/nt	++
15. *Umbra Krameri*	VU Alace	+
16. *Hucho hucho*	DD	
17. *Pelecus cultratus*	DD	
18. *Syngnathus abaster*	DD	+
19. *Gymnocephalus baloni*	DD	
20. *Gymnocephalus schraetzer*	VU Alace	
21. *Stizostedion volgensis*	DD	
22. *Zingel streber*	VU Alce+2ce	
23. *Zingel zingel*	VU Alce+2ce	
24. *Neogobius fluviatilis*	DD	+
25. *Neogobius gymnotrachelus*	DD	
26. *Neogobius melanostomus*	DD	
27. *Neogobius kessleri*	DD	

c+ marks the species which can find suitable conditions in the restored wetlands

c++ marks those species, the numbers of which would be significantly influenced in positive direction (it depends very much on the hydrological regime which is to be observed)

Table 12: Information about the fish caught in the Danube for 2000 IARA-Rousse

	Svishtov	Rousse	Tutrakan	Silistra	Total
Sheat-fish	2975	4694	4830	3946	**16445**
Carp	2787	3515	2370	4755	**13427**
Bighead carp	2663	6250	2970	3666	**15549**
Barbel	5825	12700	4390	6752	**29667**
Grass carp	575	1043	580	786	**2984**
Carp bream	937	2700	4290	766	**8693**
Asp	276	500	280	498	**1554**
Pikc-pcrch	0	1465	1500	1572	**4537**
Pike	117	234	630	146	**1127**
Bleak	1765	0	1290	414	**3469**
Other	5116	13432	2310	10729	**31587**
Hausen-f	140	0	425	343	**908**
Hausen-m	0	0	600	450	**1050**

Danubian sturgeon-f	0	100	175	75	**350**
Danubian sturgeon-m	0	0	0	80	**80**
Sterlet	0	317	160	525	**1002**
Sturgeon-f	0	0	285	280	**565**
Sturgeon-m	0	0	0	90	**90**
Mackerel	1500	1520	495	6014	**9529**
Burbot	0	100	410	540	**1050**
Total	**24676**	**48570**	**27990**	**42427**	**143663**

Table 13: Number of the licenses issued for business fishing and quantity of the caught fish in tons for the period 1995-2000 in the Danube in the Svishtov-Tutrakan area

Year	Fishermen with license	Caught fish in tons	By one fisher in kg
1995	710	323	455
1996	633	385	608
1997	1027	311	303
1998	843	189	224
1999	599	96	160
2000	404	100	248
Average	**703**	**234**	**331**

The number of fishermen with issued licenses for commercial fishing in the Danube has been decreasing during the last three years in consequence of the drastic decrease of the fish stocks. One fisherman from the Danubian area Svishtov-Tutrakan for the six-year period declares an average of 331 kg of fish yearly / 0.852 kg monthly. According to inquired fishermen the average catch amounts to 3-4 kg of fish which means that the average number of fishing days in the year is 94. These data are quite below the real ones because the fishermen are afraid to put down everything because they think they will be taxed for it afterwards. The real catch of fish is probably about twice as big. Even for such a short period (5 years) there is a clearly marked trend for decrease of the catch, the number of fishermen and the significance of fishing as a means of living. A great number of the fishermen are willing to give up fishing if they have an alternative occupation. All fishermen share the opinion that the restoration of the wetlands will increase the amount of fish in the river Danube and most of all that of the carp. In the conversations very few of them assumed that they could catch fish in the wetlands.

III.7.6. RESTORATION OF THE WETLANDS

The restored wetlands will not influence the numbers of sturgeon since it is a typical rheophil species and inhabits, during all stages of its life, only running waters, it is possible only that occasionally young single representatives will enter the wetlands.

The complete drying out of the wetlands even for a short period of time will have an extremely negative influence on the ichthyofauna in both project areas, it is necessary to provide an option with canals or artificially dug out strips, though not being very large, in which the typical wetland species will be preserved, which would be difficult to restore from the river Danube.

At the average depth of 0.35-0.45 m of both areas and the maintenance of that level for about a month and a half their main function will be the breeding of species (that is the supposition of the local fishermen) spawning caviar on plant residues or the entire flooded vegetation (mainly carp, carp bream, to some extent sheat-fish out of the economically valuable species). If the wetlands do not have open water surfaces, fishing will be impossible and the only option is "on guard" fishing at the outlets, of fish leaving the wetland and returning to the Danube. In such conditions it is necessary to secure the unobstructed return of the larvae to the wetlands Especially in the English text, this needs explanation, e.g. (please correct if necessary):

The "guard" is at the outlet of the wetland, where a metal grid with large openings can be placed, capturing only the largest fish but letting the smaller ones freely through. This was a typical way of fishing e.g. at Belene Island in the past.

The Brushlen marsh should not be excluded from restoration.

The numbers of tritons (larvae) at the beginning of August is for the small triton - 4 spec./m2 and 2spec/m2 of the Danubian triton (*Triturus dobrogicus*). The former bed of the river Tarchil is the place with greatest number of tritons.

There is a certain risk for the larvae of the breeding species of being infected by Postodiplostomosis caused by Plostodiplostomus cuticola, it turns out that the infection of some small species (*Leucaspius delineatus*) is almost 100% (especially in Kalimok-Brushlen). The parasite has one more intermediate host - small helixes, and final hosts are herons and other floundering fish-feeding birds. A mass invasion could lead to mortality of the larvae. No medical treatment or prevention methods are known.

III.8. CHARACTERISTICS OF PROTECTED AREAS

The protected areas subject of this investigation fall into the Danubian lowland area. That area is one of the most anthropogenised areas in our country with a limited possibility for the development of conservative protection of nature.

III.8.1. "BELENE ISLANDS" COMPLEX

International ecological status - the site is a part of a CORYNE Biotope Site

National ecological status Nature Park

Reserves: Order N: 1106 KOPS /02.12.1981 "Persinsky Blata" - 385.2 hectares with buffer area - 551 hectares

Natural sights: "Persina Iztok" - 718.9 hectares

The Persinsky Blata reserve belongs to the Belene island group. It includes the freshwater marshes Peschina (182 hectares), Martvoto (122,6 hectares), Staroto Blato and Doulyova Bara (80.6 hectares), the surrounding floodplain forests as well as the neighboring islands of Kitka and Milka. The buffer area is 551.3 hectares. The meadows in the buffer area of the reserve are used for pastures of sheep and cows. Sylviculture is available - part of the area is afforested with hybrid poplars which are regularly changed. The northern part of the island is occupied with agricultural areas and artificial plantation of poplars. Hunting is practiced, international hunting tourism included.

The significance of the reserve's territory with regard to the flora and fauna has been discussed above.

Meanwhile, in immediate proximity to Persinsky Blata - on the island of the same name is the Kitka reserve (24.5 hectares), created to protect the original peculiar vegetation as well as the habitat of the white-tailed eagle which is characteristic of our country.

Towards the end of the 40s Milka Island was also proclaimed a reserve, and it is situated in the same group of islands. Abandoned as a reserve it is again included in the list of protected natural areas.

The island of Belene has a special status. Within the boundaries of the reserve certain activities are forbidden that they are enumerated in the Protected Areas Law.

III.8.2. "KALIMOK-BRUSHLEN" MARSHES

With order N: RD-451/04.07.2001 the area of the "Kalimok-Brushlen" wetlands is proclaimed a Protected Site, including parts of the land of the villages of Oryahovo, Goliamo Vranovo, Babovo, Brushlen in the district of Slivo pole, Tsar Samuil, Nova Cherna, Staro Selo and the town of Tutrakan in the district of Tutrakan.

The Protected Site has the total area of 5952.349 hectares. Certain activities, enumerated in the order, are forbidden within the boundaries of the protected area, precisely:

- Activities related to, or resulting in, draining or disturbing the water regime of the existing wetlands, defined as such by means of permanent designation according to the land register of the respective areas
- Transforming the meadows and pastures from the State and Municipal land fund into arable land;
- Decreasing the afforested area in the forest fund
- Decreasing the forest fund by changing the designation of the land;
- Decreasing the area of natural forests, owned by the state and the municipalities
- Tree logging in the period March-July (incl.) at a distance of less than 300 m from the nesting colonies of birds;

It is necessary that within a six-month period from the publication of the order the boundaries of the Protected Site be marked with solid and easily recognizable marks.

The present order cancels Order RD-2600/17/07/1995 proclaiming Ostrov Bezemenen a protected area (State Gazette, 69/1995).

III.9. LANDSCAPE - BRIEF DESCRIPTION OF THE MAIN FEATURES OF THE STRUCTURE AND LANDSCAPE FUNCTIONS IN THE AREAS STUDIED

In accordance with the regional landscape division of the country please translate, the areas studied fall within the range of the North Bulgarian region of the Danubian lowlands, and two subregions respectively:

- North Danubian lowlands subregion with region Brushlenski, and for Belene Island - Lower Osam region;
- South Dobrudzha sub-region with region Rousse-Lom.
- Encompasses class - Lowland landscape:
  - type – landscape of the moderate continental meadow-steppe and forest lowlands, subtype - landscape of the meadow-swampy lowlands; group - landscape of the marshy meadow alluvial lowlands with a comparatively low degree of agricultural utilisation;
  - type- landscape of the moderate-continental steppe, meadow-steppe and forest-steppe lowlands, subtype - landscape f the chernozem meadow-steppe lowlands, group - landscape of the chernozem meadow-steppe lowlands of loess rocks with a comparatively high degree of agricultural utilization;

Each landscape region inside its higher regional unit differs from neighboring regions by its local features of the rock substratum, mezorelief, and its horizontal and vertical landscape structure.

Nowadays, from a geoecological point of view it is very important to take into account the impact of the anthropogenic factor. The maximum man-influenced geological components in the area are animal life, vegetation, soils and water.

On the other hand, the basic landscape type is divided into: urban landscape, which is characterized by its engineering and technical infrastructure, agricultural landscape, water, river, and riverside landscapes, forest landscapes. The special-purpose landscapes - protected nature areas and the urban landscape, were designated.

III.9.1. AQUATIC LANDSCAPE

The different elements of the riverside area with a dominant natural element the river Danube, are mutually related, and form the basic structure and scale division of the riverside landscape, and they also determine its division into natural sections with varying ecological conditions. The main landscape and ecological features of this type of landscape (according to prof. Robev, 1989) amount to the following: unity of the river system, high dynamics and instability of the separate ecosystems within the range of the water currents for more limited time spans; actively visible water exchange between the atmospheric, intrasoil and underground waters horizontally as well as vertically, which in turn increases the self-purification capacity of shallow waters, a process of accumulation of riverside terrain waters in the alluvial cones, seasonal periodical exhibiting of water exchange, possibility, when necessary, to draw on the accumulated underground waters, swamping of the low floodplains.

A high floods terrace characterizes the riverside sector, it has a hydrophilic vegetation shelterbelt - mostly willows *(Salix)* and poplars *(Populus)*. Behind the dyke is found the easement strip, and behind it - agricultural areas and meadows. Behind the dyke are found the wetlands as well – including the Kalimok-Brushlen complex and the Belene Island wetlands.

These special status areas (wetlands as protected areas) are part of the urban development areas in the preliminary planned terrain in accordance with the requirements of the Protected Areas Law. Enlargement of such an area would have to conform to the specific requirements of the areas with the main purpose of preserving biodiversity and the habitats of rare species of plants, birds and other animals, also preserving the specific landscape, all the time taking into account the forecasts of the urban development plans, with the existence and location of the high-fertility lands, forest and perennial crops, with the transferred land property, and the variation of the habitation standard requirements.

Riverside areas construction work is based on large scale landscape elements - large forest massif areas, meadows, open areas, marshland areas and cultivated land. There are areas where particular nature friendly project variants can be developed, which could contribute to biodiversity enrichment, and would also have aesthetic impact on the riverside landscape. Good results are achieved when technical projects and planning are combined and completed by biological construction methods.

Water canals – these appear to be a frequent cause for the occurrence of ecological and aesthetic problems of the landscape. The basic requirements of the purposes set have to be complied with: appropriate maintenance of the land around the canal, availing some of the area for the needs of the wetlands, creation of new flora and fauna biotopes.

According to the ecological landscape design principles most attractive are such areas as are natural and situated freely in the landscape, thus forming rich and diverse habitats.

Since the construction of water canal is in fact man's interference with the environment, the requirements for the overall scenery variety must be complied with, meanwhile trying to preserve some of the specific character and features of the original landscape, which can be achieved in

several ways: roper tracing of the water canal, whenever possible - constructing the channels by excavation, utilization of the excavation works for the strengthening of the banks and following the natural terrain shapes configuration; also planting of suitable vegetation with consideration to biological diversity and decorative and spatial volume; also procuring the free pass of animals and birds through the canals.

The anti-erosion forest shelter-belts in the project areas are: the riverside vegetation strips between the dyke and the right bank of the Bulgarian section of the Danube, the forests of Belene Island, and the 220 meter strip at the high river bank. These areas are intended to contribute to the stability of the bank strip by means of the protective functions of the forests, also to improve the landscape around the water current, and hinder erosion, landslide, abrasion, and other destructive processes.

The forest shelter belts up to 10 meter wide that are situated on both side of irrigation and other artificial water currents have a meliorative impact, which results in stabilization of the environment, improvement of the microclimate, reduction of evaporation from the spaces between the canals.

In the *riverside* strips of the Danube growing, renovating, reconstruction and sanitary cutting is performed. In case of a full cutting of poplar vegetation in the area between the dyke and the riverbank, creation of willow trees shelterbelt is obligatory.

Please check the translation to make sure that willow is willow and poplar is poplar!

Natural water currents have a characteristic cross section that determines how is riverside vegetation upwards from the aquatic zone of the bank slope to be situated. After the deep fast-running water section, there is a shallower section of slow waters and various vegetation. Then, above it, there is a wetland riverside area of the reed belt, alders, willows and poplars, and finally comes the dry area of the hardwood tree and bush species. Apart from the vegetation, deeper waters and the shallows are inhabited by various animal species, and thus a finite ecological system is created, which is ecologically balanced and almost entirely self-purifying.

Controlled vegetation planting along the water currents provides one of the best ways to stabilize the soil and prevent bank erosion. A protection layer can be created on the riverside slope with an appropriate dip by means of turfing, grass and planting of suitable bulrush, reed, and even softwood bush variety. It is also recommended that there be left an open, unafforested area, at least 6 m. wide, between the dyke heel and the planted poplar woods.

In the forest shelterbelts along the irrigation canals, maintenance cutting of average intensity is performed, which ensures the appropriate structure and aerating of the vegetation.

Marshes - The marshes are a variety of the natural water areas - these are basins whose total area, or most of it, is taken by hydrophilic vegetation. During planning and development of the areas around the water basins, it is a generally accepted practice for them to be planted with typical vegetation. The wetland between the water and the dry lands can be planted with special grass mixtures of wild perennial grass species with a strong surface root system that will strengthen the soil.

Various foreign and home specialists have concluded that biological conservation and self-purification of the natural and artificial water basins can be achieved by means of appropriate vegetation. Water basins and areas protection is ensured by means of several vegetation belts, which appear as filters where polluted water passes through. In order to protect the water basin it is necessary to ensure a wide strip of land with loose soil, rich in microorganisms, which, together with the vegetation growing on it, retains a large quantity of harmful material.

III.9.2. AGRICULTURAL LANDSCAPE

Areas of good prerequisites for farming and large scale agricultural structure; areas of low production potential, which will be changed by merging or termination of their utilization as farming land.

Areas of high natural value, which will be stabilized and integrated in agriculture on the basis of expected funding of their landscape development.

The mismatch of interests in agricultural utilization of the land and the stable structure of the various landscape elements entails inevitable changes. Each landscape, however, can be changed within certain limits, and then a new type of agricultural landscape appears - a new landscape structure is forced on the original natural system.

In some agricultural regions restoration of the traditional scenery of the farming landscape is governed by other principles, different of those of farming (tourism and recreation, ecological protection, limiting of the urbanization process, etc.)

When a new strategy is developed for the future of the farming lands in the are, a balance must be achieved between the necessity to preserve and revive natural environment, and the social issue, related to the depopulation of particular regions.

Efforts must be directed towards the realization of some activities like introduction and maintenance of farming activities that meet the requirements of the natural landscape conservation; buying out of land or warning of proprietors by the state about the performing of environment protection activities, about wildlife conservation, creation of ecological refuges and corridors, development of recreation areas, etc.

A current issue for the farming regions is that more and more people are living and working in the countryside, in the agricultural field; the strife for wildlife protection is gaining strength, also the efforts to re-establish the old agricultural traditions.

Changes in agricultural landscapes due to the acceleration of the urbanization process are related to the taking up of agricultural terrain for the development of urban places and their accompanying functional zones. For example, the transport system is both a source of soil pollution but also a largely land-consuming system.

Internal factors for changes in the structure, appearance and character of the agricultural landscapes are connected to the way the land is cultivated, the application of pesticides, fertilizers, stimulators, irrigation systems construction, etc.

According to 1991 data, in Bulgaria land is distributed by 0.45 ha per capita, however about 96% of our farming land is polluted and damaged.

III.9.3. TYPES OF AGRICULTURAL AREAS

Agricultural areas as a whole fall in the category of non-irrigation farming, irrigation farming, and pastureland.

In natural landscapes there is a constant circulation of substances and energy between the soil and the vegetation. In agricultural areas, however, this process is one-sided - nutrient substances are obtained from the soil through the crops, while their natural return from drying up and vegetation rotting is missing. The formation of humus substances in the soil is slower and at a smaller scale. Agricultural land cultivation leads to mineralization of the organic and humus substances, to dusting and loss of nutrients. What is more, erosion occurs, various weeds start developing, and yield shrinks. As a result from ploughing up and washing of solid particles, solid composition inflow to the rivers is increased. Thus river water chemical composition is changed due to

agricultural waste pollution. In closed water basins and smaller rivers with a deferred water circulation phytoplankton increases, which in turn leads to lack of oxygen and the appearance of the so called "dead water". The eutrification process is very difficulty to be reversed.

Irrigation farming - it is the cause for some of the most serious anthropogeous changes of the landscape. Agricultural landscape is changed most drastically in the areas of irrigation and drainage systems. Changes take the following shape: change in the relief - network configuration of the landscape structure, changes in the microclimate, disruption of the general water balance; disruption of natural soil formation; occurrence of irrigation erosion, secondary acid salts formation in the soil.

Pasture stockbreeding is a separate kind of agricultural utilization of the area. Overuse of grass landscapes for pasture of a large number of cattle has caused changes - general deterioration, turf destruction, soil destruction, etc.

Activities for agricultural landscape development - the efforts foe restoration of the eroded agricultural farmland are carried out as a system of landscape development activities - agroengineering, hydro engineering, and afforestation and melioration activities.

Beside the basic ecological, engineering, and economic problems pertaining to the agricultural landscape development, there are also some social and aesthetic issues to be resolved. Part of them have to do with the conservation of the landscape structure containing the basic elements - crops, vegetation belts, tree plantations, water areas and irrigation channels; the others concern the establishing of land-utilization culture, and also the agricultural landscape utilization in the recreation sphere, and development of the so called "rural tourism".

Agricultural landscape protection in Bulgaria is made possible by the some new laws on regional development, on property and farmland utilization, which regulate the way the land should be used without damaging the soils, and in compliance to the sanitary and hygiene, fire precaution and ecological requirements.

It is also essential that landscape development plans be available for the areas studied, which should include the following:

- determining of the basic damage caused by the development of agriculture -soil and water pollution, erosion, acid salts concentration, decrease in soil fertility, destroyed habitats, etc.;
- planning of the routes and the sites of the engineering infrastructure of the agricultural areas, and special purpose areas, and their shaping with appropriate tree and bush vegetation so that they fit the scenery better;
- creation of isolation vegetation massifs around the agricultural structures, the cattle farms, warehouses, etc;
- merging of areas of perennial vegetation into large massifs;
- development of a system of forest shelter-belts;
- choosing of recreation places along the water currents;
- development of a synchronized system of the area by merging of all isolation and protective forest massifs, perennial agricultural crops, forest shelter-blets, etc. which form the spatial structure of agricultural landscapes;
- creation of ecological "isles" - sections of natural vegetation, as safe ports for animal and plant species threatened with extinction.

III.9.4. FOREST LANDSCAPES

Human activity is a basic phytogeographic factor. Our forests fall into two basic groups, according to their utilization: economic utilization and special purpose forests. Special purpose forests are:

Protected natural forest areas:

- natural reserves, protected landscapes;

Other special purpose areas:

- hunting ground;

The age structure of the forests is negative. The greater part is of young trees of age up to 20 years, and those of the III class, of age 40-60 years only comprise 3/4 of the forest areas. Such type of age structure is unsuitable both for economic maintenance and for recreation activity.

In the Bulgarian forest areas classification system (Robev, Zahariev) the lowland forest landscapes comprise of areas of willow and poplar plantations, plain and mixed ones, along the Danube riverside, also those of its tributaries, as well as those of the islands subject to longer periods of flooding.

There is one peculiar type of forest plantation that very well reflect the forest-anthropogenic activity relation, and namely small woods, green isolation and shelter belts, as well as small groups or single trees on the agricultural landscape. Against this countryside background they are the sole survivors of the vegetation habitats, which are now hosts of a peculiar wildlife, without which the ecological equilibrium in nature would be impossible. It is therefore not recommendable to use them in a way to compromise their specific character of natural plant communities and animal habitats.

A certain tendency has been recognized for transforming part of cultivated land into forest plantation areas with the aim of improving the landscape state by creation of new wildlife habitats, stimulation of the recreation tourism and sports activity utilization of these areas, and thus increasing farmers' income and the ensuring of new employment, plus the new wood production.

However, during the construction process the landscape will be disturbed. Some of the landscape types, as well as visual appearance and character will inevitably be changed.

III.10. CULTURAL HERITAGE

Close to PS23 of Drainage System Brushlen is found Kaleto - a historical site that is very often visited by treasure-hunters and sometimes by tourists ☺. After a choice of the flooding alternative, it might have to be surrounded by protective dykes. Is it known at what elevation the site is located and how feasible it would be for this site to be affected? If yes – please indicate. If not – please recommend the corresponding assessment.

III.11. HEALTH RISK

III.11.1. MOSQUITOES AND THEIR CONSEQUENCES

The mosquitoes from the *Anopheles* genus transmit the four types of plasmodia, which are the causative agents of human malaria. They are *Plasmodium vivax, P. malariae, P. ovale, and P. falciparum* and cause the tertian, the quartan, the atypical tertian, and the tropical malaria respectively. Prior to 1965, all of them were detected in Bulgaria. Three types of malaria transmitting mosquitoes were registered in Bulgaria.

Anopheles maculipennis is the most widespread in our country. It is almost ubiquitous but prefers cleaner and overgrown with vegetation water basins that are slightly shaded, shallow, and sunlit. It is widespread in the Danube River wetlands nowadays.

Anopheles sacharovii is spread at the seaside and is the second most important causative agent. It is not met around the Danube River.

Anopheles superpictus is the third most important plasmodium transmitter, which larvae develop in slow stony-bottomed streams. It is widespread around the Danube River, particularly during the late summer months.

The species composition of mosquitoes will not change following wetlands restoration. Mosquitoes, which could be potential transmitters of malaria plasmodia, are encountered within the region in great numbers even now.

In 1965, Bulgaria was announced a malaria-free country by the World Health Organization. According to the Rousse Sanitary Inspectorate, no endemic malaria cases were registered in any of the Danube River settlements. In Bulgaria, only single malaria cases imported by Bulgarian or foreign citizens from endemic malaria regions are known. The disease may reappear in the following ways:

By means of infected people – if a large number (>10) of people infected with malaria are located simultaneously in any malaria plasmodium endemic regions (none in Bulgaria) and they are exposed to the bite by the mosquitoes of the *Anopheles* genus for a sufficient period of time. Could you indicate what period of time would be sufficient?

Through infected mosquitoes – with the import of *Anopheles genus* mosquitoes into the region, infected with malaria plasmodium. Such an import could happen through migration of mosquitoes from endemic foci in neighboring regions. However, we should take into consideration that mosquitoes do not migrate more than 10 km. The closest endemic malaria foci are the Asian part of Turkey and the south parts of Greece (700 — 800 km), i.e. the transmission of plasmodia is not possible in practice.

Neither of the situations aforesaid does depend on the surface area of the recovered marshlands, nor will be facilitated by the activities related to the restoration of the wetlands. **The recovery of the wetlands will not increase the risk of malaria under any circumstances.** Please make this statement stand out and include it in the conclusion of the report.

The mosquito number depends mainly on the presence of shallow waters or floods, which are not linked to the main water basin, and where the temperature is rather high for any fish or amphibia, which feed on larvae, to be present. Therefore, the mosquito number is greater during the driest periods and years no matter how paradoxically it sounds, when the water basins break down into separate puddles and the appropriate habitats are abundant. The restoration of the wetlands, which presupposes a comparatively constant high level, would limit to a great extent these habitats.

The greater part of the people living around the project areas that were born in the 40's or before (and they are the predominant portion) suffered malaria or their relatives suffered or died from this disease. These people associate the disease disappearance only to the drainage of the marshlands, in which they also took part. It should be made clear to them that malaria cannot arise suddenly by itself; it should be transmitted from somewhere. **The great mosquito number is not a reason for malaria appearance.**

Malaria plasmodium carries out a part of its cycle — the sporogonium — in the mosquito body, which terminates with the appearance of sporozoites in the mosquito salivary glands. The duration of sporogony depends on the temperature of the environment, where the mosquito is located

and on the type of plasmodium. If temperature is low, the mosquito development stops and continues with its rise. It means that the gonotrophic cycle is shorter than the sporogony duration. The female undergoes 3-4 cycles, although only one sporogonium is carried out. It was shown that a certain amount of summated heat is necessary for the realization of sporogony, the lower threshold being 16°C; in such case the sporogony duration is increased for the development to take place. This is the reason the foothills in Bulgaria to be free of malaria.

We recommend that an approved methodology for mosquito control be used. Such methodology is described in the report of the team working on the ToR for the Management Plan.

III.11.2. FACTORS, WHICH INFLUENCE MALARIA INFECTION

- Degree of susceptibility to the infection with the human plasmodium.
- Duration of sporozoa preservation in the salivary glands: e.g. in *An. superpictus* they degenerate more rapidly than in *An. maculipennisi.*
- Mosquito count — the transmission probability is proportional to the mosquito number.
- Mechanism of host seeking and finding.
- Seasonal course in mosquito counts, individual life duration.
- Number of gonotrophic cycles and number of females reaching maturity.
- Endophility (in or outdoors mosquitoes).
- Mosquito hibernation (as a larve or an imago).

Four types from the *Plasmodium* genus parasitize in man, which cause 4 malaria diversities. *Plasmodium vivax* causes the Tertian malaria, *P. falciparum* — the Tropical malaria, *P. malarie* — the Quartan malaria, and *P. ovale* — a tertian malaria with a weaker manifestation.

The bloodsucking mosquitoes as plasmodia transmitters

In the past the malaria transmitters in our country were the mosquitoes *An. maculipennis* and *An. superpictus*. In 1965 The World Health Organization officially declared Bulgaria for a malaria-free country. Since then up to nowadays only cases of imported malaria were registered in our or foreign citizens coming from endemic malaria regions. However, on a world scale even nowadays malaria remains the most widespread protozoic disease on the planet, from which still suffer over 200 million of people annually and over 1 million die, mostly children. The local (autochthonous) malaria in Europe is to a great extent eradicated —there are still cases of that disease in Turkey, as well as single cases were registered in Greece and in the Soviet Union. Now, the major problem in Europe is the malaria imported from other continents.

III.11.3. TAENIAE

Only one type of the taenia *Metagonimus yokogawai* (Fam. *Heterophyidae*) with host the freshwater cephalus *Leuciscus cephalus* was described in 1978 in the Lom's and Svishtov's regions from the parasites with a fish host, which could be dangerous to human health. As far as it is a typical river (reophilic) species and its entry into the recovered wetlands would be occasional and only in single numbers, the risk of that parasite is practically zero. This taenia has not been observed in humans so far. How do the highlighted parts make sense together? Has it not been found in man in Bulgaria or ever? An infection could occur only through consumption of uncooked fish that was not freed from its viscera.

III.11.4. HEALTH RISK FOR THE LIVESTOCK

The only livestock disease of significance directly related to wetlands is the parasitic distoma. It is caused by the trematode *Fasciola hepatica*. Its final hosts are almost all domestic animals and many wild animals. The intermediary host of the disease, Galba truncatula, establishes the link to the wetlands. Usually, the most widespread contagion occurs during the autumn. The parasite establishes itself in the liver and in the gall-bladder ducts. Typically, a large number of the animals in the herd/flock fall ill at the same time with various, non-specific symptoms. The acute phase is followed by a chronic sequence, almost without any symptoms.

According to the Mekom slaughterhouse in the town of Silistra, which collects animals from the entire northeastern part of Bulgaria, the sheep and cattle in the area are 75% infested with this parasite. The restoration of the wetlands cannot increase this percentage of incidence, which has reached its saturation maximum.

The same is assumed to be the case in the Belene Island of which no data are available. Trematode is a widespread disease at present, more like indisposition among the diseased animals, whose only economic impacts is slight reduction of meat and milk yields. The risk of serious regeneration of trematode and possible serious agricultural damage is unfounded.

The remaining transmittable diseases such as leptospirosis and the parasitic diseases such as paramphystomytosis, echinostomatosis, drepanidoteniosis and spirouratoses in birds are related to water to certain extent but are unrelated to the restoration of the wetlands.

III.11.5. RISK FACTORS DURING THE BUILDING PROCESS

Risk for the health of people working without abiding the requirements of the Healthy and Safe Working Conditions Law (Governmental Journal, Vol. 124, 1997) and its substatutory acts.

During the realization of the building projects:

- Atmospheric air and working environmental pollution with increased concentrations, dust and other building materials with a marked effect upon the upper respiratory system, the eyes, and the skin;
- Exhaust-pipe gases and end-products from the destruction of motor lubricating oils of the building machines;
- Additional noise loading;
- Risk of accidents and damages;
- Inappropriate stocking of building materials.

It is necessary to abide to the instructions for safety of work and to keep strictly the technological and labor discipline in order to avoid the risk for human health.

The resources spent in agriculture and in forestry enterprise, as well as the resources for prevention from mosquitoes, should be coordinated with the Ministry of Health authorities.

IV. ANALYSIS OF THE ALTERNATIVES WITH REGARD TO THEIR EFFECT ON THE ENVIRONMENT, ANALYSIS OF THE "NO PROJECT" ALTERNATIVE INCLUDED.

IV.1. ZERO ALTERNATIVE

The zero alternative (no project) will cause complete degradation of wetlands and, even, disappearance in the near future of some marshes (such as on Belene island) in the two project areas. This would have a negative effect from environmental and conservation viewpoints. It should not be forgotten that in the past these had been among the most important floodplains for fish spawning and for breeding of certain rare bird species along the Bulgarian banks of the Danube with enormous significance for fishing, sustainable natural maintenance of the fish resources and preservation of the populations of endangered species of birds, and of the biodiversity in general.

In reality, the environmental situation in the project areas would be favorable for the more and more massive spreading of mosquitoes in the region. The situation is such that there are shallow drying water bodies with standing water, many puddles, marshes and wet meadows, all combined with insufficient natural predators feeding on the larvae of mosquitoes (such as certain fish species and aquatic invertebrates).

There is no serious potential for the economic use of these lands. The wetlands cannot be used for sustainable agricultural practices due to the negative impact of ground water, due to risk of soil salination. Only limited grazing is possible (extensive livestock breeding) and extraction of reed and wood, which would not have a significant socio-economic effect for the local population.

There is international pressure for the implementation of ratified conventions and international documents directly or indirectly related to the issue of wetland restoration under which Bulgaria has undertaken international commitments, such as *the Convention on wetlands of international importance especially as waterfowl habitat (the Ramsar Convention), 1971; the Convention on co-operation for the protection and sustainable use of the Danube river, 1994; the Convention on the protection and use of transboundary watercourses and international lakes (Helsinki, 1992); the Convention between the Government of the Republic of Bulgaria and the Government of Romania on environmental co-operation, 1992; the 1992 Convention on biological diversity; Convention on the conservation of European wildlife and natural habitats (the Bern Convention); the Convention on the conservation of migratory species of wild animals (the Bonn Convention), 1979 (amended 1985,1988); the Convention concerning fishing in the Danube water, etc.*

In conclusion, the zero alternative would cause restriction of any large investment in the area defined as a pilot area for restoration of the large wetlands along the lower stretch of the Danube. Such restoration project would lead to rejuvenation of the area, creation of new jobs, supporting of and initialization of sustainable economic practices as well as a number of other indirect activities in support of the local population which lives in deep poverty at present.

IV.2. ALTERNATIVES FOR THE RESTORATION OF BELENE ISLAND

In general, we support regulation of the proposed flood level in this project area up to 20 m above sea level as is provided for in 4 of the proposed technical flooding alternatives. Although a slightly higher flooding level would ensure a much larger flooded area (2,400 ha, as compared to only 1,562 ha), the high levels of the water of the Danube are rather short at present and would not last for more than a few days (following the construction of the Iron Gate facility). Pumping of water would be required to maintain such high levels for longer periods, which is extremely expensive and virtually impossible owing to the high permeability of soil. We believe that the

proposed flooding level of 20 m will ensure flooding duration of 50-60 days, which is sufficient from an environmental point of view.

Two of the alternatives propose entry of the water from the southern part of the Belene island which is undesirable because of the possible thermal impact in the future by the nuclear power plant whose construction has been stopped, and because of the very high cost of the construction and maintenance of the canals. We would prefer the other two alternatives offering entry of water from the northern side of the island. According to the technical team, one weakness of the northern flooding option is the "complex water regime around the two inflow points caused by the unstable bank strip". However, it should be kept in mind that this had been the main and natural flooding in the past. We put the stress upon the northern option with additional internal dykes, which protect agricultural land to the west of the wetlands. However, this should be supported with a much more detailed technical design in order to evaluate the risk of bogging and salination of agricultural lands, estimate the functioning of the draining system in the western part of the island used for agricultural produce and assess the risk to the existing infrastructure and buildings.

IV.3. ALTERNATIVES FOR THE RESTORATION OF KALIMOK-BRUSHLEN

Similar argumentation regarding the flooding level (see above) relate to Kalimok-Brushlen as well and it should be accepted that following the construction of the Iron Gate facility, the original flooding regime will never be restored. Therefore, we support the proposed flooding level of 14 m above sea level. The technical information (according to the report of HPC-Bulgaria Ltd and Aquatest a.d.-Prague) showed that direct flooding of flood plains is possible for around 60 days and the wetlands will have no connection to the Danube for the remaining 300 days. This is natural of the type of ecosystem and the natural maintenance of the water level in the marshes by means of pumping (as proposed for both project areas) would not be a sustainable economic practice owing to the large financial cost for construction and maintenance to be borne in such serious economic crisis. We believe that the drying of these habitats is a unique phenomenon and should not be regarded as a negative aspect, and constant year-round flooding should be sought after by all means.

The issue of preserving absolutely all dykes should be clarified and that the flooding regime will depend on the inflowing and outgoing of water through sluices and through soil infiltration. The sluices should be designed to comply with the possibilities for migration of the fish species in the lower stretch of the Danube, i.e. they should be equipped with adequate fish ladders.

At this stage we cannot render definite support for any of the alternative ideas for the flooding of the Kalimok-Brushlen marshes for the following reasons: (i) No technical solution of the problem of irrigation of large agricultural land prior to the wetlands has been proposed, since the current drainage will be stopped by the restored marshes and would lead to flooding of agricultural land and infrastructure; (ii) All possible efforts should be made to restore the Brushlen marsh and the wetlands along the Tarchil river. These wetlands are of different types and would provide for multiple increasing of the conservation significance and sustainable drainage of the Tutrakan marsh pan-valley. At present these are severely degraded, poor in biodiversity and with deteriorated ecological conditions; (iii) The technical aspects of flooding of the eastern zone of the former fish farm are not provided for in any of the alternatives. There is an enormous number of dykes in these fish farms, formerly Bulgaria's largest, that would not be flooded at levels of 14 m, i.e. much of the project area would remain unflooded. The opening of the fish farm and the provision of open connection between the pools should be a primary objective of the project in order to stop the rapid degradation of the empty or half-empty old pools. The remaining structures in the Eastern zone of the fish farm are a serious technical problem regarding the flooding of the Kalimok marsh; (iv) We do not accept one of the alternatives for construction of deeper fish pools (for intensive fish farming) at a depth of 2-2.5 m and their connection via meandering

canals, since this negates the project objectives and the cost would be enormous. Also, the naturalness of these wetlands would be largely lost and these artificial structures would be useless in trapping nitrogen and phosphorous from the Danube.

We would prefer the first proposed alternative for maximum restoration of the project area, but with the construction of many additional protective internal dykes and other protective structures.

IV.4. USAGE OF THE PRODUCTION FROM THE FLOODED FORESTS, REED, AND THE FLOODED MEADOWS

IV.4.1. FLOODED FORESTS

In order to foster nutrient reduction, the accumulated biomass should be regularly removed and utilized by the local population in an appropriate way. The utilization of the biomass may be carried out as a fuel (with or without an additional transformation into brickets of patent fuel), as a raw material in the paper industry or as a building material. When necessary, the areas of the flooded forests could be increased artificially and regulated.

IV.4.2. FLOODED MEADOWS

The flooded meadows may be utilized for non-increase/reduction of the nutrient sources in the same way like in the flooded forests. Following the falling of the water level, the meadow production may be utilized as hay or pastures. The production in the flooded meadows is up to 1 kg dry weight/m^2/per year.

IV.4.3. REED AREAS

The reed area production may be utilized as a fuel or as a raw material for the paper industry. According to the measurements in 'Sreburna' reserve (near Kalimok), the production by this community is 1.926 kg neat dry weight/m^2/per year.

The utilization of all type of resources should be strictly regulated and limited. The utilization of the game resources should be subjected to a strict control as well. The number of some animal species should be limited (Belene Island) such as jackals, boars, rooks, which are a great many of for the time being and menace the populations of rare and threatened species. The legal regulations for utilization of the protected territories should be abided to.

The stage of recovery of the affected components of nature will be longer, and yet their nature conservation value will increase.

IV.5. RECOMMENDATIONS FOR A SUSTAINABLE DEVELOPMENT OF FISHERY IN THE PROJECT AREAS

IV.5.1. LEGAL REGULATION OF FISHERY IN THE REGION

Under the new law for fishery and aquacultures the Danubian wetlands are considered foresightedly as areas where fishing and fishery may be carried out (although at the time being such wetlands practically do not exist). The licenses that are issued nowadays are valid only for the Danube River. With a lack of a forbidding regimen mentioned in the ordinances about the protected areas, separate licenses will be issued for the Danubian wetlands Fishing could be carried out by everybody who possesses a certified fishing license issued by the Regional Forest Authorities (RFA).

IV.5.2. PROPOSED VARIANTS FOR THE INTRODUCTION OF A FISHING MANAGEMENT REGIME IN THE PROJECT TERRITORIES

IV.5.2.1. Kalimok-Brushlen

Variant #1

Complete ban on fishing. This is the best solution for the ichthyofauna preservation provided the other conditions are ideal. Unfortunately, the control will be rather difficult in practice due to the vastness and difficult accessibility of the territory. The security efficiency will be very low, while the poacher methods seriously damage the ichthyofauna. The reserve Sreburna may be given as an example, where the poacher fishing is a severe threat and its prevention requires a lot of finances. It is not recommended.

Variant #2

Authorization of fishing (by annual licenses according to the new law) within a specified period, as well ban on the catching of certain species and fish catch quotas. As a result of the supposed large number of fishermen, control on fishing and catches will be very difficult. An actual risk exists for overfishing or fishing in the prohibited periods and territories. As a result of the short-term duration of the licenses the fishermen are not interested in sustainable fishing. It is not recommended.

Variant #3

Creation of a fishing cooperation, which should manage the fish wealth of the recovered wetland — it is the best variant in practice as the fishermen from the cooperation are interested in sustainable fishing due to the supposed long-term functioning of the cooperation, the control is much easier as only one unit is regulated. There exist conditions for intrinsic control. The fishermen in the cooperation will not allow poaching themselves. Working places will be opened for non-fishermen.

An example with the 'Danube' Cooperative

The 'Danube' Cooperative was founded after 1921 in the Brushlen village with the appearance of 'Law for Fishing' and with a fishing region the Brushlen marshy lowland. Toward 1938 it comprised 28 persons and eleven boats, The Law for Fishing had provided funding of fishing cooperation. Part of their profit (10%) was deduced according the law for the maintenance of the marshland – guards, canal. It probably lasted till the draining of the lake. Unfortunately, because of the short time and the difficult access to the archives, we cannot specify the quantity and the species composition of the fish caught by the cooperation. The cooperation chart is to be written by a team of specialists - ichthyologists and IARA experts. As basic limitations there will be - prohibition on introduction of non-native species, prohibition on fishing during the reproduction period, a catch quota can also be introduced, along with other similar measures. Marshland fishing has to be stimulated by means of comparatively inefficient but highly spectacular fishing methods such as "on guard". Together with the Danubian Fishing Museum in Tutrakan, traditional fishing can be transformed into an ecotourism opportunity. A fish market can be founded in Tutrakan where everyone will abide to clear rights and obligations, the whole establishment being under IARA control It is also necessary that regulatory framework, and fishermen's attitude towards membership in such a cooperation be studied, but this will happen over time.

IV.5.2.2. Belene

There are no problems on the island in connection with poaching control, therefore it does not exist a real poacher danger. Nonetheless, it is important that fishing management is coordinated with the prison management, whose members are very unlikely to agree to prohibition on fishing

in the wetlands that have previously been used as fisheries as part of the prison facility. In the event of lack of such consent, fishing prohibition automatically becomes meaningless as far as control is concerned. The best alternative would be for the wetlands to be maintained by the prison itself; this combined with certain rules to be complied with, similar to those of the proposed Brushlen cooperative.

Table 24 shows the fish catches from the Svishtov-Silistra section with the sole purpose of giving an idea of the significance of fishing in the Danube as a mainstay for local people. These lists also clarify the current situation of the ichthyofauna there. Numerity distribution is the following: 1. Various; 2 Barbel; 3. Wells; 4. Tolstolob; 5. Carp; 6. Common beams; 7. Sturgeon.

This statistic clearly points the domination of the rheophillic species – a tendency that has existed since the 70s. The cause for it was established long ago (Marinov, 1978) – draining of our Danubian riverside marshlands. This catch of 144 tons of fish per year is done by a total of 240 fishermen, that is 600 kg per professional fisherman. The average price per kg being BGL 2.50 it can easily be calculated that a fisherman gets around BGL 1,500 per year, or BGL 125 per month. Of course, here we do not include fuel expense for motor boats in the estimates, which could, on the other hand, reach up to 70% of the value of the fish caught. To put it simply, this means that profit amounts to BGL 450 per year. We believe the numbers we get from the fishermen themselves do not correspond to the actual figure, but are twice as high. It appears that at present fishing is not the main activity to support a family. Fishing is one of the traditional occupations, which are however, becoming less and less popular among the young generation. For example, there are about 45 licensed fisherman in the town of Belene, of whom the greater part have some other job or are now retired. They believe that fishing alone cannot support their families, all of them practicing fishing from the Danube solely.

IV.5.3. FISH FARMING

One basic recommendation for both of the areas under consideration is that they should not be transformed for industrial fish production. It is by no means acceptable to have non-native species - even as a measure against the mosquitoes (see below). The only exceptions present the worldwide-endangered status species, which supposedly inhabited the Danubian wetlands before their drainage *(Umbra krameri)*. In a situation (scenario) where the natural re-introduction from the Danube would prove difficult or impossible, semi-artificial stocking can be allowed with wetlands species such as the Carp, Prussian Carp, Wells, Ide, etc., and this only provided that the breeding stock was taken from the Danube itself. It is here recommended the implementation of such a regime or scenario that would not hinder natural fish reproduction. Should this be the case, artificial stockbreeding would be much less efficient and at the same time more expensive than the natural process. From an economic point of view, in the long term artificial breeding will prove much less profitable than the execution of an appropriate scenario, and the maintenance of an optimal hydrological regime favoring natural reproduction.

IV.5.3.1. Comment on some of the most often discussed artificial breeding and introduction variants

In earlier studies, an assessment was made of the breeding of Gambusia for biological control of the mosquito larvae, as well as to determine why Gambusia was not bred prior to 1921. The assessment found quite a large number of new species in the Bulgarian Danube sector, such as the sunbleak note that the same species has been named Belica, Owsyanka or Sunbleak in various places throughout this document. Please decide on the correct English name of the species and use only one (*Leucaspius delineatus*), enlisted in Bulgaria's Red Data Book. The Sunbleak is not a new inhabitant but has rather been left unstudied and undetermined because of its closeness to the juvenile specimens of other Carp species. The Sunbleak is the local equivalent of the North American Gambusia *(Gambusia holbrooki)* used for the biological control of the mosquitoes. Its

existence enforces a total ban on non-local species breeding, and especially with Gambusia, although the Sunbleak would probably dominate in a competing habitat, which is what happened after the first artificial breeding in 1921.

Other species include the so-called "far-east complex" (*Ctenopharingodon idella, Hypophthalmichthys molitrix,* and *Aristichthys nobilis*). These species are not representatives of the local ichthyofauna, and to a certain extent are in the role of rivals of some of the local species. They do not reproduce in the area, which is not their natural environment (some data have been collected for particular specimens' reproduction within the Danube river, but there is no evidence to such a process within the Bulgarian section.) Artificial stocking with them could only be justified if the restored/revived areas are used as fisheries for industrial fish growing. These species' function would be to assimilate such resources in an ecosystem that are not, under normal circumstances, utilized by other fishes, but by other organisms (birds, invertebrate) for the purpose of obtaining as higher quantity of fish biological mass from a decar as possible. Moreover, because of what was just pointed, and namely that these species do not reproduce in Bulgaria's natural environment, small fish stocking would be necessary each year, which in part, provided there is a connection with the Danube, will shortly afterwards migrate to the river (Romanian Danube fisheries are quite experienced in this fact from the biology of the far-east complex representatives). This fact makes artificial stocking less profitable from economic point of view. Apart from all this, they need to be caught at the end of autumn, and provided opportunity to enter the Danube rivers (thus being highly unlikely to return in spring), since they are heat-loving species and cannot survive the low winter temperatures in the vicinity of the shallow marshlands.

Artificial introduction of the Mud Minnow (*Umbra krameri*) – a species not proven for Bulgaria – in case an international action plan for the species is undertaken, there should be a way for its artificial introduction within the country. It is possible that the species used to be encountered in Bulgaria but it has disappeared after the draining of the marshes – investigations of the marshes did not use to be the practice – this is also supported by the fact that the Sunbleak was only discovered for the Danube fauna during our expedition, and this in numbers that put it on one of the first places along with the Roach.

IV.5.4. FISHERIES

This is a comment on the suitability of the Riahovo fish ponds for the growing of Sturgeon, and it does not have as its aim the presentation and preparation of specialized investigation for a project organization or promotion. It could, however, lay the foundation for the future teams performing necessary activities connected with the restoration of the marshlands.

The Riahovo fishponds are located close to the ricer but are at present dry, and even used for farming purposes. In this kind of fishponds (ground - piling type) Sturgeon growing is very difficult and unprofitable. It needs investment of considerable funds for the construction of concrete reservoirs. Also, it will need a permanent water flow of at least 20-50 l/sec/dca, and this water could be from the Danube (the conducted chemical analysis showed that the water has good indices, and only during high-temperature periods it will be necessary to improve basin flow rate so that oxygen deficit can be compensated, and also to avoid water overheating). One other possible way, which is much preferable, is the use of drill water but considering the fisheries' proximity to the guarded water supply area, procuring a permission for drilling would hardly be possible.

Further down, we provide the basic information of the most flexible of the Danube Sturgeon - the Sterlet Sturgeon, to give a more clear idea of the conditions that would have to be established in the fisheries:

Sterlet Sturgeon (Acipenser rhutenus)

For this purpose large basins would be needed, and such of higher flow rate (20 l/sec/decar) of the water, and goof oxygen circulation. It cannot inhabit basins overgrown with higher water vegetation, and is therefore often grown in mixed crops with the *Ctenopharingodon idella*. There is also one method of concrete basin growing (ex-salmon farms). It eats benthos, and it also assimilates limited quantity of artificial food. Reproduction is only artificial in case of hypophysis. Spawn incubation period is between 100 and 120 hours. It grows slowly and reaches 200-250g for two vegetation periods (two summers and one winter).

The construction of Sturgeon fisheries requires a large initial investment for the building of infrastructure, which repays slowly. Moreover, Sturgeon market is strongly limited and depends on the export quota, assigned to Bulgaria, and thence to the companies trading with caviar. If the quota is low (as it is now 20% of the requested), then respectively the breeding material quantity that the company can breed into the Danube is small. This quantity can often drop below the profit margin (if there is a rival company developed on the market). Construction of such fisheries requires serious preliminary analysis, and a very reliable and good future management.

The growing of Sturgeon fishes to trade size (or maturity) does not prove profitable.

It is therefore necessary to decide on what species of Sturgeon will be grown and to what purpose.

Construction will need funding, which can be granted by the NDEF or some of the nature protection foundations.

IV.5.5. ASSESSMENT OF OTHER WATER BIORESOURCES (CRAYFISH, FROGS, ETC.) AND THEIR UTILIZATION POTENTIAL

There is no tradition of professional crab and frog catching within the project areas. Crabs are caught solely in the bank cavities of the Danube riverside. We dispose of no information on the resource quality in the Danube riverside marshland, even in the Sreburna Reserve. It cannot be assessed whether they would be of any economic importance without the artificial breeding preceding restoration of the wetlands. Fishermen consider crab catching a funny activity, and would prevailingly not take it up.

The big water frog is the subject of even amateur hunting. It does not inhabit the project areas in large` numbers because of the large flood areas. Its future significance has not yet been assessed because of the lack of information of previous population state.

Probably, if there happen to be established markets for these species, new interest will arise. The basic question is whether such a practice should be introduced in the area, which is a potential threat of destruction of the populations of before mentioned species. It is, therefore, suggested that an assessment should be made after the restoration of the area of whether the recovering wetland resources could sustain such damages.

IV.6. MEASURES FOR WETLAND RESTORATION

For the wetlands to be able to perform their nature conservation functions, measures should be taken for the restoration of their normal water regime. Restoration of the wetlands is to a large extent dependent on the engineering decisions of the project - the essence of the construction the purposes it fulfills, choosing of a variant alternative, financial means available, social responsibility and citizen benefit, also the execution, and of course, last but not least, the maintenance of the achieved.

Revival of the biological diversity is a slow and continuous process requiring consistent maintenance of structures already built. The engineering project and the execution of the different construction works must be well considered in relation to the already existing engineering infrastructure - canals, dykes, pumping stations, roads, existing buildings, drained areas and their farming, as well as the interests of the local population and different organizations.

IV.6.1. THE "FLOODING" OPTION

As a whole, both wetland areas considered can be flooded in a natural way by use of the canals and the dyke sluices. Additional water volume can be fed by pumping, if this is needed.

When pumping water feeding is used, flooding will be supervised and it will not be dependent on the level of the Danube. Incoming flow will be possible even at low river level so that nutrient substance can be retained.

Negative aspects: Direct connection to the Danube would be cut, and the marshland ecosystems will be virtually isolated. A danger exists from the storing of nutrient substance, while pump operation and other artificial measures taken for the maintenance of the closed ecosystem make this approach quite expensive.

Areas allotted for the construction and restoration of the marshlands and fisheries need to be cleaned and purified from household and construction waste - sections polluted with pesticides, fertilizers, petroleum products, vegetation material, etc.

Cleaning of the canals remaining in operation during the new developments from precipitation and dead organic material.

It is also necessary that before launching of construction works and flooding, the humus layer of the vegetation areas be removed, and preserved for later farming needs.

V. MONITORING PROPOSAL

The Ministry of Environment and Water is a competent authority in the management and monitoring of the actions aimed at environment protection – legislation, strategies, policy, international projects and programs, monitoring and supervision, regulation of the activity in the private and state sector. Part of these activities the Ministry carries out through the Environment Executive Agency and its network of 15 Regional Inspections of Environment and Water.

Regional Inspections of Environment and Water gather information and perform supervisory functions in relation to the requirements of ecological legislation/laws for the different environment components.

The Environment Executive Agency creates and supports a National Automatic System of Ecological Monitoring, also provides information for the functions of the Ministry of Environment and Water by means of data and analyses, and performs the ecological monitoring for the various environment components.

V.1. AIR

Harmful emissions over the emission limit values are not expected for said area. It is important that after realization of the sites the possibility for monitoring concerning the air component be considered more precisely and profoundly, although no negative impact of the sites on this component is expected. It our opinion that for this purpose the data from the national Danube bank monitoring can be utilized.

V.2. WATER

The wetlands will be flooded to a certain quota. This entails measuring and supervision of:

- quotas of the water level at certain locations within the wetlands;
- quantity of water fed to the wetlands;
- drainage from the wetlands of the Danube.

Measurement locations will be determined according to the alternative chosen.

Introduction of auto-monitoring in relation to the quality of the waters when entering and exiting the wetlands. A water analysis program connected to the biogenetic elements, and registering of the degree of reduction and catchment in the wetlands.

At a permanent inflow of Danube water, a short-term monitoring should be performed of the indices: water quantity, temperature, electric conductivity, pH, BPK_5, HPK, HB, total nitrogen, including ammonium, nitrate, and organic; total phosphorus, including soluble phosphates.

In rare case of pollution signals monitoring of the specific indices: metal ions, petroleum products, etc.

In case of still water, a monthly registering of the indices for organic pollution and biogenic elements and sulfides content (hydrogen sulfide).

Annual examination of the river bed alluvia/mantles.

Introduction of a hydrobiological monitoring.

Once per season – complex investigation of the Danube waters within the range of the sites.

Use of the data from the national monitoring stations.

V.3. FLORA AND FAUNA

There is an ecological bird-monitoring center of the Bulgarian Academy of Sciences.

It is important to choose such species whose population status has been followed for the last 10-15 years at the least. Such species are:

- birds – Chlidonias hybridus and Aythya nyroca
- mammals – Lutra (Lutra lutra), and Vormela pergusnal,
- amphibian – Southern Nine-spined Stickleback (Pungitius platygaster), and Pelebates syriacus balcanicus,
- medical leech, some species dragonfly, zooplankton;
- plants – white water lily (Nymphaea alba), and Trapa natan).

The species are selected in such a way as to cover the largest possible number of biotopes in the wetlands.

V.4. ICHTHYOFAUNA AND THE ECOSYSTEM

So far it has not been established that biogene concentration (within the range of variation of an ecosystem as the Danube) in the water influences in any way the physiological status of any species of fish, therefore fish populations (and their functions as density, species variety, frequency, etc.) cannot be used as the direct indicator of biogene concentration and content of their habitat. Fish, however, can be a very good indicator of the overall ecosystem development, since they live on different trophic levels and ecological niches, so the presence of some species, and its number appear a good indicator of the direction the reservoir is developing in. In winter, which is a non-active state period for most of the species, fish monitoring is also harder, but it can be carried out by means of other criteria such as winter mortality-rate. This fact is seen as an inevitable, and it will undoubtedly damage fish population if carried out in winder when fish is in a non-active state – December through February.

We suggest that monitoring should comprise of two phases:

Phase 1 – determining of initial state, before beginning of activity for restoration and monitoring of changes in the ichthyofauna state during activity performance.

Here monitoring is flexible and performed within short terms, and is closely connected with the activities carried out. In case of activity, which could cause fast changes in the environment, the impact of which is unknown, monitoring is carried out parallel to them, and the moment any negative impact is registered, they are terminated, and new alternatives must be looked for. In case of activity with negligible impact, monitoring is performed three times a month during the active season and once a month during winter. Description of fish species offered as bio-indicators in level III (of monitoring.

Bitterling (*Rhodeus amarus*)

Brief description: inhabits calm or slow water. The Reproduction process is determined by the presence of freshwater mussels of the Unio genus, in whose gill cavity the roe is spawned. Its development outside the mussel is impossible. Bitterlings do not inhabit places where the mussel is not present. Mussels, on the other hand, do not develop in drying pools or pools with poor gas-circulation at the bottom layers. Here the basic indicator for the basin status is the mussel, but while its monitoring is difficult, bitterling would be the better option especially since it combines two indicators.

Indicator of: clean water, good gas circulation of the bottom for years on end

Carp (*Cyprinus carpio*)

Brief description: inhabits slow and calm water. For reproduction period goes to temporary floods and marshes. It spawns its roe on terrestrial flooded vegetation. It can inhabit such areas permanently but in such cases it barely manages the competition of the other species, especially the gold fish. It has no preferences to the oxygen content and the quality of the water.

Indicator of good connection between the main basin and the wetland if there is a good number population of normal age structure.

Weatherfish (*Missgurnus fossilis*)

Brief description: inhabits slow and calm water. For reproduction goes to temporary floods or marshes. No preferences as to oxygen content of the water.

Indicator of: long-term good state of the basin, lack of hydrogen sulfide at the bottom layer, and of the presence of high water vegetation.

Sunbleak (*Leucaspius delineatus*)

Brief description: Inhabits stagnant water, old river beds, one of the most sensitive species in relation to oxygen content of the water, however, due to the fact that it inhabits the upper water layer it can be found in basins where other, more sensitive species are not present.

Indicator of:

- as part of the rich ichthyofauna, it is indicator of a good ecological equilibrium
- as a mass sole inhabitant (or together with the Prussian Carp) it is an indicator of past or present hydrogen sulfide content or for improper oxygen circulation in the bottom layers, and lack of connection to other basins.

Table 14: Suggestion for monitoring based on the ichthyofauna

Type of Monitoring	Indicator	Purpose of Monitoring
Level/degree III Water ecosystem monitoring by use of fish species as biological indicators	Suggestions for biological indicator species 1. Rhodeus amarus 2. Cyprinus carpio 3. Missgurnus fossilis 4. Leucaspius delineatus 5. Carassius gibelio 6. Pseudorasbora parva	• Gathering/accumulation of information on the ecosystem state • forecasting of its development directions • suggestion of measures at negative changes of anthropogenic or other character
Level II Fish communities monitoring (the wetland ichthyofauna as a whole)	Qualitative and quantitative indicators of the populations – density, numbers, species variety, species co-relation. dominating species, ratio carniverous– peaceful species, bottom dwelling (ecological groups)	• Accumulation of information on the status of the fish communities • forecasting of their development direction • determining of the degree of sustainable use • proposing of measures in case of negative changes
Level I Monitoring of species(international status species, and species of local environmental protection significance)	Number (ind./dca) • pre-reproduction • post-reproduction Age structure of the population	• Accumulation of information on the state of the populations of the threatened species • Proposed plans for purposeful directing direction of some species

V.5. NEGATIVE ECOLOGICAL SITUATION INDICATORS

Prussian Carp (*Carassius gibelio*)

Brief description: ecologically flexible invasive species. Has no preferences as to the habitat conditions. Seriously endangers its kin species – the Crucian Carp.

Indicator of: when it is the dominating species, it indicates seriously deteriorating reproduction conditions and bad gas circulation.

Stone morocco (*Pseudorasbora parva*)

Unevaluated species with potential significance as an indicator of a negative ecological situation in the restored basins.

Brief description: ecologically flexible invasive species. It is not an original representative of the local fauna being artificially imported during the 70s. Seriously endangers local species. So far only separate representatives have been registered.

Each of monitoring levels is independent enough to be used depending on the purposes set. It is recommended that all three levels of the monitoring be performed since indicators of all three can be monitored simultaneously, some species overlap or share other characteristics. At full monitoring the information gathered from each level is much more exhaustive and reliable than of each level was conducted independently.

V.6. COMMENT ON THE BIO-INDICATOR FISHES SUGGESTED ON THE 1999 DANUBE POLLUTION REDUCTION PROGRAM

State of said species population in the Bulgarian sectors.

- Blue Bream (Abramis ballerus)
- Streber (Zingel streber)
- Crucian Carp (Carassius carassius)
- Weatherfish (Misgurnus fossilis)
- Mud Minnow (Umbra krameri)

The two species – Blue Beam and Streber – cannot be used for marshland monitoring since they are strictly reofill species and do not inhabit still water. The Mud Minnoe is a very good indicator but it, too, cannot be used as such, since today it does not inhabit the lakes, though it probably did inhabit the clean still waters overgrown with vegetation before marshes were drained. Its species natural restoration is highly unlikely.

The other two species, the Weatherfish and the Crucian Carp are very good indicators. In our project, we propose the Weatherfish for the assessment of the wetland state, while the Crucian Carp cannot be used as such an indicator because of its small numbers, and is therefore pointed in the Level I monitoring – rare species population monitoring.

Distribution of the monitoring species along the Bulgarian section of the Danube water between 1960 and 1962:

- *Umbra krameri* – not found (still not described as part of the Bulgarian fauna)
- *Carassius carassius* – not found
- *Misgurnus fossilis* – not found
- *Abramis ballerus* – 1 specimens – Village of Ostrov (661 river km)

- *Zingel streber* – 11specimens

  9 specimens – 1961 – between the mouth of the River Timok and the River Archar (845 river km – 770 river km)

  1 specimen – 1962 – town of Kozloduy (704 river km)

  1 specimens – 1962 – Village of Krivina (536 river km)

V.7. HEAVY METALS BIOACCUMULATION

The plan suggested below is basically developed on the Wachs (1998) although it was not proposed for the limnic zone (the current) of the River Danube can be used, with some adjustments, as one of the indicator species for the Danube marshlands as well.

***Table 15*: (after Wachs, 1998)**

Pollution class	Heavy Metals Pollution Degree	Chart color
I	no polluted and low pollution	dark blue
I-II	low pollution	light blue
II	average pollution	dark green
II-III	critical pollution	light green
III	high pollution	yellow
III-IV	very high pollution	orange
IV	extremely high pollution	red

A detailed monitoring survey can be conducted after it is accepted as necessary that such should exist. Then a more detailed description would be possible of the method, the criteria of pollution class determining, etc.

Depending on weather heavy metals accumulation will be monitored in the bioresorce species (those used by man) or their bioaccumulation in the ecosystem, different indicator fish species are proposed.

In case of bioresource species the Carp is suggested, but as far as various flooding alternatives, or rather the hydrological regime changes will determine the different bioresource species, it remains possible for indicators to be chosen among the others – the Roach *(Rutilus rutilus)* for example.

In case of bioaccumulation of the system, three fish species are suggested from three different ecological groups

- Sunbleak (*Leucaspius delineatus*) – short life-cycle – 1-3 years, feeds on plankton;
- Prussian Carp (*Carassius gibelio*) – comparatively long life-cycle, all-eating benthofagus
- Pike (*Esox lucius*)– long life cycle – eats fish.

VI. CONCLUSIONS REGARDING THE ENVIRONMENTAL IMPACT ASSESSMENT

1. There is some risk that the restoration of wetlands may not lead to reduction of pollution (especially regarding biogenic elements such as nitrogen and phosphorous) and may not lead to the expected increase in fish resources in both regions. We expect moderate purifying and trapping of pollutants (mainly biogenic elements) by the restored wetlands. The reason for this is that in order to preserve the naturalness of flooding, no fine adjustment of the hydrological regime would be possible as is the case in the use of artificial wetlands to purify wastewater.

Impact mitigation measures: This is not a true ecological impact but should be considered, nevertheless. A technical solution is proposed to ensure a annual flooding for around 60 days (45 at the least) which would be sufficient for successful spawning of fish and for inflowing of significant volumes of water from the Danube to be treated by the water vegetation. Another important measure is the careful design of the inflow and outflow sluices ensuring unhindered passing of juvenile and adult fishes during their sping-time migration. We recommend construction of special fish ladders for the less agile fishes from the lower stretch of the Danube. Regarding fish resources, the wetlands should be provided with such an aquatic regime as to be able to feed the Danube with larvae and juvenile fish. Regarding the improved purification capacity of these wetlands, a plan for the optimal management of the water in the floodplains in consideration of the water level in the river should be elaborated. Also, we recommend the removal of all possible organic waste from the project area in order to reduce the limited loading of the flooded areas.

2. Risk of flooding and negative impacts by the ground water on arable and non-arable land, buildings, irrigation and drainage structures, roads etc. We consider the risk of negative impacts by ground water in both project areas very high during the spring because of the possible impact on agricultural lands and of the different ownership of land.

Impact mitigation measures: (i) A compensation system should be provided for and agreed upon with the owners of land in order to avoid any possible social tensions (especially in the Kalimok-Brushlen area). (ii) The technical project should stress upon the inland protection such as small dykes, drainage canals etc. (iii) Drawing up of a technical solution for continued functioning of the remaining part of the drainage system upstream of Kalimok-Brushlen which prevent flooding of the large agricultural lands west of the project area, and the drainage system in the western part of Belene island managed by the prison.

3. Health risk – increased population of mosquitoes, risk of malaria and pollution of fish products. Although no significant increase in mosquitoes in both areas is expected, it could occur in years of deteriorated water regime. For example, the zero alternative provides for the most favorable ecological conditions for massive breeding of mosquitoes (drying shallow puddles without a sufficient number of natural predators such as fish and aquatic invertebrates). There is a very low risk of malaria. It is possible that due to global warming, vectors and new sources of contagion could be transferred from the south. The pollution of fish with toxic substances should not be different from that in the Danube, but the data is still insufficient.

Impact mitigation measures: (i) Elaboration of a mosquito management plans for both areas using a combination of biological and chemical control measures. (ii) Introduction of the European standards for control of fish products.

Table 16: Significant (or Potentially Significant) Issues for Restoration Schemes

Issue	Location	Impact Description	Mitigation Measure
1. Reduced pollution and increased fish stocks in result of wetland restoration	Belene Island; Kalimok/Brushlen marshes	It is expected that after the restoration, the wetlands will trap and remove nutrients and will provide for a significant increase in the fish stock and for positive changes in the fish community structure, but this may not happen if the ecosystems become degraded and if they are additionally loaded with nutrients.	1
2. Risk of flooding and negative impact of the ground water	Belene Island; Kalimok/Brushlen marshes	We consider the risk of negative impact of the ground water particularly large during the spring due to the possibility of impacting of agricultural lands. Also, in isolated occurrences there is a real risk of flooding of certain roads and buildings.	2
3. Health risk	Belene Island; Kalimok/Brushlen marshes	No significant increase of the number of mosquitoes is expected after the restoration, except in years of disturbed flooding regime. The risk of malaria is practically non-existent. The pollution of fish will not be different from that in the Danube.	3
4. Impacts of the construction phase on biodiversity, habitats and rare species	Belene Island; Kalimok/Brushlen marshes	It is possible for the construction work to affect certain rare species particularly by disturbance during the breeding period. Also, the opening of the Danube dykes and the installation of sluices will affect the natural tree line between the dykes and the river whose erosion control and conservation significance at present are enormous.	4
5. Impact of the deposition of excavation spoils	Belene Island; Kalimok/Brushlen marshes	In all cases there will be excess soil, organic matter, construction waste etc., requiring removal from the wetlands and disposal.	5

Table 17: Environmental Management Plan

#	Mitigation Measure	Phase	Institutional Responsibility	Cost (USD)
1.1	Elaboration of a manual for sustainable management of the water regimes in the wetlands, such as procedures in the event of accidental pollution, oil spills, sharp changes in water levels, floods, consideration of the breeding requirements of fish, birds, provision of optimal treatment capacity etc.	Operation	Management bodies of protected areas together with MoEW, consultant companies.	5,000 To be included as in the ToR for the preparation of the protected areas management plans.
1.2	A program for reduction of the organic load into the restored wetlands – removal of biomass; protection from organic pollution etc.	Planning	Management bodies of protected areas, MoEW, consultant companies	10,000 To be addressed through the nutrient friendly agriculture program to be supported by the project
2.1	Specialized study for evaluation of the risk from flooding and negative impact on the ground water	Planning	consulting companies, scientific institutions	30,000
2.2	Development of technical methodology for assessment of the project impact on private land owners affected by floods or by increasing ground water levels in the Kalimok/Brushlen area	Planning	MoAF, MoEW, consulting companies	30,000
2.3	Establishment of compensation mechanisms	Operation	MoAF, MoEW, consulting companies	To be addressed through the contingency relief fund program to be supported by the project.
2.4	Drawing up of a technical design of the remaining sections of the drainage systems outside the wetlands on Belene island and Kalimok/Barcelona	Planning	PCU, consulting companies	30,000
3	Elaboration of a mosquito management plan	Planning	Environmental expert of the PCU and MoEW	--

#	Mitigation Measure	Phase	Institutional Responsibility	Cost (USD)
4.1	Elaboration of recommendation for biodiversity conservation during the construction phase	Planning	PCU, consulting companies responsible for detailed design and bidding documents of restoration works	--
4.2	Above recommendations to be included in construction contract provisions/clauses	Construction	Contractor	--
5	Selection of suitable landfills for disposal of waste from the construction phase	Planning	PCU, consulting companies in charge of the protected areas management plans	- -

Table 18: Environmental Management Plan

#	Monitoring Activities	Institutional Responsibility	Cost (USD)
1	Local Integrated Environmental Monitoring (LIEM), including water quality, sediment quality parameters and biological indicators with emphasis on fish monitoring; LIEM will comply with International, National and Regional Monitoring Programs.	Management bodies of protected areas together with MoEW, consultant companies.	Included in component 2
2	Monitoring of ground water level (a part of local integrated monitoring)	Management bodies of protected areas, MoEW, consultant companies	Included in component 2
3	Mosquito population monitoring (a part of local integrated monitoring)	Management bodies of protected areas, MoEW, consultant companies	Included in component 2
4	Biodiversity assessment program during construction phase	Management bodies of protected areas, MoEW, consultant companies	Included in component 2
5	Erosion assessment program	Management bodies of protected areas, MoEW, consultant companies	Included in component 2
6	Solid waste inventory program	Management bodies of protected areas, MoEW, consultant companies	Included in component 2

VII. CONCLUSION

The in-depth analysis of possible environmental impacts allows for the conclusion that the proposed project complies with the environmental requirements of Bulgaria and of the World Bank and the restoration is entirely possible with minimal negative impacts on the local population and on the environment. Any further wetland management would cause significant increasing in the fish resources with positive economic effects for the local population, restored unique biodiversity and reduced biogenic elements and pollution (although not to a large extent).

The EA team completely accept the remarks in Aide Memoire, Technical Appraisal Mission, Sofia, December 3-8, 2001 in the field of environmental assessment issues. We appreciate and support Next Steps and Actions, especially the stated water modeling, which will be realized by the RIZA institute (The Netherlands).

We draw a special attention to Kalimok – Brushlen project area where according to our team the wetland restoration alternative is still unclear. We support the idea for restoration including the Brushlen and Tarchila marshes taking into account all the recommendations for guaranteeing the stakeholders interest.

VIII. PUBLIC HEARING OF THE PRELIMINARY ENVIRONMENT IMPACT ASSESSMENT REPORT

The Public Hearings were carried out individually for each of the 2 project areas.

- For the Persina Nature Park – in the town of Belene, 30.01.2002
- For the Kalimok–Brashlen Protected Site – in the village of Slivo Pole, 31.01.2002

The Participants List is given in Annex I.

VIII.1. GENERAL IMPRESSION

The following conclusions can be drawn based on the good representation of the stakeholders, their activity and participation as well as the overall discussion:

1. A sustainable interest in the Project, its development and future is generated – representatives of the main stakeholders, some of which are regular participants in the meetings, took part in the event. The presence of the local authorities (mayors of towns and villages) was expressed very well. In addition, the Public Hearings were chaired by high-ranked representatives of the local authorities – the Deputy Mayor for the Persina Nature Park (in the town of Belene) and the Deputy Governor of the Rouse region for the Kalimok–Brashlen Protected Site (in the village of Slivo Pole).
2. The Project is considered "feasible" – the No Action Alternative was not mentioned at all by the local stakeholders and not commented upon. Moreover, the Project provokes certain expectations and even concrete activities – the Municipality Council of Belene has already determined a site for a Danube City Park, the development of which is dependent on the Project's implementation.
3. The discussions were carried out in a friendly and constructive manner; there was a good dialogue and no contradictions.
4. The necessity of a concrete technical design for the restoration that would help determine the affected physical and juridical persons was underlined, especially for the Kalimok–Brashlen Protected Site.
5. There is a serious necessity of broad-scale public awareness rising campaign in order to prevent speculations with the Project, to show the national importance of the Project and to continue to attract the local people.

VIII.2. PUBLIC HEARING IN BELENE, 30.01.2002

Mr. Milen Vraykov – the Deputy Mayor of the town of Belene, chaired the meeting.

VIII.2.1. PRESENTATIONS

Mrs. Marietta Stoimenova – Project Manager, PPU

General presentations of the Project, its recent phase, the progress achieved, the changes and the agreements that were reached during the December mission.

Mrs. Snejana Kostadinova – Managing Director, ACG Ltd.

Presentations of the goals and objectives of the preliminary Environment Impact Assessment and of the team that has competed it.

Mr. Stoyan Mihov – expert ecologist, ichthyologist, ACG Ltd.

Presentations of the key findings of the ecological assessment and the position of the consultant team. Stresses on the recommended by the team of ACG Ltd.:

- restoration scenario with arguments pro et contra;
- main ecological benefits (restoration of the past ecological balance, fishing, disappearance of amorpha, minimal ecological risk);
- conditions required to reach these benefits and the relevant recommendations of the consultant team including these on the construction works.

Dipl. Eng. Siyka Vasileva – licensed EIA expert, ACG Ltd.

Elucidates the effects of the restoration on the existing infrastructure, stressing on the need to construct new sluices, protective dikes, channels, etc., and the related to the construction works ecological issues: construction debris, disposal sites, places (careers) from where soil for the rising of the dikes will be taken.

Mrs. Stela Ivanova – licensed EIA expert, ACG Ltd.

Presents the nutrient reduction capacity of the restored wetlands.

Mrs. Snejana Kostadinova

Summarizes the Project from both ecological and social points of view – overall positive effects, identified possible negative impacts and proposed mitigation measures. Information on how the issues raised during the previous visit (Dec. 15, 2001) was reflected in the presented version of the EIA Report.

VIII.2.2. QUESTIONS, ANSWERS AND COMMENTS

Question (Boyko Razgev) Will the deepening of the marshes (the lowering of their bottoms by soil excavation) help lower the level of underground waters? Will it ensure a permanent free water surface?

Answer (Stoyan Mihov) This will put the ecosystem to stress. A depth of 1,2 – 1,5 m is required in order for a permanent free water surface to be formed. In our case no permanent free water surface is needed. As it was already mentioned in the presentation, the ACG Ltd. team recommends that the restored areas be kept as close to the natural conditions as possible. The deepening is not recommended for the following reasons:

1. The natural status of the ecosystem will be perturbed and it will be put to stress during the excavation works.
2. The permanent free water surface is not recommended as the lack of regular drying of the area will tolerate the development of mosquitoes larvae, swamp snails and "weed" (non-native) fish species.
3. In order for this free water surface to be permanent, it should be no less than 1,5 m deep; the reed reappears and grows without a problem at smaller depths. Anyway, deepening is only a temporary solution for the bottom will be filled in again in quite a short time because of the nature of the soil.
4. The main problem is where to dispose of this nutrient enriched soil. No doubt it cannot be used to rise the protective dikes or similar constructions. On the other hand, it should not be neglected that the project area is situated on an island from where it will be quite difficult to remove tons of organic and soil matter.

5. The process of excavation and deepening is quite expensive itself and economically not reasonable.

Question (Christina Panovska, RIEW Pleven) How will the opening of the dikes influence the natural processes of siltage? What is the speed of silting up of the marshes?

Answer (Stoyan Mihov) The aim of the restoration and our expectations are that the process of silting up will be slowed down. The succession is a natural process that leads to the gradual silting up of lakes and, as a result, to their disappearance. The floods of the Danube River slowed the succession in the past. The whole eastern part of the island was flooded at high water level at that time and the strong flow carried away the accumulated in summer dead organic matter. The construction of the dike terminated the process and the organic matter has been accumulating in the wetlands for decades by now, unable to be removed by its natural process. This is the reason for the rising of the bottom of the wetlands. It is expected that the restoration of the connection to the river will slow down the succession processes in the marshes, once again including the organic matter in the natural circle of elements.

The administration of the Prison on the Belene Island (in the person of Mr. Petar Dobrev) expressed its statement, made concrete recommendations and asked concrete questions. It was agreed that these questions concern not only the EI Assessment but also the Project as a whole:

Question When is the beginning of the Project's implementation expected? There are multiseasonal crops in fields that are to be flooded – the crops will have to be changed or moved to new places so it is necessary to know the time of starting of the project activities. These fields total 6000 dekars arable land and there will be significant losses unless timely precautions are taken.

Answer (Mrs. Marietta Stoimenova) Explains the expected forthcoming development of the Project and that the earliest flooding can be expected in autumn 2004.

Comment (Mrs. Snejana Kostadinova) Is it real that from 1290 ha area that is expected to be flooded 600 dekars arable land?

Comment (Mr. Petar Dobrev) This estimation is made based on the proposed restoration maps and on personal experience.

Question (Mr. Petar Dobrev) Could the proposed liquidation of Object 2 be avoided?

Answer (Mr. Stoyan Mihov) This is not of the competence of the EIA consultancy; the question should rather be addressed to the technical team that has developed the restoration scenarios. ACG Ltd. believes that the liquidation or the movement of Object 2 is not compulsory. The Prison could use it during the dry period. However, ACG Ltd. strongly recommends that the stored there organic matter (manure, etc.) be removed. Another recommendation is to use the road on the northern protective dike to access Object 2 rather than the one that crosses the island along its long axis. According to the predictions of the technical team, the latter will be flooded at level of 20 m. It is also recommended that the possibility of destroying the concrete road leading to Object 2 (which now divides the island into 2 parts along its long axis and which will not be used after the restoration has taken place) be considered, so that the road will not block the free movement and exchange of water.

Question (Mr. Petar Dobrev) The existence of the pumping station "Persin 2" is important as it drains agricultural lands of the Prison. Isn't there a possibility to dismantle and remove the station instead of destroying it, as is recommended by the technical team?

Answer (Mrs. Siyka Vasileva) The preliminary EI Assessment draws special attention to the fact that the lands outside the wetlands should remain drained. For that purpose, the construction of a new draining pumping station might be necessary. It could be equipped with the installations from "Persin 2" or with new ones.

Question (Mr. Petar Dobrev) Where will be the soil for the rising of the dikes taken from?

Answer (Mrs. Siyka Vasileva) The quantities of the soil required for the purpose as well as the careers from where it will be taken have not been determined so far. We suggest that this be done along with the construction works design that is to be carried out in the next phase of the Project.

Question (Mr. Petar Dobrev) Where will the terrestrial animals go after the actual restoration of the project area? Won't the pushing out of the wild animals from these lands, associated with the flooding, and their concentration in the remaining smaller area cause health risk, for example – isn't it dangerous that rats will spread diseases among the farm animals and people?

Answer (Mr. Stoyan Mihov) Fear that the entrance of water into the restored wetlands will push the wild animals to the farms and buildings of the Prison is not sound. It must be pointed out once again that the flooding resulting from the restoration will not exceed the present level of flooding caused by infiltration of water under the dike. The natural ecosystems are very fine balanced and the restoration of the natural state of the territory will rather decrease than increase the populations of such human-associated species as rats. The main goal of the restoration is to create better living conditions for the inhabitants of the island by restoring the natural environment, and not to push them out.

Comment The health risk should not be underestimated and new serious studies must be undertaken to assess it.

Answer (Mrs. Snejana Kostadinova) The carried out studies and the assessment of the health risk treat the typical diseases associated with this type of water bodies. Medical experts made them and, based on the recommendations from the previous meetings, a veterinary expertise was included in the report. The position of the team is that the restoration will neither increase the existing nor cause new health risks. However, we strongly suggest that the Management Plan of the Park include monitoring and prevention of the determined risks in order to liquidate any possible source of disease in time. They should be monitored closely during the construction works as well.

(Mr. Stoyan Mihov) We share the point of view that a public awareness raising campaign must be carried out in order to clarify the current level of infectious diseases to the local people. It will cut any speculations and will help avoid the negative attitude of the local people during the restoration, e.g. if presently there are 2 cases of leptospirosis per year, a single one during the restoration works will be referred to as resulting from the Project. It is believed not only that the health risk will not increase in the project areas but even more – there will be much more possibilities (including financial) to reduce the current risks under the Project.

Question (Deputy Mayor of the town of Belene) Won't the restoration of wetlands lead to increase in the mosquitoes population?

Answer Mosquitoes are quite a serious problem even now. The restoration will neither increase nor decrease the mosquito population. However, measures to control the mosquitoes (to be funded by the Project) may be included in the Management Plan of the

Park. The colleagues from the team responsible for the development of the Management Plan presented a German case study and explained the method in general during the previous meeting.

Question Can the water supply tower on the island and the access road to it be preserved? It will be necessary to strengthen also the pipe that supplies the tower with water in order to grant the constant supply of water to the Prison. This could be accomplished through deepening of the wells to the project depth of 18 m.

Answer (Mrs. Siyka Vasileva) Based on your reasons we support and recommend to keep the access to the tower and to the water supply system throughout the whole year.

Question Do the planned activities take into consideration the capabilities of the only bridge connecting the island to the bank? It is decommissioned military pontoon bridge, allows only for one-way traffic and can stand as much as 40 t at a time. The existing road network leading to the bridge and the one on the island are also in bad condition.

Answer (Mrs. Siyka Vasileva) The organization and the implementation of the construction works will be regulated by a project. The latter will be compliant with the access regime to the island and with the capabilities of the existing bridge.

Question (Mrs. Snejana Kostadinova) Is it possible that the administration of the Prison prepares detailed technical characteristics of the bridge and gives it to the Project Preparation Unit (PPU)?

Answer (administration of the Prison) Its is possible and the information will be supplied to the PPU.

Question (Mr. Petar Dobrev) What will be the Prison's compensation fort the opportunity costs of agriculture and farming in the areas to be flooded?

Answer (Mrs. Snejana Kostadinova) There are no real possibilities for compensation as the Prison is state owned and its main activity is not connected with economical profits. However, the ACG Ltd. team suggests that all affected by the restoration land users have equal access to the financial assistance from the transition fund that will be established within the Project. This would allow the Prison to continue its economical activities and keep its social and educational effects on Prisoners. Of course, it must be considered that there will be changes in the economical activities of the Prison – it will be regulated by the Management Plan of the Persina Nature Park.

Question (administration of the Prison) Is it possible that we are supplied with the complete documentation on the Project preparation? We know the territories perfectly and we could express our opinion and make concrete assessments.

Answer (Mrs. Marietta Stoimenova) It is possible. Unfortunately we have only the complete report of the previous consultant team at present. It will be possible for you to get familiar with all Project's details after the additional modeling and the completion of the technical project for the restoration.

Comment (administration of the Prison): The guarding of the island from water is a problem. Most probably there will be a lot of poachers accessing the island by boat.

Question (Mrs. Christina Panovska) Where has the soil for the construction of the existing dikes been taken from? It would be of use to study the history of their construction.

Answer (Mr. Boyko Razgev and administration of the Prison) Soil from the island has been used.

Comment (Director of Persina NP) I think that information must be asked from the Prison for all the proposed steps and activities. The people there are the only ones that have a clear view on the situation and will be of great help.

VIII.3. PUBLIC HEARING IN SLIVO POLE, 31.01.2002

The meeting had a similar beginning to the one in the town of Belene. Here Mr. Evgeny Marinov – the Deputy Governor of the Rouse region, chaired it.

VIII.3.1. PRESENTATIONS

Mrs. Marietta Stoimenova – Project Manager, PPU

General presentations of the Project, its recent phase, the progress achieved, the changes and the agreements that were reached during the December mission.

Mrs. Snejana Kostadinova – Managing Director, ACG Ltd.

Presentations of the goals and objectives of the preliminary Environment Impact Assessment and of the team that has competed it.

Mr. Stoyan Mihov – expert ecologist, ichthyologist, ACG Ltd.

Presentations of the key findings of the ecological assessment and the position of the consultant team. Explanation of the arguments why ACG Ltd. would not support any of the proposed restoration scenarios. Recommendation to design a new scenario that will be reasonable from both ecological and social points of view. An Old Russian topographic map from 1886 was presented. The card gives clear impression on the location of the marshes prior to the construction of the dike. In this context a special attention was paid to the main aspect of restoration.

There are several recommendations to the restoration:

1. The restoration must be as close as possible to the status presented by the old map but in smaller scale as the level of the Danube is much lower than it was 100 years ago. That's why no more than 60 days of free water surface are expected.
2. A restoration as close to the past status as possible means that the Brushlen marsh should be restored, too.
3. The creation of direct natural connection to the river is a must. There will not be any pumping from the river into the wetlands and no artificial enlargement of the wetlands.
4. The restored wetlands will not cover areas other than the ones currently flooded by infiltration of water under the dike.
5. The construction of sluices is obligatory. They will have to meet many requirements.
6. The opinion of the mayor of the village of Nova Cherna that the "southern channel" must be deepened and strengthened is reflected in the present report.

Prior to the end of Mr. Mihov's presentation, Mr. Evgeny Marinov – the Deputy Governor for the Rouse region – changed the discussion mode and insisted on asking questions on the presentations so far. He believed that would help making a discussion. For that reason two main themes were discussed further:

- An accent on broad range of general issues related to the Project as a whole at the early stage;
- Focusing on main issues related to ecological and social assessments at the later stage.

The general issues treated:

- International experience in wetlands restoration;
- Financing of the Project, protection against misappropriation, good coordination between the Ministry of Environment and Water (MoEW) and the Ministry of Agriculture and Forestry (MAF);
- The overall budget and the allocations for the different activities – partners, donors' requirements, exact sums;
- Official promotion of the Project in the massmedia as soon as possible. A misrepresentation in the media might result from misunderstanding of the goals of the Project and lack of coordination between the responsible institutions. The question who is responsible for the Project's official presentation in the public space and what will be the procedure to provide information regarding the Project;
- Information and media policy of the Project as a whole.

Mrs. Marietta Stoimenova provided detailed answers to the above questions. On behalf of ACG Ltd., Mrs. Snejana Kostadinova informed the meeting of the presence of an international consultant in her team and of the keystones in his expertise, related to international experience, benefits of wetlands and their ability to reduce nutrient loads.

VIII.3.2. QUESTIONS, ANSWERS AND COMMENTS

The main issues related to the ecological and social assessments were:

Question (Mr. Evgeny Marinov) Are there similar projects for the Danube basin for restoration only of the two Bulgarian marshes looks quite insufficient for the reduction of the nutrient loads of the Danube?

Answer (Mrs. Marietta Stoimenova) Presents the similar projects in other Danube riparian countries. Reveals the significance of the Bulgaria Wetlands Restoration and Pollution Reduction Project in the light of the Strategic Partnership to reduce the nutrient loads the Danube and Black Sea basins.

Question (Mr. Evgeny Marinov) Will the Project have a demonstration role? Shall not only the ecological effect but also the public opinion and attitude be considered?

Question (Mr. Evgeny Marinov) Will the Project promote practices that will stop the mangane pollution?

Answer (Mrs. Snejana Kostadinova) The assessment made by ACG Ltd. includes both the ecological and the social effects. Mrs. Kostadinova informs in details of 1) all the social studies carried out as well as the methodology used; 2) identification of positive effects and negative impacts of the Project and 3) suggested mitigation measures to reduce the negative impacts.

Question (Mr. Philip Vassilev) What will happen to the fish farms in the region of the villages Staro Selo and Nova Cherna?

Answer (Mrs. Marietta Stoimenova) Explains that the goal of the Project is the restoration of the wetlands and not of the fish farm. The Green Balkans NGO consigned the fish-ponds to the Project and no problems are expected from that direction.

Answer (Mr. Stoyan Mihov) The fish farm is not functional nowadays. It is situated exactly in the area where the formation of the free water surface is expected. The internal dikes between the fisponds will hinder the natural flow of water and the natural flooding of the area. For that reason the dikes will have to be cut in several places. It will be best to completely remove them but this is impossible because of the great volumes of earth that will have to be removed. Anyway, the exact design of the cutting is again a decision of the team developing the restoration scenarios.

Question (Mr. Philip Vassilev) At what intervals will be opened the protective dike along the Danube?

Answer (Mrs. Marietta Stoimenova) Additional studies will have to be carried out in April (at high water level) to determine at what intervals the protective dike shall be open.

Answer (Mr. Stoyan Mihov) What is for sure is that the protective dike will not simply be destroyed to let water in. Specially designed inlet sliuces will be constructed in 2 places.

Question (Mr. Philip Vassilev) What will be done to preserve the agricultural lands?

Question (Mr. Philip Vassilev) What will be done to solve the problem with mosquitoes?

Answer (Mrs. Marietta Stoimenova) Additional dikes will be constructed to protect the arable lands neighbouring the project areas. No drainage pumping stations will be destroyed. If necessary, additional drainage channels may be built.

Question (Mr. Reyhan Ablihim) Is the water of the Danube good enough for environment friendly agriculture?

Question (Mr. Reyhan Ablihim) Is there a possibility that the restored wetlands will turn to depots for heavy metals carried by the Danube waters?

Answers (Mr. Todor Moskov) I can assure you that the Regional Inspectorate of Environment and Water takes samples from the Danube every month. The analyses do not show any excess of the MAC. There is certain excess only in sediments at some spots but there is no way that they enter the flooded areas.

Question (Mr. Reyhan Ablihim) Will the management of the Project be good enough to grant the benefits for the local people?

Answer (Mrs. Marietta Stoimenova) Gives information on the coordination between the MOEW and the MAF and on the planned meetings.

Comment (Mr. Todor Moskov) I think that 60 days of flooding are not enough. The free water surface must be granted troughout the whole year.

Answer (Mr. Stoyan Mihov) The ACG Ltd. team recommends that the restored areas be kept as close to the natural conditions as possible. The deepening is not recommended for the following reasons:

1. The natural status of the ecosystem will be perturbed and it will be put to stress during the excavation works. Populations of globally threatened species were discovered in the project area and they must be conserved.

2. The permanent free water surface is not recommended as the lack of regular drying of the area will tolerate the development of mosquitoes larvae, swamp snails and "weed" (non-native) fish species. There will be enough free water in the channels.

3. In order for this free water surface to be permanent, it should be no less than 1,5 m deep; the reed reappears and grows without a problem at smaller depths. Anyway, deepening is only a temporary solution for the bottom will be filled in again in quite a short time because of the nature of the soil.

4. The main problem is where to dispose of this nutrient enriched soil. No doubt it cannot be used to rise the protective dikes or similar constructions. On the other hand, it should not be neglected that the project area is situated on an island from where it will be quite difficult to remove the hundreds of tons of organic matter.

5. The process of excavation and deepening is quite expensive itself and economically not reasonable.

6. The alternative suggesting the construction of several deep ponds that would connect to each other by means of a canal was commented at the previous meeting. It was agreed then that this option would not support biodiversity and does not correspond to the goals of the Project.

Question Could the present consultant team meet journalists and provide correct information about the Project?

Answer (Mrs. Marietta Stoimenova) Presentation of the Project is not a responsibility of the consultant teams. This is right and obligation of the PPU.

Comment (Mrs. Snejana Kostadinova) If our assistance is needed we could help the PPU with the realization of the public campaign.

Question (Mr. Venko Yordanov) What will be the restrictions regarding fishing?

Answer (Mr. Stoyan Mihov) We would not like to undertake any obligations regarding the fishing. What will be the restrictions and will there be restrictions at all will be determined by the Management Plan of the Kalimok–Brashlen Protected Site. When we mentioned that the access of fishermen might be restricted we envisaged the restoration might lead to flooding of some of their paths to the Danube bank, thus forcing them to change their paths to the tones along the bank or the way of accessing them.

Comment (Mr. Venko Yordanov) Don't worry about that – even now fishermen use boats to access the tones.

Question (Mr. Venko Yordanov) Is there any coordination between the Project and the team responsible for the strengthening of the riverbank?

Answer (Mrs. Marietta Stoimenova) Their work will not be affected in any way. The riverbank will be strengthened as before.

Question (Mr. Boris Ivanov) When will you inform the people in the villages of the concrete project activities and which lands will be affected? Without this information and without concrete maps there is no sense in any more meetings – personally I am not willing to attend them any more.

Question (Mr. Boris Ivanov) Are there any activities planned for April 2002? This is the proper time to measure the water level and to determine the threatened lands.

Answer (Mrs. Marietta Stoimenova) Explains the next steps of the Project and assures the mayors that they will be given more information as soon as the concrete technical design for the restoration is elaborated.

Question (Mr. Boris Ivanov) I would like to raise the issue of the mosquitoes once again.

Answer (Mr. Stoyan Mihov) As I already mentioned, mosquitoes are quite a serious problem even now. The restoration will neither increase nor decrease the mosquito population. However, the Management Plan of the Protected Site will provide measures (including financial) to control the mosquitoes.

Mrs. Snejana Kostadinova summarized the accents from the statements and the suggestions in order to grant their correct reflection in the report.

VIII.3.3. CONCLUSIONS

The audience agreed to the following conclusions:

Mr. Evgeny Marinov, Deputy Governor:

7. An adequate public information campaign must be implemented in order to prevent any possible speculations with the Project.
8. The Project should finance the expenses on the mosquito treatment methodology.
9. The local people must have priority as employees for the implementation of the Project activities.
10. The benefits of the Project must be presented in exact numbers – number of new working places, wages, etc.

Mr. Venko Yordanov, Chairman of the Municipality Council of the village of Slivo pole:

The underground water levels should be studied in details and the risk of flooding adjacent arable lands should be minimized.

Mr. Reyhan Ablihim, Mayor of the village of Goliamo Vranovo:

We support both the ecological and the social assessments. We insist on checking the registers of the Employment Office in Slivo Pole and if there are suitable people they must be given the chance to work.

Mr. Boris Ivanov, Mayor of the village of Nova Cherna:

We do not object to the Project. We support the assessments but we insist to have all the details of the technical design for the restoration.

When planning the next meetings please have in mind that Thursday is not suitable day for us – we are having a session of the Municipal Council on Thursdays.

Mr. Assen Tonchev, Mayor of the village of Brushlen:

I suggest that the administration of the Project be situated in the village of Brushlen. There are a couple of reasons for that: first, our village is situated in the middle of the Protected Area and the Protected Area is named after our village and, second, we have convenient premises – the building of the former kindergarten. The building offers good functional and communication possibilities.

IX. ANNEX 1

Public hearing list of participants

Belene, 30.01 2002, 14.00 h

No.	First name, Last Name	Organization	Position	Telephone, e-mail
1.	Marietta Stoimenova	MoEW – PPU	Project Manager	Wetlands_ppu@moew.govrn.bg +359 2 980 87 34
2.	Svetoslav Apostolov	MoEW - NNPS	Junior Expert	Nnps@moew.govrn.bg +359 2 940 65 54
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6.	Stoyan Mihov	ACG Ltd.	Consultant	+359 2 987 34 65
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16.	Tsanka Stoyanova	Nikopol Municipal-ity	Head specialist	21 90
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25.	Liliana Simeonova	SFB - Svishtov	Manager	+359 631 233 75

Public hearing list of participants

Slivo pole, 31.01 2002, 9.00 h

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20.	Venelin Jordanov	Slivo pole Municipality Council	Chairman	+359 81 31 21 95