Ecological aspects of the river Bug waterway

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ABSTRACT

The Bug valley from the State border, i.e. from Niemirów all the way to the Zegrze Reservoir is subjected - due to its unique natural and landscape merits –to different forms of nature preservation such as reserves, landscape parks, and has been included into the European system of preserved areas "Natura 2000". The natural resources can contribute to development of the region by intensification of tourism, on the other hand it can lead to a limitation of potential economical use of the Bug as a shipping waterway. This paper presents ecological and hydro-morphological conditions of the region and a proposal of intensification of tourist activities along the waterway, and variants of tourist servicing, which would not be in contradiction with the present forms of nature preservation applied to the Bug valley.

Keywords : ecological tourism, Natura 2000.

GEO-MORPHOLOGICAL CHARACTERISTICS OF THE BUG VALLEY

The form and geo-morphology of the Bug valley in its lower course between the end of the border section at Niemirów (207th km) and its inlet to Zegrze Reservoir were conditioned to a large extent by the Middle -Poland glaciation processes. The valley formed after glacier retreat, consisted of after-melting sections and the connecting erosion - built sections [Falkowski 2003]. The valley is built of diluvial sands covered in places by alluvial deposits. The valley bottom is occupied by a wide flooding terrace, and the sandy above-flooding terrace ascends 4- 8 m higher than the mean water-level of the river [Mierkiewicz, Sasim 2003].

Width of the valley gradually increases from several kilometers in the border section up to a dozen or so km at the inlet, except for the mentioned connecting sections which presently have a character of gorges, and constitute narrowing zones of the valley. The sections are characterized by greater slopes, and in the bed area appear formations of alluvial ground which build almost non-washable thresholds. In the region of Mielnik the valley crosses through the zone of Warta glaciation end moraines. The depth of valley incision into surrounding uplands reaches from 30 m to 60 m [Kondracki 2000].

The river-bed, though having many bends and curvatures, is only to some extent a winding bed due to limiting outcrops of almost non-washable formations, mainly residual cobbles and rocky morass ores.

Along its considered section the Bug is a lowland river having slopes from 0.19 ‰ to 0.10 ‰. Icing phenomena start usually from the beginning of December and last till 2nd decade of March.

FORMS OF NATURE PRESERVATION IN THE BUG VALLEY

The basis of the policy of all European countries including Poland constitute : care of natural resources, preservation of nature merits being national resources, and economy management in compliance with the principles of balanced development. According to the Act on environment preservation (of 16 April 2004, Dz. U. 04.92.880) the aims of nature preservation are a.o. the following : the maintaining of ecological processes and stability of ecosystems, maintaining of biological variety, as well as the ensuring of continuous existence of species of plants, animals and fungi together with their sites. These aims are realized a.o. by taking into account the nature preservation demands in planning documents associated with site planning and development, as well as the introducing of various preservation forms to resources, formations and components of the nature.

Due to the unique natural and sightseeing merits of the Bug and its valley almost its entire considered section is subject to various forms of nature preservation (Fig.1). The areas most valuable from the point of view of natural merits and the least transformed ones were subjected to the reserve form of preservation. The reserves were established in order to preserve fragments of the forests along the Bug valley (Jegiel, Łęg Dębowy, Przekop), natural sites of plants including the protected species of stenothermal plants (Kózki, Skarpa Mołożewska, Szwajcaria Podlaska) as well as breeding standings and winter quarters of water fowl (Wydma Mołożewska).

The merits of the Bug valley which is only slightly transformed, with the river of winding bed, many islands, shoals, beautiful cliffs and old river beds, as well as the merits of the natural and cultural landscape of Podlasie region are subjected to the preservation within the frame of the landscape park "Podlaski Przełom Bugu" (Podlasie Gorge of the Bug), "Nadbużański Park Krajobrazowy" (Bug Landscape Park), as well as Nadbużański Obszar Chronionego Krajobrazu (Bug Area of Protected Landscape) (www.npk.pl, www.podlaskiprzelombugu.pl).

The Bug valley has been also included into the European system of preserved areas "Natura 2000" whose aim is to ensure permanent existence of European flora and fauna, preservation of valuable, endangered natural standings, as well as integration of nature preservation with human activity [Simonides 2003].

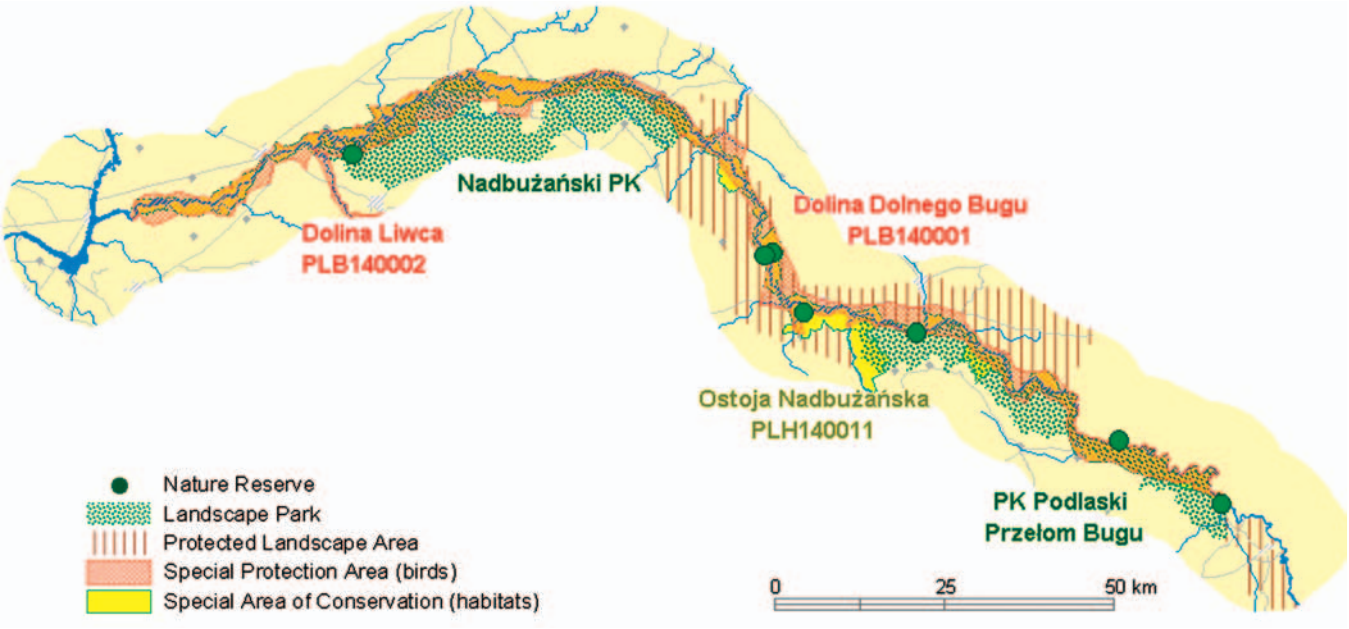


Fig. 2. *Forms of nature preservation .*

The determined areas of the network "Natura 2000", i.e. the area of special protection of birds " The Lower Bug Valley – Dolina Dolnego Bugu" (The decree of the Environment Protection Ministry of 21 July 2004 concerning the areas of special protection of birds " Natura 2000" Dz.U. No. 229, item 2313) as well as the special area of protection of standings "Refugium upon the Bug - Ostoja Nadbużańska" (www.mos.gov.pl) cover almost the entire considered section of the Bug. The merits which decided on establishing such form of protection, are a.o. the following : the unimpaired valley and river-bed of the Bug with their sandy islands settled in different degree with the marshy forests, old river-beds of different stages of succession, swamp terrains and complexes of riverside forests.

The number of the already established protected areas as well as projects of new ones (www.podlaskiprzelombugu.pl) clearly demonstrate the recognition which the natural merits of the Bug and its valley received. Majority of the protected areas is closely associated with the river and its valley under relatively low anthropogenic influences. The high natural landscape merits make it possible to commune with the nature of a unique form, admiring its beauty and richness. Popularization of the merits of the region, tourist traffic development including the use of the Bug as the tourist waterway would certainly contribute to very desirable development of the region. However the preservation of the natural merits will require to be very careful in undertaking the activities which could disturb the present state and do a harm to the most precious values.

THE PRESENT STATE OF THE WATERWAY

The natural character of the Bug with its many bends and old-river beds (Fig.2) and flooding terraces makes it possible to see a waterway of natural character and the river practically unchanged by human activity. In present an insignificant human interference has been limited to bank strengthening by means of faggot bands. In some sections still can be found old wing dams and stony bands which had to regulate the river stream-way but now not fulfilling their aim. The river washed out the not maintained infrastructure objects, a part of which became overgrown and turned into a wonderful place for fowl standings.

Rys. 2. *Meandry i starorzecza rzeki Bug w okolicy Brańszczyka*

The Bug - from the inlet of the river Muchawiec (286th km) up to the inlet of the river Narew (0 km), i.e. over the section 224.2 km long - is the river of regional importance. It was classified as that of the Class Ia (acc. Dz.U. 77 dated 18 June 2002), which means that the minimum dimensions of the waterway have to satisfy the following criteria :

- ★ Width of the waterway (at the level of bottom of the ship under permissible load and at its full draught) – 15 m
- ★ Transit depth – 1.2 m
- ★ Bend axis radius of the waterway – 100 m.

At the beginning of shipping season, i.e. at the moment of opening the waterway, not all the above mentioned criteria are satisfied. For instance, the enouncement of the RZGW?,Warsaw, dated 28-04-2005, informed that the waterway on the Bug had to be opened on 6 May and the then waterway parameters were the following : 100 cm transit depth at 190 cm water-level measured on the river gauge at Włodawa, the waterway width of 25 m, the limiting value of the draught – 80 cm (whereas it should be of 100 cm acc. the classification of inland waterways – Dz.U. No. 77/2002, item 768).

During the shipping season navigation conditions worsen relatively fast. In the season 2005 the water-level indicated by the river gauge at Włodawa, dropped below 190 cm already in

the beginning of June. Already on 11 July the waterway was closed due to excessively low water states (in the announcement of the RZGW, Warsaw, it was stated that along many sections of the river in question its water depth did not exceed 40 cm, which did not guarantee safe navigation).

The measurements of depth and width of the Bug waterway were carried out during three measuring campaigns in 2005: from 2 to 5 June, from 10 to 16 June and from 7 to 15 July at the water-level values in the range of the bank-full, bank-full/mean and mean/low states, respectively (Fig.3). The bathy-

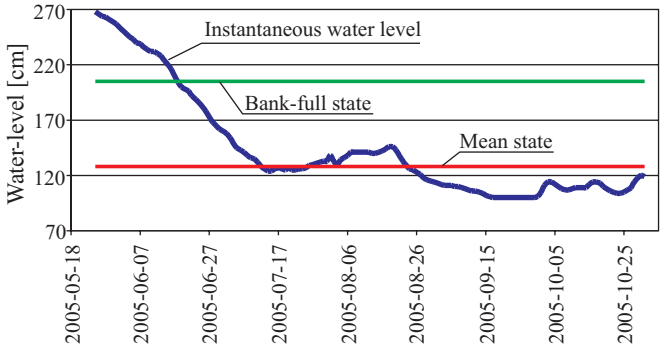


Fig. 3. *Water-level state indicated by the river gauge at Włodawa .*

metric measurements were performed from a boat by means of an echo depth finder or measuring steel rod (at low states) and GPS receiver to localize measuring points. The continuous measurement of water depth (Fig.4) was performed along the cross-sections oblique relative to the river-bed axis. The last measuring campaign, at the low water state, made also it possible to find shallow waters, sandbanks, shoals, underwater dunes and islands emerging at low water states.

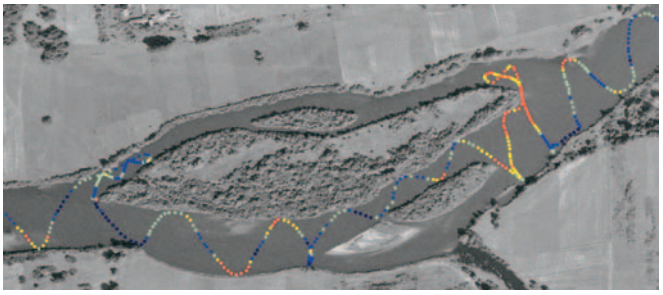


Fig. 4. *An example of collected measurement results of the river-bed bathymetry (the used colours stand for water depth values obtained dring 3rd measuring campaign : red: < 50 cm, yellow : from 50 to 70 cm, green : from 70 to 100 cm, blue : > 100 cm) .*

The measurement results, after determination of local water depth values, were stored in a data base and superimposed onto calibrated maps and satellite photos of the river. Simple numerical procedures make it possible to receive information on current location of river-bed banks, their distances, parameters of bends, co-ordinates of river- bed axis, maximum depth contour lines etc.

The river waterway depth analysis was performed by using the spatial information system included in the ArcView software. To fix the waterway the water depth values measured during 1st and 2nd campaigns were reduced to the values corresponding to the water-level states recorded during the 3rd campaign. This made it possible to fix allowable shipping routes along the river and to determine the sections where the river is not navigable or where the obstacles in the form of boulders or sandbanks appear. Comparing the course of the river-bed represented on the maps and photos one can distinctly observe the changes which have occurred along with time (Fig.5).

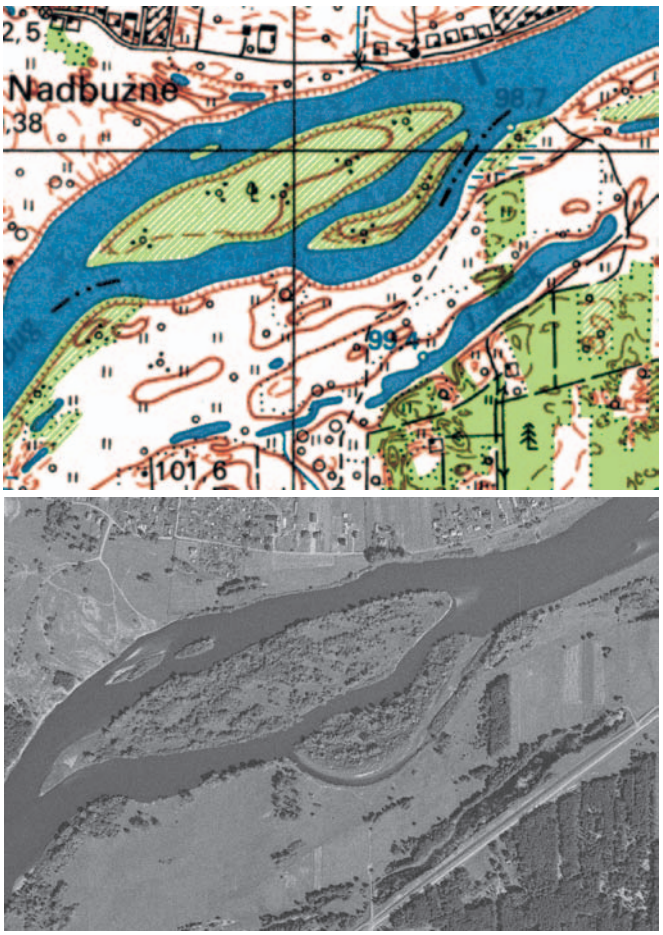


Fig. 5. *An example of changes in the river-bed of the Bug (the overgrowing of the side arms around islands) .*

Tab. 1. *Specification of non-navigable sections of the waterway of 70 cm water depth, and some proposals concerning its regulation*

km	Location	Proposals of regulation work
167.5	Sarczewickie Błonia	Closing the water flow around islands
144.5	Granne	Forcing the water flow through left-side arm – closing the water flow behind the islands
133	Białobrzegi (inlet of the Nurzec, right-side bank)	Cutting the arm behind the island
125.5	Kamionka Nadbużna	Broads with islands in the river-bed – the narrowing of the bed by means of a longitudinal dam
106-110	Podgórze Gazdy – Rytele Olechny	Non-navigable section – no proposals for regulation not interfering into the natural environment
89	Zabocze/ Podkole	1st – the narrowing of the river bed – right-side bank strengthening 2nd – the profiling of the bend by means of longitudinal dam
43-55	Nakieł-Szumin	Non-navigable section – no proposals for regulation not interfering into the natural environment

For the assumed depth of the waterway of at least 100 cm, were specified 47 sections which have not complied with any of the selected criteria for water depth, and 7 such sections for the assumed depth of 70 cm. After performing the analysis on possible regulation of the river without any serious interference into the natural environment, two following non-navigable sections were specified :

- 1st - from the inlet of the Liwiec near the village Nakieł up to the village Szumin (about 12 km long)
- 2nd - between the village Rytele Olechny and Podgórze Gazdy (4 km long).

PROSPECTS OF ECOLOGICAL TOURISM IN THE BUG VALLEY

From the point of view of economical development of the Bug valley and its region, seems to be interesting a concept of intensification of the use of the Bug waterway for developing ecological tourism. The concept should take into consideration the conditions of balanced development of tourism, in which the using and tourist development of the natural and cultural environment should be carried out in such a way as to ensure maintaining the balance of ecological systems and to prevent degradation of cultural merits of the region.

The high tourist merits of the Bug results from the fact that it is one of the last- in- Europe large rivers whose bed is practically unchanged by man, and its valley maintained almost in the natural state - with many bends, cut-off old river-beds, flooded meadows and swampy forests.

Worth stressing, that not only the Bug valley but also the whole region of Podlasie is rich in enclaves of almost intact nature (ecological lands), natural landscape complexes subjected to the various forms of preservation presented in Ch. 3 (peat lands, reed lands, field and forest water pools, clusters of trees and bushes, cliffs etc), which make the agro- tourist areas more interesting.

It is also important that there are many overlook points from which panoramic views can be observed (located mainly on cliffs of the Bug valley and tops of hills). Such especially exposed points, can be found on the high cliffs of the Bug valley close to the village Jegiel, Wiczogęby and Brzostowo. Especially attractive is the gorge of the Bug valley from the State border with White Russia to Wólka Zamkowa and Drohiczyn. Just in this region attractive relieves of terrain with large relative height differences can be observed.

The tourist attractiveness of the Bug region is associated with its cultural richness resulting from its violent history as well as from combining architectural relics with interesting landscapes. In contemporary tourism just such conglomerate of features, variety of tourist merits, and possible ways of versatile making use of them for tourist purposes, decides upon tourist attractiveness of a region and places.

Therefore opening a regular tourist tour along the Bug from the State border up to the Zegrze Reservoir would arouse a wide interest among tourists not only Polish but also from abroad.

In order to intensify tourist traffic, especially waterborne, is necessary to take care on complex development of the Bug and its surroundings by providing different forms of water tourist servicing, namely :

- ⇨ Centres of tourist services with special taking into account water tourism
- ⇨ Water tourist campsites and staying places for canoe trips
- ⇨ Transfer points for tourists voyaging on passenger ships
- ⇨ Development of the Bug valley and surrounding regions as regards the following forms of servicing : stays (in boarding-houses, rent rooms, agro-tourist objects), qualified and special tourist activities e.g. angling
- ⇨ Complex development of towns and larger villages upon the Bug as regards the servicing of tourist stays, sightseeing tourism, vacation and holiday rest, as well as waterborne tramping
- ⇨ Introduction of new agro-tourist objects over the entire region of the Bug respective to their co-operation within the network of the objects specially adjusted to servicing various forms of tourist activities (e.g. bases for waterborne, bicycle and horse riding tourism)
- ⇨ Development of summer-resort building, outside landscape parks
- ⇨ Introduction of a tourist information system in the Bug region.

As above mentioned, the navigation conditions of the Bug along the section from Niemirów up to Zegrze Reservoir, are varying. For tourist traffic organization, a crucial role play the limitations to passenger shipping over two non-navigable sections : that from the inlet of the river Liwiec to the village Szumin, and that from the village Rytele-Podgórze Gazdy up to Zgleczewo Szlacheckie. Taking into account the limitations one proposed to arrange a supplementary variant of passenger transport. Due to the present road network capable of ensuring effective coach transport, in the periods of low water states along the non-navigable sections, it is proposed to arrange the transfer points in the villages : Zuzela, Rostki-Piotrowice, Tuchlin as well as Kamieńczyk. Additionally, the transfer points can be used to broaden tourist service offer of the region and prepare proposals of associated tourist service products such as sporting and recreation, cultural and folklore events, nature observation e.g. nature and sightseeing tours, special trips.

Two variants of making use of the waterway depending on seasonal changes of water-level in the river, are proposed :

Variant I : representing the state of full navigability of the waterway from Niemirów up to Zegrze Reservoir which makes the waterway accessible for all kinds of floating units in the periods of bank-full water states of the river

Variant II : consisting in the split of the waterway into 5 sections, namely :

- ☆ three navigable sections : from Niemirów to Zuzela, from Rostki Piotrowice to Tuchlin, from Kamieńczyk to Zegrze Reservoir
- ☆ the two above specified non-navigable sections, under assumption that they are excluded from passenger shipping but accessible for waterborne touring by means of canoes, pontoons, rafts or similar floating gear not requiring a large water depth. In this variant land transport along the non-navigable sections could be organized by using coaches, chaises or bicycles.

Along the non-navigable section of the Bug between the village Zuzela and Rostki Piotrowice, south of the river, it is possible to organize various tourist activities. It could be even daylong landscape trips over the wide forest terrains located west of the commune village Ceranów, in the region of such villages as Wólka Rytelska, Noski, Radość, Krupy, Jakubiki and Garnek. There is also possible to organize qualified tourist

trips (hikes, bicycle and horse rides) as well as various forms of nature observation and nature education tourism e.g. observation of forest fauna and photographing natural phenomena. The possibilities are associated with natural sights and curiosities of that terrain, to which e.g. the flora reserve "Biele" belongs. A supplementary item of the program can be making acquaintance with cultural merits of the region as well as taking part in folklore events.

In the case of navigation down the river the transfer points on the north side of the Bug at Tuchlin as well as in the village Kamieńczyk on its south side would make the main directions of tourist traffic, accessible : from Tuchlin westwards along the north side of the river via Wyszków, as well as from Tuchlin along the south side of the river to Kamieńczyk.

SUMMARY

- To make use of the natural merits for development of the region one proposes to intensify tourist traffic and to perform a slight regulation of the river-bed of the Bug to an extent not contradicting the present forms of nature preservation applied in the river valley.

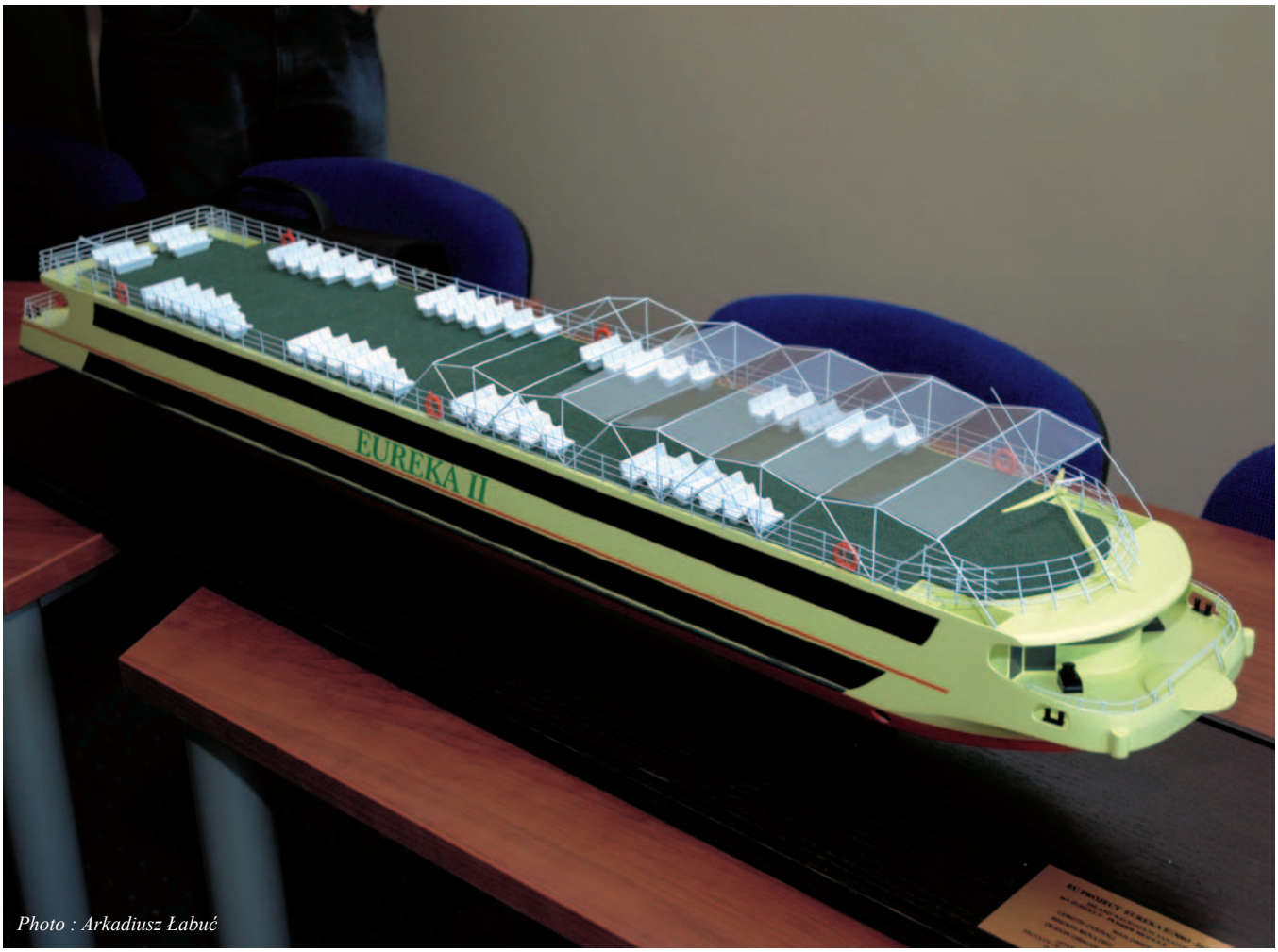
- To make use of the waterway two solution variants are proposed depending on seasonal changes of water-level states in the river.

- The first of them concerns the situation of full navigability of the waterway along its section from Niemirów to Zegrze Reservoir in the periods of bank-full water state in the river.

- In the second variant to divide the waterway into 5 sections is proposed, namely : three navigable sections from Niemirów to Zuzela, from Rostki Piotrowice to Tuchlin, from Kamieńczyk to Zegrze Reservoir, as well as two non-navigable sections along which tourist traffic can be realized by land with the use of coaches, chaises or bicycles.

BIBLIOGRAPHY

1. Falkowski T.: *Outline of the geological structure,* in : *The river Bug – water and nature resources*(in Polish). IMGW, WSEiZ. Warszawa, 2003
2. Kondracki J.: *Regional geography of Poland* (in Polish). PWN - State Scientific Publishing House. Warszawa, 2000
3. Mierkiewicz M., Sasim M.: *Conditions of outflow forming – floods and draughts,* in : *The river Bug – water and nature resources* (in Polish). IMGW, WSEiZ. Warszawa, 2003
4. Simonides E.: *Natura 2000 – its concept and legal basis* (in Polish). Parki Narodowe, No. 1, 2003
5. Ministry of Environment Protection : *The decree of 21 July 2004, on the areas of special protection of birds - Natura 2000* (in Polish). Dz.U. No. 229, item 2313
6. *The act on environment protection of 16 April 2004* (in Polish). Dz.U.04.92.880.



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