ECOLOGICAL REHABILITATION WORKS RIVER MOLDOVA IN THE "NATURAL SITE ONICEŞTI - MITEŞTI"

LUCRĂRI DE REABILITARE ECOLOGICĂ A RÂULUI MOLDOVA ÎN „SITUL NATURAL ONICEŞTI – MITEŞTI”

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Abstract*: Middle and lower course of the river Moldova is integrated into the "Site of Community Importance ROSC10363 River between Oniceni and Miteşti Moldova". It is an integral part of the European ecological network "Natura 2000" in Romania. Part of inactive arms of the river (meander cut) is in a state of ecological degradation. In the area around Sochi are to be accomplished on the river Moldova hydraulic works to rehabilitate pipes under-crossing the water adduction Timişeşti - Iaşi. Positioning the regularization of the river Moldova in the natural site "Oniceni - Miteşti" imposed special conditions on the design of water management. Case study analysis is placed in the area of Moldova under-crossing the river by water adduction Timişeşti - Iaşi. Regularization and defense works on the section of river bank have been designed to provide optimal habitat in the major riverbed and minor riverbed Moldova.*
Key words*: river, natural site, regularization, protection works, fluvial habitat*

Rezumat: *Cursul mijlociu şi inferior a râului Moldova este integrat în „Situl de importanţă comunitară ROSC10363 Râul Moldova între Oniceni şi Miteşti”. Acesta este parte integrată a reţelei ecologice europene Natura 2000 în România. În zona localităţii Soci sunt prevăzute realizarea de lucrări hidrotehnice pe râul Moldova pentru reabilitarea conductelor de subtraversare a aducţiunii de apă Timişeşti - Iaşi. Lucrările de regularizare a râului sunt poziţionate în sitului natural „Oniceni - Miteşti”. Acest aspect a impus condiţii speciale la proiectarea construcţiilor hidrotehnice. Studiul de caz este amplasat în zona de subtraversare a râului Moldova şi a fost analizat pe o perioadă de 12 ani (2004-2015). Rezultatele cercetării s-au aplicat la proiectarea lucrările de regularizare şi de apărare de mal pe tronsonul de râu considerat. Lucrările au fost proiectate în scopul asigurării condiţiilor optime de habitat în albia minoră şi cea majoră a râului Moldova.*
Cuvinte cheie*: râu, sit natural, regularizare, apărare de mal, habitat fluvial*

INTRODUCTION

Hydraulic works regularization changes hydrodynamic balance of the river and surrounding area. Change can be positive or negative. The effect of the regularization may occur immediately or after a longer period of time. The regularization affects existing habitat major and minor river bed (Manoliu, 1973).

The last time there was a change of design concepts to the regularization of the river. New concept aims at collaboration of nature with human activity in modifying

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the hydrodynamic balance of the river.

Follow-up of cooperation with the regularization of the river allowed for useful results for design and execution. The research yielded new theories regularization of rivers. These theories are based on work with construction parameters and habitat requirements of existing river bed. The new concepts aimed at ensuring favorable conditions of life for existing flora and fauna in the river bed and its shores.

Makers involved in the environmental field in the design and implementation of the regularization. Intervention is done by imposing conditions and operating parameters to determine the influence of work as reduced environmental impact. A particular problem requires completion of the regularization of the "natural sites" of rivers. These sites require special environmental conditions in the river bed and the surrounding area.

Protection of flora and fauna zones imposed creating "natural sites" protected by law. In Europe was created the ecological network "Natura 2000". This ecological network was implemented in Romania by a number of community sites protected by law. Community sites include protected areas where human activity is limited. Part of the Moldova River fall into the "site of Community importance ROSC10363 River between Oniceni and Miteşti Moldova" (Fig. 1a).

MATERIAL AND METHOD

The research was conducted in the Natura "Oniceni - Miteşti". It is located in the basin of river. In the natural site was chosen research sector Moldova River in the town of Soci, Iasi County. The research was conducted in several directions: theoretical studies, field studies and numerical simulations. The theoretical studies were analyzed: a - geo-physical characteristics of research sector; b - site features natural habitat.

The field trials were analyzed: a - Moldova riverbed morphology and stability of shore protection works; b - the influence of hydraulic structures on the natural habitat of the site. The numerical simulations were analyzed behavior shore protection works in various situations of exploitation.

RESULTS AND DISCUSSIONS

Natural site "Oniceni - Miteşti" is located in the river Moldova and Suceava, Iasi and Neamt County. Site area is 3215 ha. Site coordinates are latitude N 470 17 '22 "; E longitude 260 29 '3 ". Site elevation is 235 mLBS minimum, maximum 339 mLBS and middle 271 mLBS. Biogeographical region is of "Alpine Continental Pannonian Pontic". Natural site „Oniceni-Miteşti" contains habitat type classes rivers, lakes, arable land, grassland and deciduous forests. Natural site contains mammal species listed in Annex II of Council Directive 94/43 / EEC (*Lutra Lutra and Spermophilius citellus*). The site area are present protected species of amphibians and reptiles (*Triturus cristalus, Bombina bombina, Bombina Variegata*). In Moldova and tributary river is protected fish species (*Barbus meridionalis, Rhodeus sericeus amarus, Gobio uranoscopus, Sabanejewia aurata and Cobitis taenia*).

Site location area natural "Oniceni - Miteşti" is characterized by various human activities. The main activities are of agricultural, grazing, water catchments, ballast operations etc. In Moldova River Municipal and industrial waste are discharged. They continuously degrade habitat natural site "Oniceni - Miteşti". Presence of hydraulic structures in the riverbed alters living conditions of flora and fauna (Fig. 1b and 1c).

Moldova River is used as an emissary for the waste generated by human activities and industrial. The Moldova River has the ability to dilute and disperse contaminants reached in the water. But self-recovery possibilities are endless natural quality. Overcoming of some limitations of pollution can cause major and irreversible changes in aquatic ecosystems (Bica, 2000; Tockner, 1999).

The construction of regularization in whites and shore protection affects habitat of species of conservation interest. This results in the need for correlation of design parameters with aquatic environmental conditions. New theories regularization of rivers hydraulic structures based on collaboration with major and minor riverbed habitat.

Fig. 1 - Framing research area within the "Natural site Oniceni - Miteşti";
a - natural site map; b, c - the research work analyzed shore.

The work carried out in the riverbed causes morphological and ecological disturbances. Disorders occur in the minor riverbed and floodplain especially. Some

hydraulic works produce an interruption of connectivity between major and minor bed of the river. Interrupting lateral connectivity (floodplain - minor beds) in a watercourse is manifested in various situations: - modification of natural habitats and ecological communities in floodplains land; b - reducing the number of aquatic species; c - achieving a cycle of habitat related to the development of connectivity side (eg reproduction for certain fish).

The research sector is three adduction pipes of the water supply system in Iaşi County. Timişeşti water sources are brought to Iasi through two pipelines adduction: adduction I Timişeşti, diameter 800 mm (put into operation 1911) and adduction II Timişeşti (two pipes with a diameter 1000 mm, in service in 1973). The riverbed Moldova in the Sochi construction is carried out under-crossing of the three adduction pipes.

The section of river regulation work has a bed and shore protection. Coastal defense works were carried out in 1970...1973. Defending the shore is made of massive stone that was laid over concrete slabs. River Moldova in the study presents the current state of a linear channel. On the section of riverbed forming calibrated water flow speeds of the flood. Hydraulic and hydrological regime of the river habitat affects the riverbed (Luca, 2008). Flows and levels of computing probabilities are given in Table 1.

Table 1

Calculus discharges and levels

Calculus probability, *p* %	**1%**	**2%**	**5%**	**10%**	**50%**
$Q_{p\%}$ (m^3/s)	1810	1555	1200	940	28,8
H (m LBS)	257,15	256,95	256,50	255,90	253,10

The riverbed Moldova transited in 2005 a flood flow of 1168 m^3/s. In 2010 there were two floods: the first summer flow of 660 m^3/s; the second in autumn flow 965 m^3/s. The effects of floods have resulted in partial degradation of shore defense (Luca, 2012).

Fig. 2 - Left bank degradation and flood defense works in 2008

Fig. 3 - State degradation protection of the bank works (year 2014)

Flooding on the river Moldova for 2010-2015 riverbed morphology changed in the Soci area, Iasi County. In 1970 there was minor riverbed into two branches

branching technological reasons. The flow is divided in two whites and produces increased water velocity. Morphological changes occurred during 2000...2015 partially or completely destroyed buildings shore defenses (Fig. 3 and 4).

On the river Moldova, in the Soci area, have conducted research in the period 2002 ... 2015 (Luca, 2008; Luca, 2012). The research results revealed the following:

- lowering product hydrodynamic erosion riverbed with about 2.0 ... 4.0 m;
- protection of the bank of the left and right have been degraded at a rate of 60 ... 95 % ;
- the left bank of the river is affected by a strong current erosion;
- habitat in the river channel is disrupted and degraded.

a b

Fig. 4 - Comparative analysis of state left bank in 2005 (a) and 2012 (b)

The riverbed in the construction of undercrossing not presented favorable characteristics for the natural habitat of the species in the site. Site negative influences occur through the formation of riverbed under-crossing zone. Influences are produced by high water speed and the presence of concrete buildings. The riverbed calibrated not allows resting areas, breeding and feeding of aquatic fauna. Flora is influenced by the presence of mobile ballast layer of foundation bed. Floodplains provide good habitat conditions on the research.

Research findings require implementation of rehabilitation works. Significant degradation of hydraulic structures affecting the stability of the riverbed in the adduction pipes (Fig. 6). Rehabilitation works sector consistent under-crossing has been designed with the requirements of "natural site". They consist of the following (Luca, 2012):

- protection of the bank replacing rigid concrete slabs made of elastic works (elastic gabion of the plastic material filled with ballast, Fig. 6);
- achieving a groin on the left for directing water flow and limit bank erosion;
- achieving a bottom sill of the last pipe downstream of the supply; threshold will stabilize the longitudinal profile of the river section;
- achievement of a fish ladder bottom threshold for passage by fish species in the river Moldova.

The works regularization construction was designed and undertaken in 2015. Protection of the bank was designed and undertaken in spring 2015 with elastic gabions. Through its vertical and horizontal mounting of these are done to restore

favorable habitat conditions in the minor riverbed Moldova.

Fig. 5 - Downstream view of the two arms of the river Moldova in the study area

Fig. 6 - Protection of the bank with elastic gabions filled with ballast

By the election of the rehabilitation of hydraulic structures in the riverbed Moldova have created favorable conditions for the existence of natural site. In april 2015 began the rehabilitation of pipelines under-crossing Soci area and the regularization works on the river Moldova.

CONCLUSIONS

1. Design the rehabilitation of hydraulic structures within the natural site "Oniceni - Miteşti" on the section of the river Moldova were considered habitat protection requirements .

2. Hydrotechnics constructions regularization performed on the natural site should provide living conditions and the conservation of species of mammals , which is among the few sites designated for *Lutra Lutra Spermophilius and citellus*.

3. The works included in the rehabilitation project of construction in the riverbed Moldova meet the insurance requirements of the habitat of species listed in Annex II of Council Directive 94/43 / EEC

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