Note

[1] **More about the Sava Rivers' space and riverbanks can be found in the project: Jankovič, K., Matjašec, D., Simoneti, M., Mlakar, A. (2001) The riverbank landscape of the Sava River, expert guidelines for the new long-term plan of the Ljubljana municipality, LUZ d.d. Ljubljana, commissioned by the Municipality of Ljubljana.**

Illustrations

Picture 1: *The main path with lateral connections and sites of programme and service points enables visitor's choice even in view of distances (or time) of passage thorough the river's space. Places where the largest number of possibilities overlap in view of distance (or time), have the largest intensity of programmes and vice versa, in correspondence to larger areas intended for preserving nature.*

Picture 2: *The system of paths with varying distances and possible structure of users.*

Picture 3: *Structure of homogenous areas in the river's space*

Picture 4: *Distribution of programme centres, nodes and points*

Picture 5: *Time phasing of development in the river's space.*

Picture 6: *The structure of homogenous areas in the river's space.*

Picture 7: *The character of homogenous areas.*

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Aleš BIZJAK
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Renewal or rehabilitation of urban river and stream corridors

1. Introduction

Urban environments are anthropogenic disturbances in the landscapes ecological structure, composed of matrix, corridors, patches and mosaics. The built urban environment and physical tensions affect the ecological and morphological state of river and stream corridors (e.g. changes in corridor dimensions and shapes and their integral parts). Simultaneously river and stream corridors are transmitters of effects of development in the influential areas of watercourses in the urban hinterland, e.g. regulation of water course and building on their retension surfaces. Usually the consequences of such effects are unpleasant or even hazardous for the urban population, such as flooding of the Southern parts of Ljubljana caused by the Gradaščica River.

River and stream corridors have numerous functions amongst other they are hydrological, aesthetic, sports-re- creation, social etc. In urban environments, because of population density, settlement and other factors specific to urban environments, their importance rises with the growth of possible uses and interests (inhabitants, riverbank dwellers, fishing, sportspeople, nature conservationists etc.) and with the status of public space given to the corridors. Therefore it is important to manage these corridors in a way, whereby they can be preserved or even restituted to their ecological and morphological pattern as much as possible, even when complying to expectations and demands of interest groups (Bizjak, 1997, 1998; Mikoš & Kavčič, 1998 / a, 1998 / b, 2000).

2. Urban rivers and streams - renewal or rehabilitation?

The hydrological network in the Municipality of Ljubljana is composed of the two main rivers, Ljubljanica and Sava, and several smaller rivers (Pržanec, Glinščica, Horjulka, Gradaščica, Mali graben, Mestna Gradaščica, Ljubljanica's urban part and the Gruber canal, Sava, the Barje streams, Veliki Galjevec, Dolgi potok, Bizoviški potok, Rastučnik, Breška, Gobovšek, Dobrunjščica, Betežica, Šivnik, Besnica with tributaries, Bajer, Stara voda, Črnušnjica and Gameljščica, as well as numerous streams (Mikoš & Kavčič, 1998 / a, 1998 / b, 2000). Many of them are subject to troubles, typical for urban rivers. They are usually severely changed, becuase of increased settlement density and infrastructure in their influential areas, but also along their banks (Zum- broich in dr., 1999). Research on their level of morphological naturalness (Vodnogospodarski inštitut, 1994, 2001) has alarmingly pointed out the poor morphological state of smaller rivers, especially in the Western parts of the municipality (e.g. Pržanec, Glinščica, Mali Graben, Mestna Gradaščica, Bizoviški potok). Graph 1 shows the level of naturalness of rivers and streams in the municipality as compared to the conditions in Slovenia.

The poor morphological state of urban rivers and streams is a consequence of former river management approaches typical for urban environments and seen as: consolidated and monotonous riverbed, fortified riverbanks, monotonous materials, disconnected riparian vegetation, rarely present retro-riparian vegetation etc. However it is important to distinguish between different types of river management (e.g. Ljubljanica in its course through the city core, Drava in Maribor and Ptuj, Savinja in Celje and Laško etc.), that have often degraded the river in the ecological and morphological sense, but not necessarily from the aesthetic aspect; monotonous management of rivers in suburban and urban environments (e.g. Pržanec, Glinščica, Mali graben, Mestna Gradaščica) or misuse of riverbanks with detached housing and other forms of illegal or semi-legal uses (e.g. Rakova Jelša).

In view of improvements to the ecological state of rivers numerous approaches are known worldwide. One must however distinguish between *»river restoration«* **and** *»river rehabilitation«* **(Wells et al., 1998). Both approaches present processes for improving degraded river regimes or hydrological functions in the influential area of a river by implementing technical and biological engineering measures in the river corridor. They differ in physical demands or demands for allocating areas, technologies, necessary labour and re-**

source input, time span for achieving goals, level of feasibility, but also goals and purposes. Most often the subject of morphological rehabilitation of urban rivers and streams are abiotic and biotic morphological structures that are divided according to the morphological structure system into functional units:

- *abiotic structure of the channel form* (limited to the river bed within its embankments): longitudinal bars on the ri- verbanks, confluence-, point- and mid-channel bars, islands, widening or narrowing of the current, bifurcations, cascades etc.);
- *abiotic structures in the longitudinal profile of the channel* (dams, cross bars, variety of currents, changing depth, form, variety and particular structures of the river bed etc.);
- *abiotic structures of the cross profile* (type and depth of the profile, lateral erosion, changing width of the profila etc.);
- *biotic and abiotic riverbank structures* (riparian and retro-riparian vegetation, changes to the riverbank) (Newton et al., 1998; Raven et al,, 1998; Zumbroich et al., 1999).

Contrary to spatially more expansive rehabilitation of rivers carried out in the open landscape rehabilitation of urban rivers generally because of poor availability of space doesn't restitute the former state of the river, i.e. before the obstruction causing degradation occurred (e.g. the channel form before regulation). It does nevertheless enable ecological and morphological improvement of the urban river as much as physically possible. By implementing measures for improving the ecological and morphological state of rivers, we can bring them closer to their pattern image or referential condition *(»leitbild«, »reference status«),* but only in those functional units of morphology and morphological categories (Bizjak & Mikoš, 2001), where such extensive rehabilitation is feasible (e.g. shape of longitudinal and cross section, shape of river bed, shape of riverbanks etc.).

We have to emphasise that the most suitable scale for river rehabilitation planning and design is the landscape, since it adequately includes all relevant external factors affecting the river or its rehabilitation, such as: forests, swamps, pastures, cultural landscape etc. (Wells in dr., 1998). These are all qualities usually lacking in an urban environment. Exceptions are rivers running through parks or other urban green surfaces where it is possible to restitute the channel form and profiles closer to their pattern images (Zumbroich in dr., 1999).

3. Project management in the rehabilitation of urban river and stream corridors

Contradictions between ecological significance and functions of urban river corridors on one hand and numerous groups and interests of river corridor users on the other, can lead to bad solutions if they are poorly managed, usually damaging for both. The outcome of inappropriately lo- j cated uses and activities in the river corridor are its functional, ecological and aesthetic devaluation. Therefore to complement contemporary management of urban space, modern approaches of project management have to be applied even in the rehabilitation of urban river and stream corridors. Scheme 1 shows the structural parts and phases of the Dutch model (Simons & Boeters, 1998) of project management of riverbanks (part 1: initiative and organisation, inventory, goals; part 2: Formulating management principles, Development of management alternatives, Selection of most promising approach, Specification and implementation; part 3: Maintenance; part 4: Monitoring; part 5: Evaluation). Resources needed for the execution of a renewal or rehabilitation project come from the budget, subsidies for building and maintenance, grants from companies involved in the process, levies and compensations, taxes and compensation contracts.

Phase 1: Initiative and organisation

The reasons for producing a riverbanks management plan are usually renewal or rehabilitation acts, pressing maintenance operations, necessary improvements concerning accessibility, ecological state or development etc. Initiative for producing the plan comes from administrative bodies, organisations responsible for maintenance and control of the river, local or regional community etc. Before the project ensues all involved parties have to be identified and knowledge and experience from available resources gathered. Clarity and transparency of the procedure has to be ensured for all involved parties and third parties that have to give concordance to the proposed project, before the planning procedure begins.

Phase 2: Inventory

All present and future functions of the river have to be checked, as well as existing management and property status, area of control, management tasks and concepts, contracts between administrators and/or private sector and present management. Knowledge has to be gained about plans of the local community or state, these are the sources where present and future functions of the river can be found. Before operations begin the state of the river has to be noted, especially characteristics of the site, land-use, hydrological and hydro-morphological features, water and water table quality, as well as landscape and ecological values.

Phase 3: Goals

The goals and period of implementation of measures is defined for particular parts of the riverbanks, generally for a 10-year period. To ensure continuity in implementation of measures it is beneficial to define the goals for two or more 10-year periods. Because of controllable management and successful achievement of stated goals in the project, the river corridor is divided into homogenous sectors. Target conditions are then specified for each of them in view of functions of the riverbanks and their particular ecological potential. Measures for achieving target conditions are defined separately. With the development of alternative solutions to achieve the target condition and improve the state of surrounding land and water, the number of options increases and points out the real potential of a particular sector. Factors affecting the choice between alternative solutions are the sites potential for developing specific habitats or specific ecological goal, available financial and human resources. The maintenance and control procedures have to be defined and periodical reports concerning conditions and management demanded. Rules concerning compensations in case of negligence or poor maintenance also have to be defined. If the riverbank is purchased, a maintenance organisation has to be appointed, e.g. nature protection agency or private company. The new property status has to be drawn on a map.

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Phase 4: Formulating management principles

The design approach is defined according to previously set target conditions of particular sectors of the corridor. The target condition has to follow ecological, hydro-technical and land-use demands, recreation, use of water etc. Demands and expectations are grouped by priority, which should be based on criteria, tested and evaluated in later phases.

Phase 5: Development of management alternatives

Alternative solutions concern for example: width of the river- bank, type of riverbank strengthening and materials. Development of alternative solutions depends on the structure of the project team, its level of expertise and creativity. Before the management process begins definition is needed about the area of intervention, possibilities for purchasing the land and present activities. It is also necessary to establish whether longitudinal and cross strengthening will be needed, does the profile need structural reinforcement, what material will be used and what forms should be achieved. All alternatives have to contain guidelines on management and maintenance, as well as expected effects and costs.

Phase 6: Selection of most promising approach

Selection of the most promising approach involves all parties that submitted proposals, together they check them and choose the one best suited for the task. When choosing the best alternative all priorities and criteria from Phase 4 have to be respected, but also benefits and costs. When assessing the costs of each proposal, construction and operation costs have to be respected. The choice has to be argued for clearly and the reasons explained.

Phase 7: Specification and implementation

After choosing the most promising approach necessary measures and activities have to be specified and a tender prepared for work to begin. The ecological role of the approach has to be stressed. All operations have to be described precisely and in detail (what, where, when, how and how much), working standards that have to be achieved, conditions under which the operations will be carried out and, of course, method of payment. The stated specifications consequentially function as a contract between the involved parties and are the basis for establishing prices.

Phase 8: Maintenance

The chosen plan for a watercourse or its already executed part, has to be adequately maintained and occasional new intervention. Maintenance is defined by periodic activities of management of the riverbanks. Successful maintenance implies precise, possible and real goals written in the maintenance plan, usually containing goals of riverbanks management, activities, containing description of methods, frequency, site, time, costs and involved company, description of procedures in contingencies and annual reports about maintenance, costs and labour.

Phase 9: Post-project monitoring, control and evaluation

On completion or adaptation to maintenance processes in the corridor and riverbanks have to be controlled and monitoring has to be documented. The latter is necessary for evaluation of the riverbank's development. The monitoring plan has to include at least: goals, method of evaluation and choice of parameters, technique and capacity. It also has to explain the method's rationale, organisation, planning and reporting.

Phase 10: Evaluation

Occasionally, for example after a 10-year period, evaluation of the management plan in view of defined goals is beneficial.

4. Administrative planning procedures of rehabilitation and renewal of watercourses

The area for renewal or rehabilitation of watercourses in urban environments is physically limited to the land along the rivers corridor (width of the river, riparian and retro-riparian vegetation on both riverbanks). From the governmental aspect, these areas are the watercourse itself, riverbanks, immediate neighbouring land and pertaining influential zone. Because execution of renewal or rehabilitation of watercourses is spatially demanding, even more so in urban environments where land is scarce, the governmental aspect is extremely important for planning and execution. Table 1 shows an example of a government-planning procedure for a river's renewal or rehabilitation land in view of adopted and proposed legislature. The table shows interactions of adopted and proposed laws on the physical planning and hydro- technical segment.

5. Research of public opinion after renewal work on the watercourse

Public opinion surveys amongst the riverbank population and other users of a river corridor carried out after renewal or rehabilitation are very interesting, also because of the quantity of resources involved, but also as recognition of success of the executed measures. Analyses of public opinion were done after three rivers in Britain were completed: River Skerne in Darlington (2 km were rehabilitated), River Cole (2 km were rehabilitated) and River Medway (3 km were rehabilitated). Surveys were used to research public opinion about changes in the environment following rehabilitation (Tunstall in dr., 2000). The asked questions were:

1. Did the changes to the river regime diminish or increase dangers of flooding?
2. Are the rivers safer or not after the changes?
3. Have possibilities for recreation increased or diminished?
4. Did the changes cause growth or reduction in habitat variety?
5. Has the river landscape become more or less attractive after changes?
6. Were the changes to the river regime legitimate?
7. Value of changes in view of investment?
8. Have the goals of rehabilitation been achieved?

Table 2 shows the shares of possible answers and opinions according to thematic issues. The authors described the deviation in the response to the Skerne River in the second question of the fourth issue in premature surveying: rehabilitation usually includes massive excavation work (digging

of old meanders etc.), after which the vegetation needs a certain regeneration period during which the river corridor resembles a building site.

6. Guidelines for management of urban water courses corridors

Because of the complexity of managing urban river corridors that has to ensure environmental sustainability, but also meet the demands and expectations of users, a systematic approach is needed. Scheme 2 shows the structure of guidelines for river rehabilitation in urban environments. They include guidelines for physical design, technical execution and management.

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Graphic material:

Graph 1: *Level of naturalness of rivers and streams in the Municipality of Ljubljana compared to the state in Slovenia (VGI, 1994, 2001)*

Diagram 1: *Structural parts and phases for project-management of the riverbanks (Source: Simons & Boeters, 1998)*

Table 1: *Example of an administrative-planning procedure of design, renewal or rehabilitation of a watercourse according to the present and proposed legislature (Source: Prelovšek, 2001)*

Table 2: *Public opinion concerning changes to the river regime for each of the three rivers in percents (Source: Tunstall in dr., 2000)*

Diagram 2: *The guidelines structure for rehabilitating watercourses in the urban environment*

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Researching the value system of interest groups as the starting point for directing urbanisation of the countryside

1. Introduction

Because of obvious and massive changes and processes in the countryside it is becoming ever more clear that it cannot be defined with agricultural activities and pertaining physical patterns. Jakoš and Gosar established that *only* 47,7 % of all rural inhabitants of Slovenia live in rural areas. Even more interesting is the fact that 37,7 % of all rural population live in urbanised areas. According to the authors 14,6 % of the rural population lives in transitory areas (Kovačič in dr., 1997, str. 101). In his discussion about physical planning in the countryside Mihevc states that mixed farms, i.e. farms which gain their income even from non-agricultural activities are those which »take care about the urban management of villages and that the share given by workers for urban services (roads, water supply, telephone etc.) is significantly higher than the one given by farmers. Such circumstances raise the issue of the social structure of future villages and the demand for maybe new settlement concepts different from the present ones.« (Kovačič in dr., 1997, str. 114)

Redefinition of countryside is therefore a consequence of restructuring processes on one side and urbanisation processes on the other. The later is especially pronounced in the vicinity of large urban centres and important roads, nevertheless, as can be seen from the before stated facts, the influx of urban lifestyle is typical for the whole of Slovenia. Urban lifestyle demands above all, better infrastructure, while local government tries to improve services - social services, e.g. health care, education, culture, sports, etc. Areas that were until recently completely agricultural have in the meantime become the target of various development pressures, often supported by local governments, since they are justly or not seen as opportunities for their area's development. In the opposition are often representatives of various sectors on the national level and non-governmental organisations that argue against development. Urban lifestyle brings changes to the physical environment, mainly by increasing exploitation of resources and specific parts of the natural environment. The local population is generally not sufficiently informed about all these changes and they are usually invited to participate in debates concerning local development in an utterly formalistic manner. Before we can create opportunities for agreements concerning development issues on the local level, numerous questions have to be addressed, such as: will abandoning of farming imply physical degradation or the opposite, enable opportunities for rehabilitation either with a different more vital activity or restitution of the natural state of the countryside; which activities will enable rehabilitation of the area; and above all, where should agriculture be preserved even with the help of sufficient subsidies; whe-