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Model-based design for restoration of a small urban river

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ABSTRACT
A model-based design is presented for restoring the small urban river Panke located in Berlin, Germany. This new design process combines high resolution 2D hydraulic modeling with habitat modeling and river-ecological expert knowledge in a highly iterative way. Advances have been made for the habitat modeling: habitat suitability maps have been developed for fish and the habitat suitability for benthos has been assessed by including groups with different hydraulic preferences.

Using the model-based design we have developed preference variants for the Panke which include structures such as pools, riffles, river banks, dead wood as well as aquatic vegetation. To account for the very detailed geometry of some structures such as dead wood, high resolution grids with edge length up to one decimeter have been generated. Furthermore flood protection has been assured. The variants should be constructed in the Panke in 2015. We expect that the ecological conditions for fish and benthos will improve, however this has to be evaluated by further measurements. The model-based approach for the design of enhancement measures delivered valuable hints on current shortcomings in the river morphology, priorities for the creation of new habitats and quantitative information on the increase of suitable areas to be expected. In addition, relating the habitat changes to different flow rates helped to estimate the temporal availability of high quality habitats after the implementation of the measures.

KEY WORDS: urban river, high resolution modeling, ecological expert knowledge, river restoration

1 INTRODUCTION

Urban water bodies are facing numerous threats to their water quantity and quality. In the past especially small many urban rivers have been straightened, embanked and partially tubed, and often they are directly bordering or very closely located to buildings. Further, many urban rivers are stressed by various loads such as nutrients, heavy metals, personal care products or drugs resulting from combined sewer overflow, highly polluted surface runoff after heavy rainfall or their functioning as receiving waters. Consequently, the biodiversity and ecological state of many urban rivers is considerably impoverished compared to natural freshwater bodies (Mayer et al., 2005, Walsh et al., 2005, Fletcher et al., 2013). The aim of the European Water Framework Directive is to achieve a good ecological state for all water bodies (Bernhardt and Hart, 2006) and corresponding criteria are defined, for example for different (natural) river types. However, achieving a good ecological state is hardly possible for many urban rivers. Therefore, the European Water Framework Directive has established a further classification, the Heavily Modified Water Bodies which are water bodies that have significantly changed their original appearance. These Heavily Modified Water Bodies have to achieve a good ecological potential rather than a good ecological status, i.e. they have to achieve less high aims which are not generally defined but