

**Thesis topic:**

*Quantitative and qualitative impact assessment of planned developments on environmental objectives established for surface fluvial waterbodies – new methodology proposal with practical examples*

The doctoral thesis in the field of natural sciences, written under supervision of professor Damian Absalon.

**Abstract**

It becomes critical to recognize what practical aspects of both an investment and the environment would have to be matched in order to provide meaningful, particularly from the environmental objectives point of view, results in terms of impact assessment. Especially, when given the fact that environmental objectives, established under the Water Framework Directive (WFD) with respect to any waterbody (WB) that would be located within the European Union borders require giving a careful consideration, when any new investment proposal is made.

Common Implementation Strategy Working Groups (CIS WG) works on the subject of WFD practical applications, although informative and considered as fundamental for allowing other creditable works like, amongst other, JASPERS's to get formulated, still don't address central, for the whole WFD based system, issue related to environmental objectives status endangerment as a consequence of new proposed developments qualitative impact assessment.

To address this, seemingly systemic inadequacies, a new methodology on a subject of quantitative and qualitative impact assessment of planned developments on environmental objectives has been proposed. The methodology straddles two separate legislative regimens and makes an attempt to reconcile identified difference between them – the WFD and Environmental Impact Assessment Directive.

The quantitative and qualitative impact assessment of planned developments on environmental objectives methodology presented herein comprises the doctoral thesis.

The dissertation consists of the two main parts – the literature based review of legislation, guidelines, methods and tools that is followed up by a practical example.

The review, apart from legislation and works carried out by Working Groups under auspices of the CIS related to the WFD legislative transposition enablement considered, in the thesis, numerical aspects of the WFD as pivotal. The WFD requires for the Member States as signatories to the Directive establishing of methods that could be, successfully, applied in order to quantify the ecological status of waterbodies.

The WFD prescribed definitions of the biological indicators and proposed numerical scales as well as procedures according to which waterbodies classification based on quality class can take place. Means through which the numerical aspects of the assessment was addressed by the WFD and worked out by the WG are defined by the ration between value of a particular biological parameter and it valued under reference conditions.

The ratio, namely Ecological Quality Ratio, and its numerical characteristics, especially when combined with their biological propensities, were used in the dissertation's practical example part as a springboard for an application of numerical models.

The physical, chemical and hydro-morphological elements assessment had been addressed through application of the Soil and Water Assessment Tool – SWAT, public domain continuous time hydrological model which results, then, were fed into Artificial Neural Network, Multilayer Perceptron model (ANN MPL); to this purpose M-Macbeth –mathematical software, was used.

The aim of this study was to develop a methodology and carry out, in accordance with the developed methodology, quantitative and qualitative analysis of the impact of a hypothetical project located in the Reda river catchment, pucki and Wejherowo powiats, Pomorskie voivodship on the condition of the surface quality elements of flowing waters. To this purpose biological elements and characterizing them indicators - MIR, MMI\_PL and IO as well as physicochemical and hydro-morphological quality elements were selected

The dissertation comprises an application of numerical tools in a form of a methodology that being in a form of the procedure that through an application of real-life example allows for emulation and application by practitioners – the utilitarian purpose of the dissertation.

In terms of the impact on physicochemical elements, as a result of the work, it was proved that the use of mathematical models, already at the early stages of the project, allows, in a manner adequate to the legislative requirements, to demonstrate the impact on the state of water by specifying its size and direction - the vector of impact.

The results of the dissertation showed the multidimensionality of the relationships between biological, physicochemical and hydromorphological elements, which in accordance with the WFD, determine the result of the classification of the affected WB and, at the same time, the feasibility of the project, if proposed methodology is applied.