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## **Barrage Włocławek on the lower Vistula**

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### ABSTRACT

Barrage Włocławek was commissioned in 1970 on the Lower Vistula, which is section of the largest Polish River Vistula. The Vistula is 1047 km long and has the catchment of 194 thousand km<sup>2</sup>, of which 87% is in Poland and occupies 54% of the total Polish territory. Lower Vistula 391 km long presents high hydropower and inland navigation potential. It represents approximately half of the total technical hydropower potential of Poland. Along the Lower Vistula there are several important cities and industrial centers. The idea of establishing Lower Vistula Cascade (LVC) was put forward after Second World War. It consisted of 8 hydraulic power plants (total capacity 1300 MW with annual energy production 4200 GWh) and 8 run-of-river reservoirs. The main aim of the LVC was energy production and formation of inland navigable route connecting the center of Poland with the harbor Gdańsk. The LVC is a very complex project which encompasses many economic, social and environmental aspects. The energy production is here closely linked with the basic objectives of water resources management i.e. water supply, stabilizing of free surface and ground water levels, flood control, development of navigation, sport and recreation. Hydraulic barrage Włocławek is located in km 675 of the Vistula. Average discharge in this cross-section is 890 m<sup>3</sup>/s and the width of the river 1200 m. Hydraulic power plant has the capacity 160 MW and electric energy production in the average hydrological year 750 GWh. Till the present time Włocławek operates as a single project bringing numerous advantages and drawbacks, thus creating a lot of controversies. Design of the project was completed by Polish consulting offices. Hydraulic model investigations were carried out by the Institute of Hydro-engineering in Gdańsk and construction of the project was performed by Polish enterprises. Part of the project: weir and hydraulic power plant were constructed under the protection of cofferdam. Important and crucial stage of the project construction was the closing of the river channel not covered by the cofferdam. The main problem of the operation of Włocławek project is the downstream erosion. It results in the lowering of the tail-water level thus causing numerous consequences. Many objections of ecologists concerned mainly the change of hydraulic, thermal and natural regime of the reservoir in comparison with the free flowing river. Very important problem was caused by the change of thermal and ice regime. This resulted in the ice jam flood which occurred in 1982 in the upper part of the reservoir due to the coincidence of extreme hydro-meteorological conditions. The lecture presents the short description of the Vistula and the Lower Vistula, concept of Lower Vistula Cascade, description of the project, hydraulic model investigations carried out in connection with this project, run of the project construction, problems encountered during 49 years of its operation and the proposal of the next barrage.