

Combined use of integrated hydrologic modeling and thermal infrared imaging to investigate the effect of hydraulic restoration on surface-subsurface interactions: Case study of Rohrschollen Island (Upper Rhine River – France)

Benjamin JEANNOT, *LHyGeS - Université de Strasbourg, CNRS, ENGEES- UMR 7517 Strasbourg, France*

Sylvain WEILL, *LHyGeS - Université de Strasbourg, CNRS, ENGEES- UMR 7517 Strasbourg, France*

David ESCHBACH, *LIVE - Université de Strasbourg, CNRS, ENGEES, UMR 7362, Strasbourg, France*

Laurent SCHMITT, *LIVE - Université de Strasbourg, CNRS, ENGEES, UMR 7362, Strasbourg, France*

Frederick DELAY, *LHyGeS - Université de Strasbourg, CNRS, ENGEES- UMR 7517 Strasbourg, France*

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Rohrschollen Island is an artificial hydrosystem of the Upper Rhine River that results from three historical geo-engineering works originally performed to prevent floods in the region [1]. These works also resulted in the disconnection of the main anastomosed channel in the island – called the *bauergrundwasser* - from the upstream Rhine River (see Figure 1). The combination of this disconnection and weak groundwater dynamics highly impacted the ecohydrological functioning of the system that was regularly flooded before. A hydraulic restoration project was funded in 2012 to reactivate the hydromorphological and ecological processes within the island by injecting river water through a floodgate and a new artificial channel that was dug in the southern part of the island.

An integrated hydrologic model that couples a low-dimensional subsurface model with a 2D diffusive wave surface model [2, 3] is applied to the Rohrschollen Island to investigate and quantify the effect of the hydraulic restoration project on surface-subsurface interactions. The model is calibrated using a dense network of piezometric measurements. Spatial distribution of infiltration and exfiltration flux mapped with thermal infrared imaging [4] is also compared with simulations to show how the model captures various patterns of surface-subsurface interactions. The calibrated model is then applied to pre-restoration scenarios/configurations demonstrating that the restoration strongly impacts the hydrological behavior of the system (see Figure 2) with enhanced infiltration during injection and the apparition/production of exfiltration zones along the old channel.

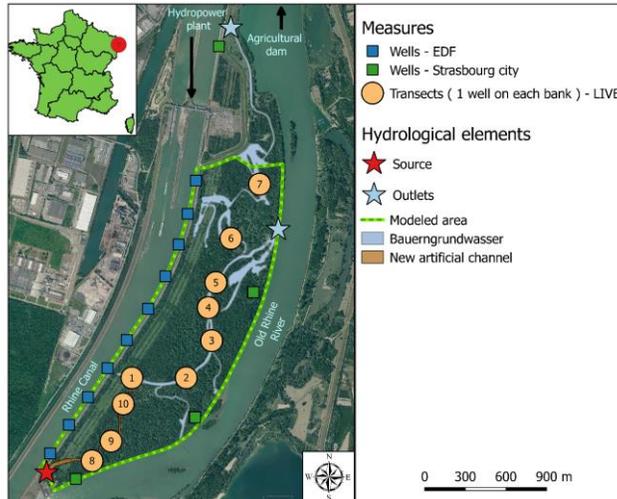


Figure 1: Aerial view of the Rohrschollen Island and location of the main wells employed for monitoring the hydraulic behavior of the subsurface system.

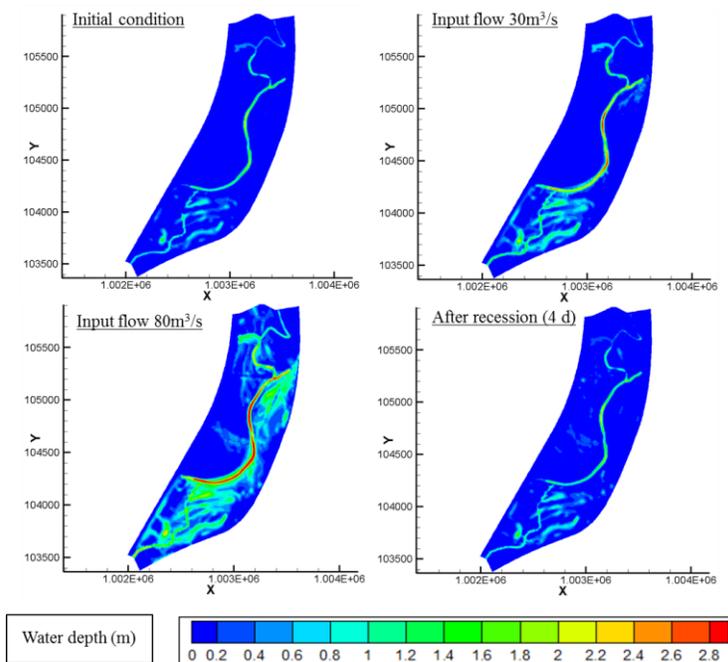


Figure 2: Snapshots of water depths in the surface compartment of the Rohrschollen Island at four times within the period selected for the model calibration.

References

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