JOURDAIN : Project of Indirect Potable Reuse (IPR) demonstrator in Vendée: Computational modelling as an enhancement tool

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VENDEE EAU, a non profit public body in charge of water supply on the French western coast (264 municipalities, 600,000 inhabitants), produces 40 million m3 of drinking water per year mainly from surface resources. In order to face an estimated water deficit during a hot year the proposed solution is the indirect reuse from a coastal WWTP (Sables d'Olonne) to complete the volume of a fresh water reservoir (Jaunay). On account of the absence of regulations and unprecedented cases of IPR in France, VENDEE EAU envisions the implementation of a 1:4-scale demonstrator during the 2018-2024 period including tertiary treatment unit, transfer pipe, discharge zone and an extensive analytical program. Towards the multiple approaches to ascertain the appropriate location for the Reuse discharge point in the reservoir and suitable operational set points and flow rate, computational modelling is particularly adapted for testing different conditions (physical, meteorological) and optimizing the system to achieve targets (maximum allowable concentration of pollutant for drinking water and recreational uses.

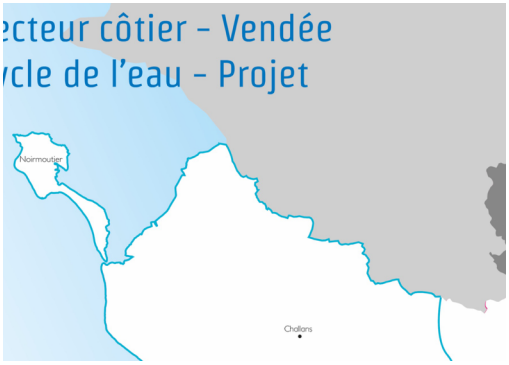

Figure 1: IPR scheme in Vendée (JOURDAIN)

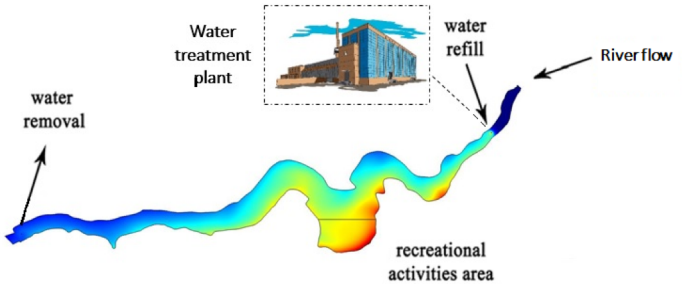

Figure 2: Simulation of pollutant distribution in Jaunay Lake after the discharge of reuse water.

In this work, we have focused on modelling the distribution of a generic pollutant in the reservoir, which is expected to vary with time and depending on system and meteorological conditions. We shall present a first computational model assuming that flow rate at the discharge point compensates the removal flow rate (so that the volume of the reservoir stays constant) and that the pollutant dynamics is influenced by two main effects: wind and water currents (resulting from the pumping processes and the discharge of Jaunay River into the reservoir). The model accounts for the geometry of the reservoir, the operating conditions of the transfer pipes and real data regarding chronicles of wind velocity, river flow and pollutant characteristics. Then, we have performed an optimization of the refilling location (see Figure 2) to minimize the pollutant concentration at strategic locations (with data from July-September 2016). Other meteorological conditions (such as rain and evaporation) may have a significant impact on the evolution of the pollutant distribution and disallow the assumption of constant volume of the reservoir. Extensions for taking into account variable volume will be discussed.

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References

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