Title: Pressure Related Demand Modelling during Incidents

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Affinity Water is the UK's largest water only supplier, providing more than 900 million litres of water each day to a population of more than 3.5 million people. It serves communities with some of the highest demand for water in the country. One of the modelling team's roles is to provide 24hrs standby hydraulic analysis support for unplanned incidents, such as bursts, production site outages, etc, evaluating the impact on our customers and the wider network, providing contingency plans and solutions using Infoworks Pro software. If the modelling results are accurate in terms of customer impact, it helps to manage efficiently the company's emergency planning resources during incidents and have an accurate understanding of Interruption to Supply (I2S).

In water networks, the domestic demand and the non-revenue water (NRW) depend on the available pressure across the different nodes in the system. Therefore, if due to unplanned works such as a burst or a pump failure, a significant pressure reduction happens in the system, the consumed flow will decrease due to insufficient pressure to fulfil the user's demand. While the correlation between pressure and leakage is well known in the industry and as a result many water companies implement pressure management schemes by installing PRVs and subsequently reduce the pressure in these discrete areas to reduce the water losses; the relationship between the user's demand and pressure is still not fully understood during emergencies or temporary large reductions in pressures: Firstly, because this is an emerging area for research, secondly because the demand does not depend on the pressure alone and finally the pessimistic view is preferred in an emergency event in the position of better safe than sorry. As a result, the traditional hydraulic models assume that the demand is constant regardless of the pressure variations during an event, which can return substantial pessimistic results specially where the hydraulic conditions make a considerable pressure reduction.

We analysed two major incidents where the model customer impact predictions were too pessimistic in comparison to reality. Due to these discrepancies, we started exploring with an initiative-taking approach using the Pressure Related Demand (PRD) Tool Option in Infoworks. Our main purpose was to understand the aftermath of the incidents, trying to replicate the observed pressures during the incidents and compare it with the model using a traditional approach and the model using a Pressure Related Demand curve. The final objective is to understand the pressure demand reduction relationship and be able to identify a factor in PRD curves with Infoworks tool and be able to predict more accurately the impact on our customers and wider network during unplanned situations. Even though with these two cases studies, it is not enough to reach a definitive conclusion, our intention is to be able to share our findings, to start a debate and to learn other water company approaches.