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Drinking Water Engineering and Science Discussions

DWESD

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Interactive Comment

Interactive comment on "Robust optimization methodologies for water supply systems design" *by* J. Marques et al.

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We thank the Reviewer for the comments and for the reference.

Comment 1. Authors assume that adding pump station is the design option for handling abnormal conditions. This may be a valid assumption for some systems, but the options should thoroughly evaluate for the final design. For instance, with the added pump station, energy cost can be neglected due to the occasional operation in a short period of time, however, associated overhead for maintaining the pump stations may not be negligible when many pump stations are required as contingence infrastructure for a large system, which is likely the case in real water system. A life cycle cost analysis needs to be conducted to compare the cost of adding pump station as contingence facility.

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Interactive Discussion

Discussion Paper

Reply 1: We understand the comment and we will take into account the life cycle cost analysis in future work. A comment has been included in the conclusions on pages 9 and 10 of the attached paper.

Comment 2. It is true that large pipe diameter required for handling abnormal conditions is not favourable under normal condition. However, large pipes should not be excluded as competitive solution. Instead, the water quality responses, such as water age, should be used to evaluate the design alternatives so that the solution can be further optimized for truly robust design.

Reply 2: Large pipe diameters are not excluded from the determination of robust solutions. In study 2, the robust solution is achieved both by increasing the pipe diameters and by using the pumping station to cope with the extreme scenarios. Future developments of this work can take into account water quality simulation to evaluate the design alternatives for a more robust design. A comment has been included in the conclusions on pages 9 and 10 of the attached paper.

Comment 3. According to the design optimization model presented in the paper, a demand satisfaction constraint is formulated and applied in such a way that the demand is totally met when the nodal pressure is equal or greater than the desired pressure, and the no demand or consumption is supplied when the pressure is lower than the admissible pressure. It is not explicitly stated if a pressure dependent demand (PDD) analysis is used for hydraulic simulation although PDD analysis should be applied to quantify the actual supply under abnormal or pressure deficient conditions (Wu et al. 2009).

Reply 3: This work uses a pressure driven hydraulic simulator where the consumption is function of the pressure between an upper limit and a lower limit. This information has been included on page 4 of the attached paper.

Comment 4. In related to the note above, authors' assumption that no demand is met when the pressure is lower than the admissible pressure does not seem to be

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a valid, although it will depend on how much the admissible pressure is specified for the nodes. In practical system, the demand or actual amount of the supplied water decreases as the pressure decreases, it is zero supply when pressure is zero. When admissible pressure, as authors prescribed, is greater than zero, there should be some demand that can be met or supplied. In the case study, authors specified the admissible pressures of 30 m, 25 m and 10 m for various scenarios. With the specified admissible pressure, there will be quite significant amount of water that can be supplied throughout the network.

Reply 4: The values of the admissible pressures are presented on page 6 of the attached paper. In the case study for scenario 1 all the demand has to be satisfied, and demand is fully met for pressures equal to 30 m. For this scenario, there's no violation of pressure or consumption. For the other scenarios, 2 to 7, pressures can be lower than desired pressures but have to be higher than admissible pressures. The case study takes 25 m as the desired pressure and 10 m as admissible pressure, for all the nodes of the network except the one with a hospital (node 7). The amount of water delivered to customers is function of the pressure between these two limits. For pressure the same as the desired pressure (25m) or higher the demand is totally satisfied and for pressures lower than the admissible pressure (10 m) there is no nodal consumption. This is just an example, based on an assumption that the design of the city represents this situation, but other values can be assumed for these pressures, depending on the particular case study being analysed.

Please also note the supplement to this comment:
http://www.drink-water-eng-sci-discuss.net/5/C115/2012/dwesd-5-C115-2012-supplement.pdf

Interactive comment on Drink. Water Eng. Sci. Discuss., 5, 173, 2012.