



## Optimization Model of Water Distribution System Using Heuristic Algorithm to Sketch Vulnerability Map

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With the development of society, more and more people move to a city, which results in heavily increase of clean water demand. The study area, Kaohsiung city, is the second largest city with many industrial activities in Taiwan, and rainfall concentrates extremely in the wet season. The ratio of rainfall for wet and dry season is 9:1, and thus water supply for agriculture, industry and increasing population becomes more and more difficult while this city develops further and especially when droughts happen. To solve above problem, a robust pipe network with well-designed water supply distribution system becomes much more important. The purpose of this research is to find the optimal solution for water distribution system, which decides the amount of water for all nodes in the network and results in the smallest amount of people affected by shortage of water when the water network faces different degree of droughts. In this research, EPANET2 is used to simulate water distribution for different drought conditions. On the other hand, EPANET2 simulation and GIS population information are combined to calculate how many people are affected for each node in the network; then we can know the total affected people in the whole city for each water distribution alternative. Finally, heuristic algorithm is applied to find the optimal solution for different degree of droughts. Furthermore, by comparing the optimal solutions, the water supply vulnerability map can be drawn for Kaohsiung city, which reveals the weaker part of Kaohsiung and should be strengthened first for future extreme climate.

Keywords: Water Supply Distribution System, Heuristic Algorithm, EPANET2, Vulnerability Map, and Optimization Model