Mapping of land subsidence induced by groundwater extraction in urban areas as basic data for sustainability countermeasures

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Abstrak

Estimation of land subsidence induced by groundwater extraction has been observed by some researcher using field instrumentation as well as a spatial mapping technique. Among the six Asian cities (Bangkok, Jakarta, Manila, Osaka, Seoul, Taipei and Tokyo), the rate of land subsidence in Jakarta is higher in the period 1900-2010 from the previous study. In order to improve appropriate monitoring system and the comprehensive result for subsidence measurement, tools for subsidence awareness-raising to government and society are needed. This paper aims to study a benchmark and sustainable countermeasure analysis of land subsidence induced by ground water extraction in urban areas of Jakarta city, using continuous monitoring system and integrated data management system. Measuring of land subsidence using field monitoring such as extensometer, leveling survey (GPS geodetic) and observation wells, was conducted in some location in North Jakarta from 1990 to 2016. The result from visual observation reached an average land subsidence rate 1.65 cm/year, while GPS geodetic measurement range from 0-12 cm/year. Monitoring from seven extensometer sensors installed in different borehole elevation reached subsidence 0.66 cm in average. Meanwhile, groundwater surface level ranged at 0.6 meters until 44 meters from surface and the deepest is in Bintaro - South Tangerang area. Data analysis conducted with computer simulation to investigate the inter-connection between land subsidence and groundwater extraction. Obviously, land subsidence has a strong associated with groundwater extraction. Integrated data management systems, including data sharing are needed to improve appropriate monitoring system of land subsidence in Jakarta.