

# Impact assessment of urbanization and reclamation affect groundwater flow and subsurface thermal environment in Tokyo Bay area

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Tokyo Bay area has been developed as one of the most urbanized area, and the urbanization has affected groundwater flow and surface warming. On the other hand, this area is the discharge area of regional groundwater flow system from the whole of the Kanto Plain. Therefore, it is considered that the urbanization affects shallower part of this area more than hills and uplands. The purpose of this study is to evaluate the effects of urbanization and reclamation by using observed data of hydraulic head and temperature-depth profiles in Tokyo Bay area, which is located between the Tokyo Lowland and the Port of Tokyo.

Hydraulic heads show the value of less than 0m below sea level in almost of all wells. According to observed hydraulic head, this is affected by pumping, however water level has shown increasing tendency in recent years.

Temperature-depth profiles prove minimum temperature, and the subsurface thermal environment is affected by surface warming due to urbanization. These minimum temperatures are located not deeper than 50m in the profile. In the Kanto Plain, the profiles with shallow depth of minimum temperature are only located in lowlands. As a result, this area is considered discharge area.

In the shallow part above minimum temperature, there is the difference of the temperature increasing which is the difference between the surface (soil) temperature and the minimum temperature caused by the difference of land use. The temperature increasing shows the value of 0.0 to 0.2 degrees Celsius in the vegetated area and more than 1.0 degrees Celsius in the urban area. Moreover, temperature increasing shows the value of 0.8 degrees Celsius in the landfill area. It was shown that high temperature of 40.6 degrees Celsius in 1982 and 28.6 degrees Celsius in 1999 in 20m deep of landfill part was affected by the heat of decomposition of organic material by microbes. According to our research, temperature has decreased to 17.4 degrees Celsius which is lower than the old data. Therefore, the landfill strongly affects subsurface thermal environment in just a short period of time, only about 30 years. However, urbanization does strongly affect subsurface thermal environment in a longer time scale than the landfill.