Impacts of Saltwater Upconing on Fresh Groundwater Resources in Sisaket Province, Thailand

Wasana SARTTHAPORN[1]; Khuan DONSUYPA[1]; Sarunya PICHAIYO[1]

[1] Department of Groundwater Resources, Ministry of Natural Resources and Environment, Bangkok, Thailand

Corresponding Author(s): Sarunya.pichaiyo@gmail.com

In 2021, local people in Sisaket province were unable to use shallow groundwater due to fresh groundwater had been changing to brackish and saltwater. In order to seek for freshwater, the locals had to install deep production wells. According to hydrogeological characteristics in the area. The aquifer system contains freshwater aquifer underlain by rock salt units. Freshwater overexploitation is the main cause of saltwater moving upwards to freshwater aquifer. This incidence is known as saltwater upconing. Therefore, continuously monitoring of saltwater upconing and groundwater management need to be implemented in the problematic areas. This study investigated the saltwater upconing related factors and effects of changing in shallow groundwater quality to initiate groundwater management plans.

The area of interest is in Mueang Sisaket, Phayu and Si Ratana district, Sisaket Province, north-eastern part of Thailand. In dry season, groundwater is high in demand for daily consumption and agriculture mostly for growing rice and crop sequencing such as maize, sweet corn, and fruit orchards such as durian, rambutan, and guava because of severely surface water resources scarcity. Generally, groundwater wells were drilled at the depth of 7-10 m from the boundary between unconsolidated sediment and hard rock, and at the depth of 10-60 m within fracture of hard rock units consists of sandstone and siltstone. The comparison of seven-year groundwater analytical data (1,498 wells from 2015-2022) was conducted to define the saltwater upconing zone by using TDS as an indicator of saltwater. Results of investigation suggested that the factors involved in saltwater upconing included: (1) The interface depth between freshwater layer and brackish-saltwater layer which is related to the rock salt accumulation. (2) Drilling and development of groundwater deeper than the freshwater layer (3) The excessive pumping per day. (4) The distance between the wells, which developed at the same groundwater aquifer, is less than 50 m which may cause overlapping of cone of depression. (5) The amount of latent water pumping that does not included in database causing difficulties in groundwater resources management. Based on spatial analysis, the freshwater area has decreased whereas the brackish-saltwater area has increased by 12.21% of the total area. Department of Groundwater Resources is defining measures of guidelines for groundwater development and conservation in Sisaket province for sustainable groundwater resources conservation. The measures included; not permitted to drilling and using groundwater in saline soil areas and in the depth of brackish-saltwater layer, controlling the depth of well development and construction, limiting the volume and duration of groundwater pumping per day. Furthermore, install groundwater monitoring stations in this area for groundwater levels and quality annually monitoring.

Keywords: Saltwater upconing, Groundwater quality, Groundwater monitoring