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MANAGED AQUIFER RECHARGE : THE EXPLORATION OF POTENTIAL AREAS, NAM KAM RIVER BASIN, SAKON NAKHON AND NAKHON PHANOM PROVINCES, THAILAND

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Climate change has a direct impact on weather and season globally. In Thailand, the rainy season usually starts from mid-May to mid-October every year, but recently this season either comes early or late that would affect human beings and ecosystems, including agriculture and livestock. Moreover, an increase in rainfall intensity, caused by longer and heavier rains, results in floods in many areas. To prevent such a situation, the exceeded water has to be managed in collaboration with local people and all levels of the organization to protect the ecology and environment. In this area, the construction of an infiltration pond is recommended since it is capable to hold stormwater during the wet season and allow water to percolate down to the groundwater system for future beneficial uses. As a result, the groundwater level increases in accordance with the amount of surface water recharge, and eventually leads to sustainable groundwater supply. This solution could lead Thailand to be on track to achieve the United Nations' Sustainable Development Goal 6 (Clean Water and Sanitation).

Nam Kam River Basin is one of the Mekong tributaries situated in the northeastern part of Thailand. The basin partially covers two provinces with an area of approximately 2,500 square kilometers, which is a part of the vast flat area known as The Korat Plateau. This area is rich in rainfall with an annual rate ranging from 1,300 to 2,400 millimeters (Thai Meteorological Department, 2021), and is sometimes affected by tropical cyclones in some years. For example, in 2017, most people who lived near the Nong Han Lake and Nam Kam River — the main lake and river in this river basin — were hit by the tropical depression named Sonca, causing heavy rainfall and considerable flash flooding in Sakon Nakhon municipality. The tropical storm largely affected residential properties, agricultural areas, and businesses, which were eventually compensated by the government. Therefore, the Department of Groundwater Resources is trying to find ways to prevent flood-related disasters as well as manage the volume of stormwater. Based on previous studies (Department of Groundwater Resources, 2020), performing managed aquifer recharge might be one of the appropriate solutions for dealing with this issue. The more exceeding water from the rain is wisely managed, the fewer flood-related problems will occur.

The methodology of the study can be described in four parts. The first part is to review the previous works or relevant secondary data. This would help not only to understand the whole area but also to plan for fieldwork. Next step, the detailed study is principally carried out in the field. This part mainly focuses on the studies of geology and hydrogeology, including groundwater well inventory, resistivity survey, drilling small-diameter wells, and determination of hydraulic properties using a slug test. The study process is then followed by the social study. The questionnaire is used to recognize the flood situation in the area, raise concerns about the lack of water consumption, and broaden an understanding of managed aquifer recharge. The final step is to delineate the potential areas. Weighting methods and geographic information systems (GIS) are the crucial tools used to analyze and identify the suitable zones for performing the managed aquifer recharge. Geology, geomorphology, permeability and slope gradient are the major factors for weighting methods.

This finding presents a map illustrating the different degrees of suitability for managed aquifer recharge with four different colors (Fig. 1). Most of the area is considered as the moderate potential area (pale yellow color) which is around 1,000 square kilometers (44%), following by the low potential area (old rose color), covering an area of 800 square kilometers (33%). Both moderate and low potential areas are found in the upper part of the river basin. The high potential area (green

color) comes in the third in size with 350 square kilometers, accounting for 14% of the basin area, and predominantly covers the lower part of the study area. The smallest area is the non-potential area (red color) which is mainly found in the high mountain area of the lower part of the river basin. The size of this area is 200 square kilometers or only 9% of the total area.

The results suggested that high and moderate potential areas must be the first two priority zones if managed aquifer recharge is brought for decreasing the overflow of water during the rainy season. Besides the suitability of the area, the selection of the techniques of managed aquifer recharge is also important. The next step would focus on the study of the appropriate methods and testing the selected technique in the actual sites.

Keywords: exploration, managed aquifer recharge, Geographic Information System

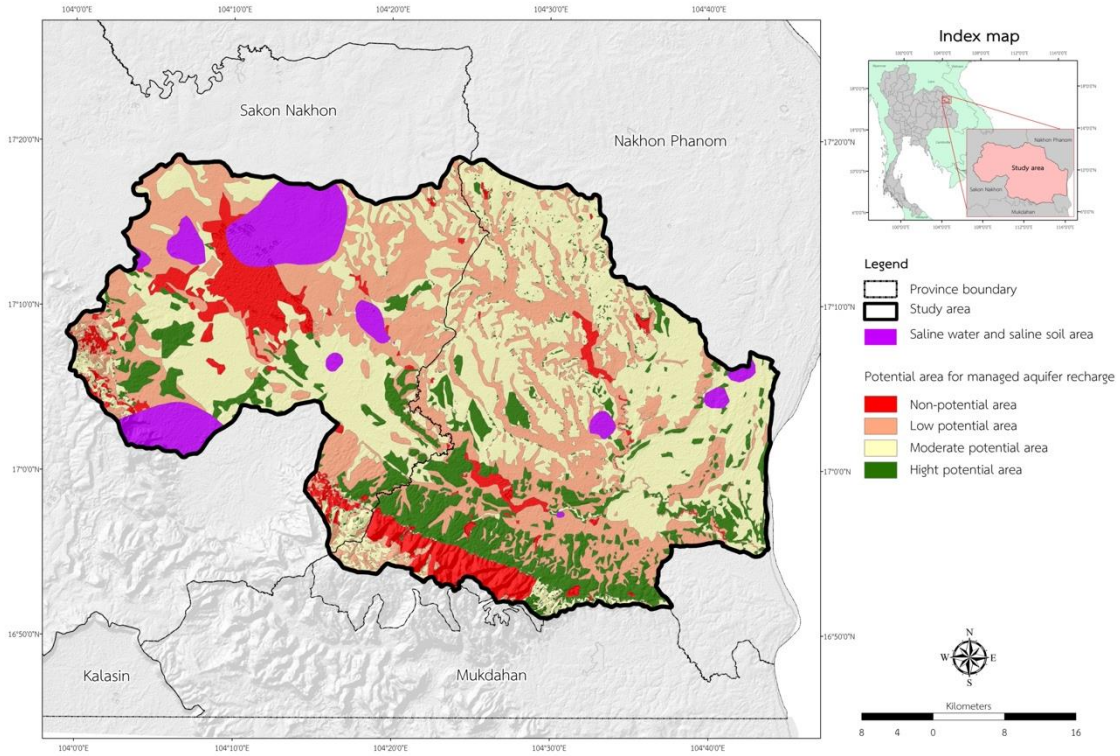

Fig. 1. Potential area for managed aquifer recharge in the Nam Kam River Basin.

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