NATURE OF OCCURRENCE AND UTILIZATION OF GROUNDWATER IN BUDALIN, MONYWA AND CHAUNG-U TOWNSHIPS, SAGAING REGION

PhD DISSERTATION

ZAW MYO OO

DEPARTMENT OF GEOLOGY
UNIVERSITY OF YANGON
MYANMAR

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ABSTRACT

Administratively, the area under investigation lies within the Budalin-Monywa-Chaung-U townships of Sagaing Region and it is situated at the north - western part of Dry Zone of Central Burma. Geographically the area is bounded between Latitude (21° 45' N) to (22° 30' N) and Longitude (95° 00' E) to (95°30' E). The aerial extend of the study area is approximately 869 square mile (2251 km^2). As the area under investigation situates in the north-western part of Dry Zone of Myanmar, the climatic condition is semi-arid and average annual rainfall does not exceed 25 inches (640 mm).

Geologically, the whole area is mainly composed of alluvial sediments of fluvial origin. This alluvium usually covers the low-lying parts of the area whereas the rocks of Irrawaddy formation and Pegu Group are exposed at the eastern hilly terrain. Limited exposures of volcanic rocks (i.e olivine basalt) have been noted probably along fault line (running along Inde-kyaukka range).

In the area, two main aquifers have been categorized into Alluvial Aquifer and Irrawaddian Aquifer. The Alluvial Aquifer is mainly composed of gravels, fine to course sands, silty clay and clay. The Irrawaddian Aquifers are mainly composed of sand, clay, silt, sandstone and locally passing into gravel.

Transmissivity value of the Alluvial aquifer is ranging from 1114 to 6988 m^2/d and storativity of the aquifer is $8x10^{-4}$.Discharge rate of 12 inches diameter well in alluvial aquifer is ranging from 32807 to 36730 gph. Transmissivity value of the Irrawaddian aquifer is ranging from 102 to 289 m^2/d and storativity of the aquifer is $1.8x10^{-5}$. Discharge rate of Irrawaddian aquifer is ranging from 4514 gph to 4672 gph for 6 inches diameter tube wells. Transmissivity value of the Peguan aquifer is 7.223 m^2 / d. Discharge rate of Peguan aquifer is 650 gph for 4 inches diameter tube well. Groundwater flow direction of the study area is generally east to west.

The total of 7 VES (Vertical Electrical Sounding) points employing Schlumberger four electrodes system has conducted at the locations where previously selected .

According to the Piper trillinear diagram and Chadha diagram, Groundwater type of Younger Alluvial Aquifer, Older Alluvial Aquifer and Peguan Aquifer is Na-Cl type. Such water generally creates salinity problems both in irrigation and drinking uses.

Hydrochemical nature, environment and composition of groundwater can be evaluated effectively by the ionic ratio. The following ionic ratios were analysed to know local replenishment of fresh water and origin of groundwater. They are Cl^-/ HCO_3 and Mg^{++}/Ca^{++} ratio. The small value of the ratio (Cl/HCO_3) in the Younger Alluvial aquifer found along the Chindwin River and eastern part of the study area and that clearly define the nature of local replenishment by fresh water surface. Magnesium and Calcium Ratio were all less than 2.The ratio value of the study area is ranging from 0.32 to 1.04.The groundwater in the study area is inland origin .Water under marine influence would have value of about 5.

Groundwater type of Irrawaddian Aquifer is Ca-Mg- Cl type. Such water has permanent hardness and does not deposit residual sodium carbonate in irrigation use. The small value of the ratio (Cl/HCO_3) in Irrawaddian aquifer found along the Chindwin River and eastern part of the study area and that clearly define the nature of local replenishment by fresh water surface. Magnesium and Calcium Ratio of the Irrawaddian aquifer is ranging from 0.5 to 2.8.The groundwater in the study area is inland origin.

Groundwater of the study area is marginal quality for irrigation because of the high bicarbonate content which will result in calcium precipitation and increase the sodium content. Salinity problem and alkalinity problem should be controlled by improving drainage, leaching, reducing evaporation and applying chemical treatment such as gypsum.

Average annual rainfall in the area is 0.64m (25 inches). An effective rainfall (37%) of 0.23 m (9.25 inches) is derived from the upper catchments in the eastern part of the study area. This produces a gross runoff from the 264 km^2 catchments area of 65million m^3/annum. Applying a runoff factor of 0.85 to the gross runoff from the catchments yields a surface runoff of 55 million m^3/annum, the remaining of 10 million m^3/annum is recharging the outcropping sandstone. 70% of the runoff 55 million m^3 from the hills is assumed to infiltrate in the Alluvial Aquifer. So, 39 million m^3/annum probably recharges to the alluvial aquifer.A total recharge of the outcropping sandstone and Alluvium is 49 million m^3. The extraction prior to 2016 was estimated as 38 million m^3/annum derived from the Alluvial Aquifer and

Irrawaddian Aquifer. The steady- state balance gives an outflow at the river of 11 million m^3/annum.

Estimating the probable land subsidence when the piezometric head drops by 3.7 m in a confining aquifer 30 m thick, having a porosity of 30% and storage coefficient $8x10^{-4}$. The elastic subsidence of the land surface in the study area is 0.5 mm.

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