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Hydrogeological Framework Model for Dhaka Regional Groundwater Flow System (DGFS), Bangladesh

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The hydrogeology of the Dhaka Regional Groundwater Flow System (DGFS) is located in central Bangladesh, consisting of sediment accumulates from the Ganges and Brahmaputra Meghna (GBM) river systems. The DGFS system is stratigraphically and structurally complex and subjected to a variety of structural disruption. These sediment deposits form a complex, three-dimensional (3D) framework that can be subdivided into aquifers and confining units on the basis of their ability to store and transmit water. The aquifer systems in this region are geologically controlled and depend on the sedimentary characteristics of the depositional environment and related parameters. More than 20 years of ground-water flow modeling of the DGFS has produced a succession of models that represent the regional hydrogeology and groundwater flow system. However, incorporation of a geologic framework in the models with different geologic data sets or subsurface interpretation is often missing. Therefore, such incorporation of geological and sedimentological information within the modeling framework could increase model calibration. The separate geological structure of the Dhaka region is studied yet detailed spatial and depth variables of geological and sedimentological information is still not evident in the hydrogeological framework. In this background, the objective of the paper is therefore to incorporate the geological information into the hydrogeological framework model and advance the approach of hydrogeology for the DGFS. We have used the concept of the Hydrogeologic Unit (HGU) – the sediment and deposits formation of the hydrostratigraphic framework for a groundwater flow system. The quaternary sedimentation processes of DGFS were subdivided into different cycles based on sea-level changes and Carbon-14 dating. The subdivisions are called 1a, 1b, 2 and 3 which correspond to high stand fluvial sequences (10-0 ka BP), Transgressive Tract/ low stand (20-10 ka BP), pre lows stand deposits (130-110 ka BP) and Cycle 3 >220 ka BP respectively. Based on data from more than 500 bore holes with an average depth of around 220 M, in which highest depth was 500 meter below sea level, a 3D hydrogeological framework model has been developed. The model provides a detail insight into the spatial variability of geological and sedimentological properties at different depths. The HGUs change for different geographic regions represented in the 3D framework model based on stratigraphic changes in the geologic units. To approximate the hydrologic effects of spatially varying material properties, different hydraulic conductivities were applied to different zones based on their hydraulic connectivities and geological setup. This model can serve as the basis for a regional groundwater flow model with more advanced data and information, which incorporate the geological and sedimentological information. This will help the decision makers of Dhaka region for effective management of groundwater resources