4
CHAPTER

Chronostragraphic Mapping

4.1 Introduction

The analysis of geological logs was conducted during the project with a view to draw some geological profiles near to the JICA study area. The activities undertaken were:

- Review of JICA Study (2002)
- Consideration of Paleo-Environmental condition in Bengal lowland
- New Geological Profile in Satkhira area
- Proposal of Hydrogeological Model in southern part of Bangladesh

4.2 Results

4.2.1 Accuracy of geological data and process of deep aquifer map

Geological log from JICA Study (2002) and DPHE & BGS (2001) are very good quality and could be used as reference data for making subsurface geological section close to the JICA study area. However, the depth of investigations in JICA Study (2002) is 300m, while depth of investigations in most other studies is about 150m. The correlation in the deeper formations is not always possible.

Geological logs from DANIDA and BWDB are reasonably accurate. However, the target area of DANIDA is only coastal area of south-east Bangladesh, while geological logs from BWDB are distributed in the whole country and valuable. Unfortunately, geological logs from DPHE differ from the format of description in each district, and are inaccuracy in some area. But, number of DPHE geological logs which were collected in this project is more than 3,000.

4.2.2 Review of JICA Study (2002)

Table 4.1 shows the comparison with aquifer unit between JICA Study (2002) and BGS & DPHE (2001) which are extremely accurate compared to other data which were collected in this project. The layer up to 300m depth in Jessore, Jhenaidah and Chuadanga district was divided into five formations (from A to E) and recognized as three aquifers (from first to third) in JICA Study (2002). Figure 4.1 shows the typical geological profiles which made by JICA Study (2002). In the view of depositional age of each aquifer, geological age of first and upper shallow aquifer are presumed Holocene (after 10,000 years ago), its second and lower shallow aquifer are presumed last of late Pleistocene (from 10,000 to 18,000 years ago) and its third and deep aquifer are presumed Pleistocene (before 18,000 years ago) respectively. Though the names of aquifer are different, the boundary of each aquifer from JICA Study (2002) and BGS & DPHE (2001) are same. These aquifer units are inferred to adapt in nationwide.

Table 4.1 Comparison of Aquifer units

Geological Age	Year	JICA (2002)		BGS & DPHE (2001) Aquifer Classification
		Stratigraphy	Aquifer Classification	
Holocene	10 Ka	A formation B formation	First aquifer (Shallow aquifer)	Upper shallow aquifer Late Pleistocene
Late Pleistocene	18 Ka	C formation	Second aquifer (Middle aquifer)	Lower shallow aquifer
Pleistocene (Pliocene)		D formation E formation	Third aquifer (Deep aquifer)	Deep aquifer

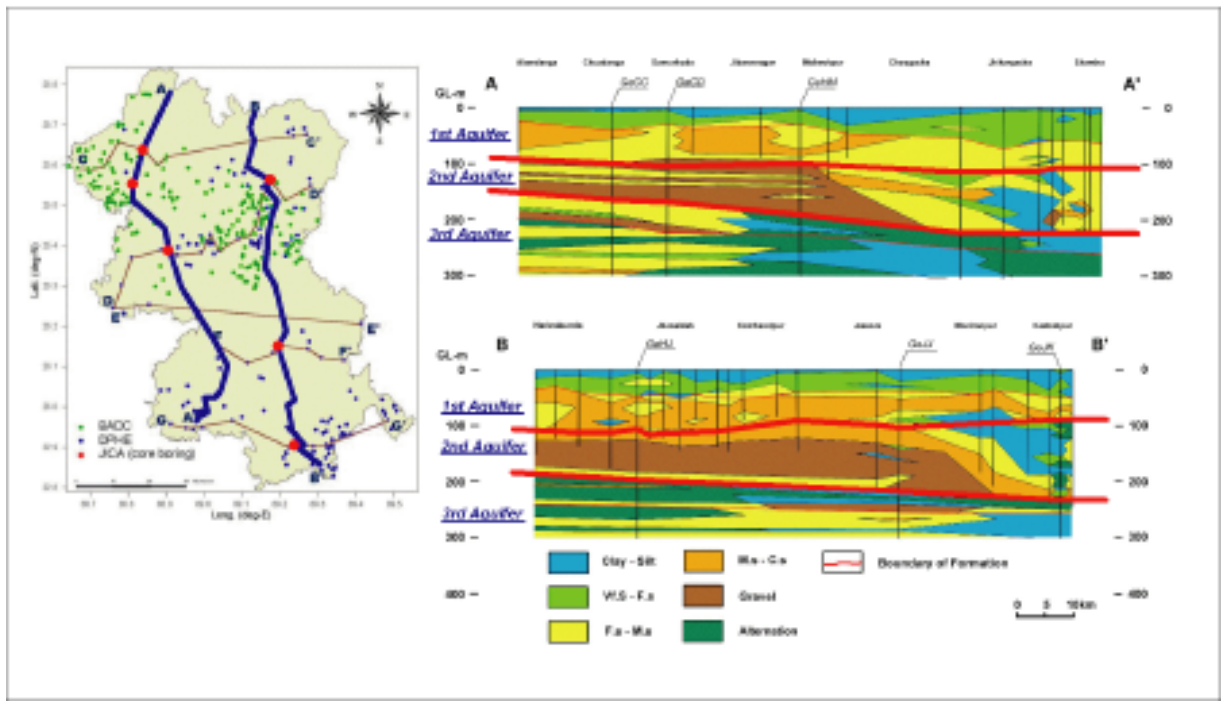

Figure 4.1 Geological profiles in Jessore area (after JICA, 2002))

4.3.3 Consideration of Paleo-Environmental condition in Bengal lowland

Quaternary deposits are formed under the influence of glacial eustasy (sea level change). Figure 4.2 shows the sea level curve after 30,000 years ago. The sea level is estimated below 100 to 120m from present level in 18,000 years ago which is the peak period of last glacial stage. The sea level suddenly rose up after 13,000 years ago and was higher than present level. The sea level had slightly fallen into present level. River transports a large quantity of soil. Near coastal line, power of transportation rapidly declines and soil deposits on the bottom of liver and sea. The coastal line and depositional place shift by occurrence of sea level change. Figure 4.3 shows a restoration of transportation of coastal line and depositional place in Bengal low land.

The geological profiles of JICA Study (2002) were reviewed on the reflection of the interaction between sea level change and depositional systems. C formation consists of the coarser sediments which were accumulated in a period of lower sea level, and retro-gradational deltaic sediments in a period of transgression. B formation consists of pro-gradational deltaic sediments in a period of higher sea level. A formation consists of paludal sediments and flood sediments which are presumed to deposit in a period of regression after 6,000 years ago. As above mentions, the chronostratigraphic model made by JICA Study (2002) is evaluated to be reflected in paleo-environmental condition of Bengal lowland and to be adaptable into other area.

4.3.4 New Geological Profile in Satkhira area

The chronostratigraphic model in Jessore area was adapted to Satkhira area where is located in southern part from area of JICA Study (2002). Figure 4.5 shows new three geological profiles in Satkhira area. When new geological profiles were made, comparison with geological logs had conducted in consideration of the interaction between sea level change and depositional systems

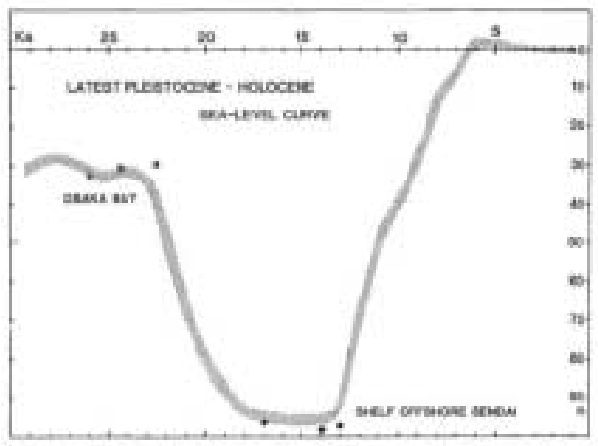

Figure 4.2 Sea level curve 30,000 years ago

18Ka: The peak period of last glacial epoch
10Ka: The boundary of Holocene - Pleistocene
6Ka: The peak period of last highest sea level

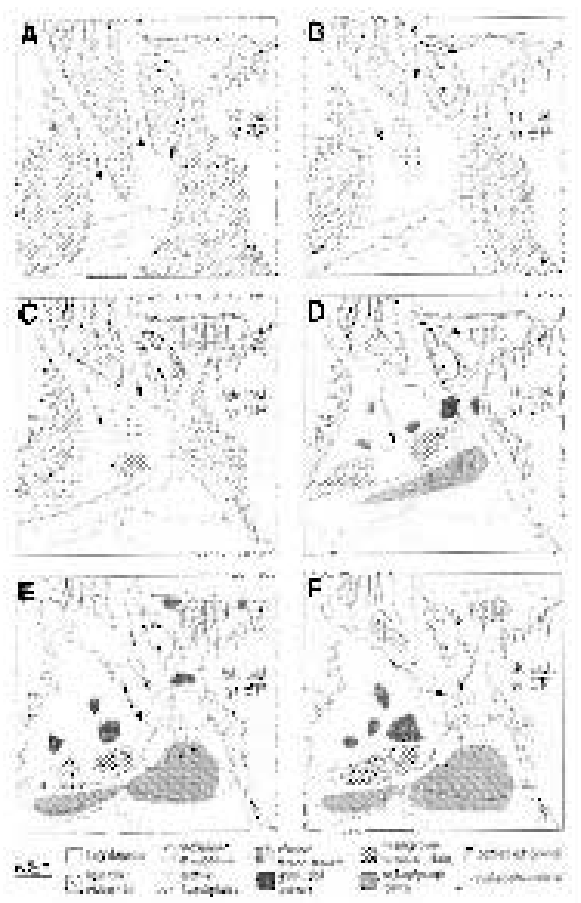

Figure 4.3 Changes of palaeo-environment of Bengal lowland

Blue line: Shoreline (Goodbred and Kuehl, 2000)

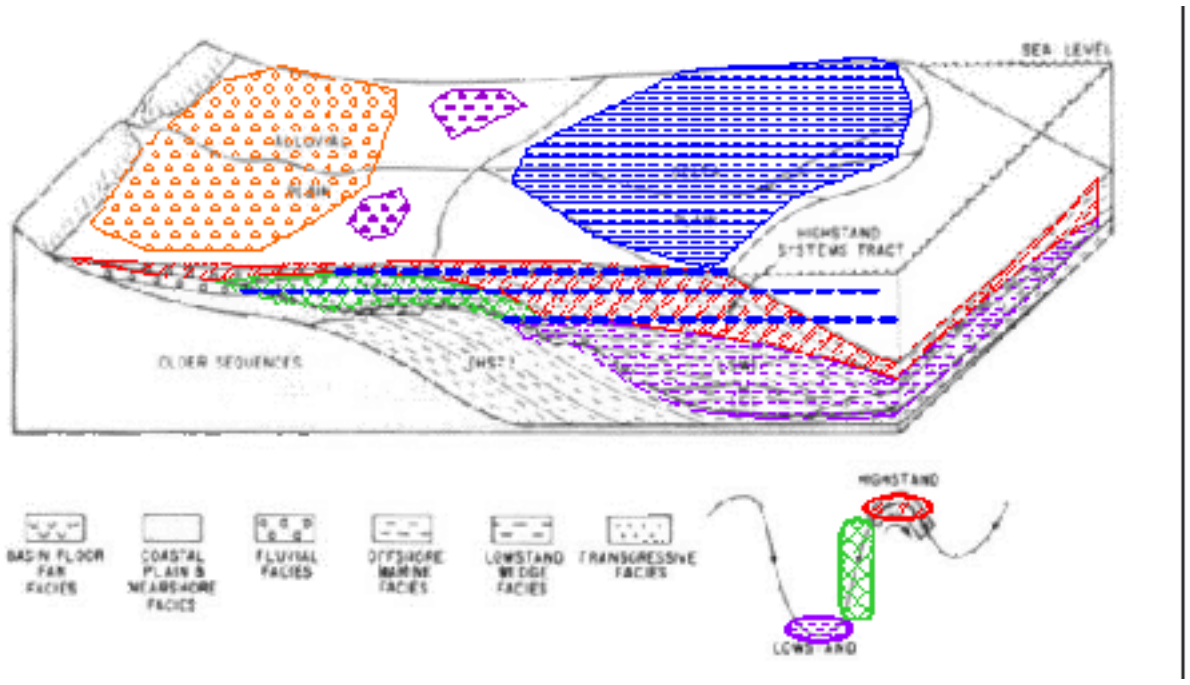

Figure 4.4 Typical depositional system from Delta plane to Flood plane (Haq, 1991))

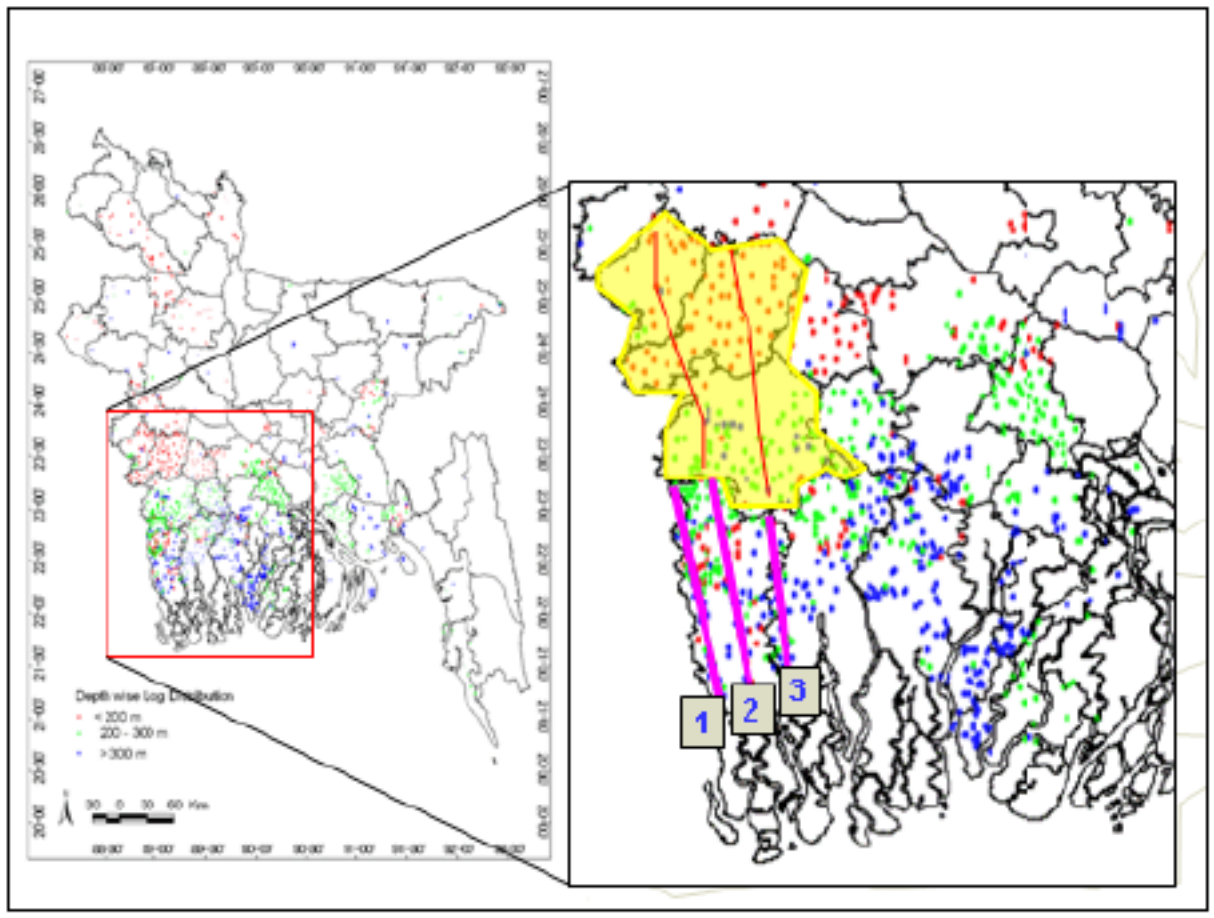

Figure 4.5 Section lines of geological profiles in Satkhira area (Yellow colored area: Area of JICA Study (2002); Dot: Location of geological log (Red: depth of 100?200m, Green: depth of 200?300m, Blue: depth of below 300m)

Three aquifers (First, Second and Third) are confirmed to continuously distributed in Satkhira area as shown in Figure 4.6 to 4.8. Clayey layer generally becomes thicker in Satkhira area and boundary of aquifer becomes deeper into southern part. In case of first aquifer, while sandy layer is mainly distributed in Jessore area, clayey layer is distinguished in southern part of Satkhira area. In the case of the second aquifer, while clayey layer is distributed in only southern part of Jessore area, two clayey layers are distributed in almost all Satkhira area. Second aquifer is divided into upper part and lower part. The layer which is distinguished clay and silt is presumed to be delta front deposit in both First and Second aquifer. Third aquifer is rarely confirmed on geological log due to become deeper in Satkhira area.

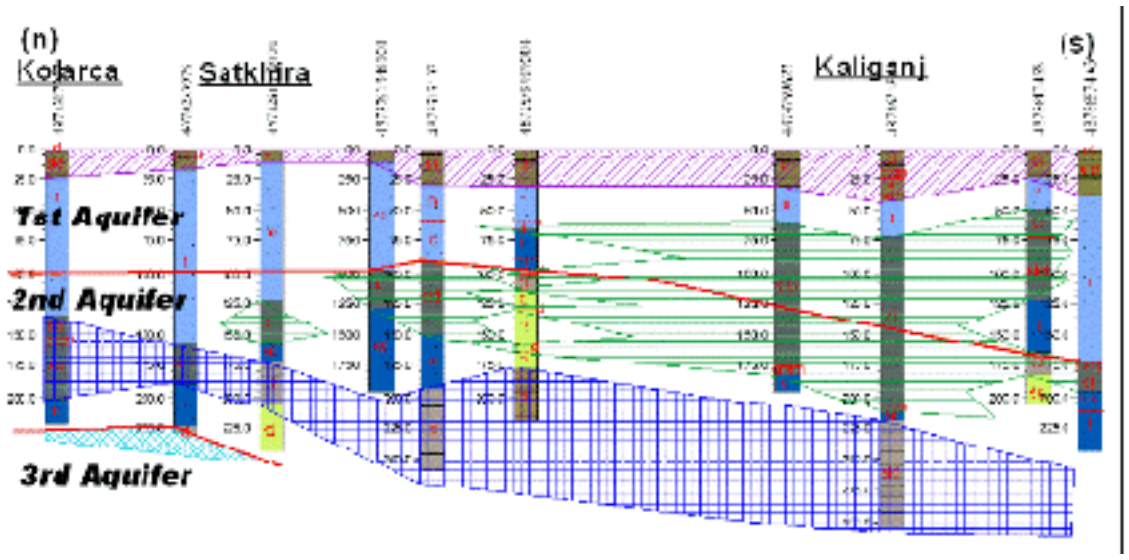

Figure 4.6 Geological profile in Satkhira (1)

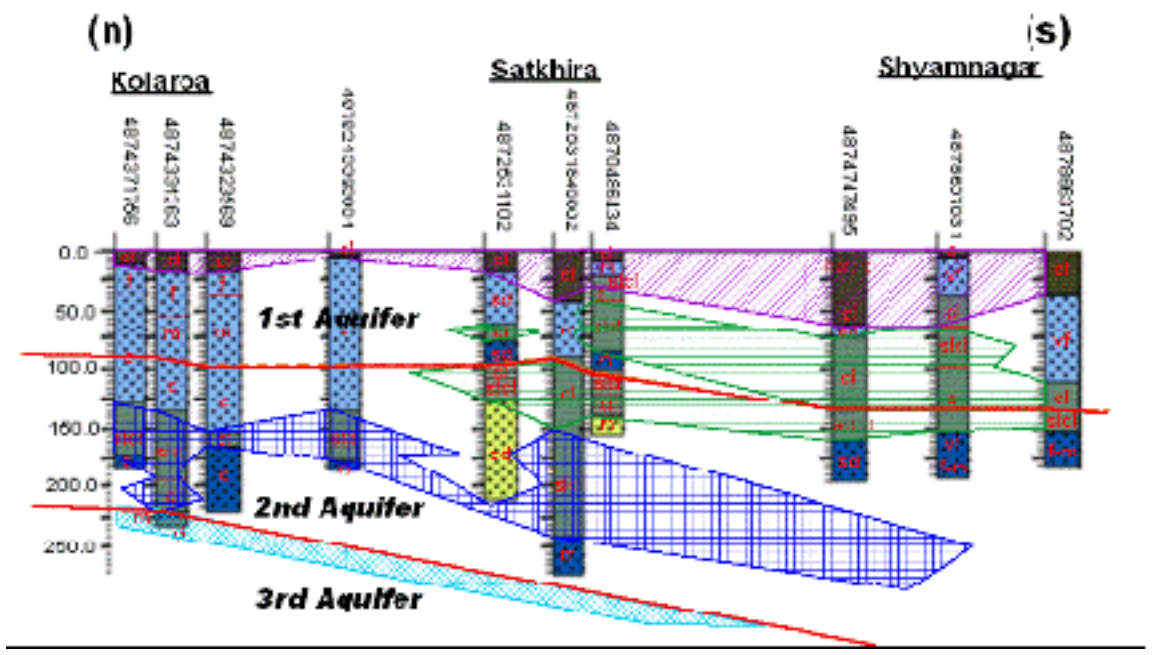

Figure 4.7 Geological profile in Satkhira (2)

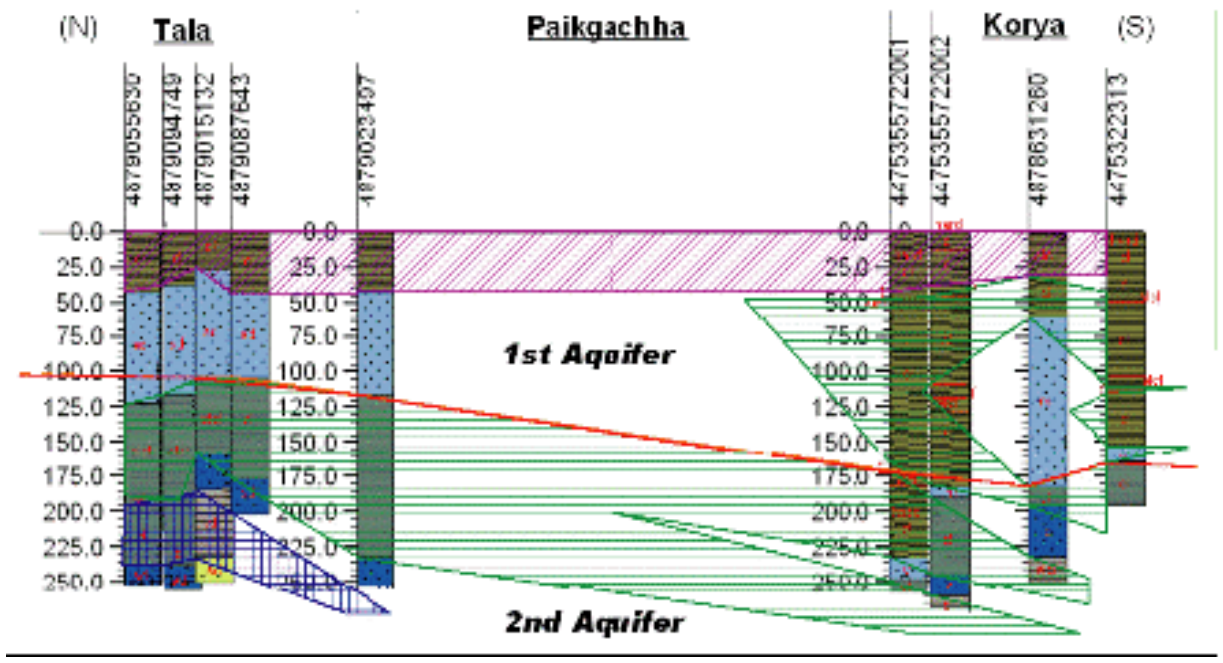

Figure 4.8 Geological profile in Satkhira (3)

4.2.5 Proposal of Hydrogeological Model in southern part of Bangladesh

Hydrogeological model is imagined as shown in Figure 4.9 in consideration of geological profiles in Jessore and Satkhira area. These aquifer units of this model are assumed to be adaptable into southern part of Bangladesh, because geological structures are similar along the coast line.

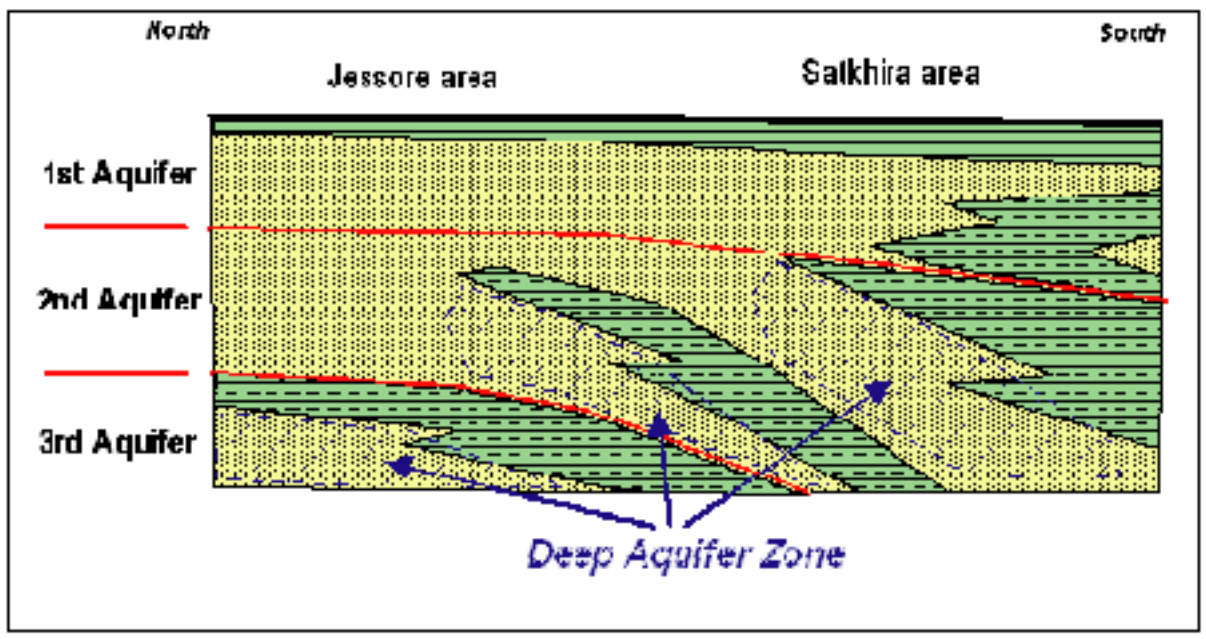

Figure 4.9: Standard model of aquifer unit in Jessore and Satkhira area (Yellow color: sandy layer, Green color: clayey layer, Blue colored area: deep aquifer

First aquifer is the target layer of shallow tube well and high contaminated zone of arsenic. Second aquifer has different geological situation from place to place and characteristics of both shallow aquifer and deep aquifer. A risk of arsenic contamination in Second aquifer is assumed to be high toward north from Jessore area, because there is no interbedded clayey layer between First and Second aquifer in Jessore area. Meanwhile development of Second aquifer is assumed to be possible from southern part of Jessore to Satkhira, because the interbedded clayey layer between First and Second aquifer exists in this area. While the interbedded clayey layer between Second and Third aquifer exists in all area, development of Third aquifer is difficult in some area because of depth of aquifer.