

Chapter 8

CONCLUSIONS

Based on the study, following conclusions are drawn:

- (i) Conventional measurements of planform characteristics of meandering rivers are a time consuming, laborious and expensive procedure. Their main disadvantage however is that they provide information only at a particular point and instant of time. On the other hand, remote sensing techniques are capable of providing information through time and space which can never be appreciated from the ground. Further, satellite remote sensing presents an expedient, reliable and cost effective alternative method for demarcation of rivers at suitable time-space intervals to establish the stability or otherwise of their channels. Advantages of the information acquired by satellite remote sensing are of synoptic coverage and repetivity.
- (ii) In the present study, analysis of the shifting course of river Ganga between Ara to Patna was carried out from the year 1974-76 (SOI toposheet) to 1989 (IRS-1A LISS-II data), 1989 (IRS-1A LISS-II data) to 1996 (IRS-1C LISS-III data) and 1996 (IRS-1C LISS-III data) to 2000 (IRS-1C LISS-III data). Based on this analysis, the critical locations along the Ganga river course from Ara to Patna where major shifting has occurred were identified as Neknamtola, Jirakhantola and Daudpur on its right bank and Ami and Hajipur on its left bank.
- (iii) In order to study the extent of erosion and the population affected in the identified critical locations, detailed study was carried out using IRS-1C PAN data, having a spatial resolution of 5.8 m, for the years 1996 and 2000 along with SOI toposheet of the scale of 1:50,000 for the year 1974-76. The places/townships which have been affected/washed away and those that are likely to be affected in the near future were identified. These analyses were supplemented using merged IRS-1C LISS-III and PAN data for the year 2000.
- (iv) Near Neknamtola, it was observed that the river course has shifted by 2.75 km from 1974-76 to 2000, while it has shifted by 0.23 km from the year 1996 to 2000. An area of 10.48 km² has been eroded. The settlements namely Neknamtola, Saligramsinghtola, Lalatola, Raghubartola, Jivaraitola, Abhiraitola, Ekauna Diara have totally come under the river course. Also, the river is showing aggressive trends and eroding its right bank and is shifting towards Semariya. The villages/townships that are likely to be affected in due course of time are Semariya, Parariya and Brahra. Thus, it is recommended that the people living in these villages should be cautioned about the event and appropriate anti-erosion measures should be taken up so as to prevent these villages/townships from being affected.

- (v) Near Jirakhantola, it was observed that the river course has shifted by 1.43 km from 1974-76 to 2000, while it has shifted by 0.32 km from the year 1996 to 2000. An area of about 4.79 km² has been eroded. The villages/settlements which have been affected are Nilkhantola, Jirakhantola, Gangatola, Bhagutola and Hathitola. Since the river is showing aggressive trends, preventive anti-erosion measures are recommended.
- (vi) Near Ami at Dighwara, it was observed that the river has shifted by 2.71 km from 1974-76 to 2000 and has come very close to the highway. Thus the highway is endangered and it is recommended that protection work must be strengthened in this reach. From 1996 to 2000 though there has been no shifting of the river course in the northern direction because of the presence of the highway, there has been a gradual translation of the river course from west to east thus threatening places like Ami, Yusufpur, Manpur, Saidpur, Kripur etc. Thus, people living in these villages should be cautioned and preventive measures are recommended to protect these villages. An area of 10.73 km² has been eroded. However, no settlement has been affected by this shifting though some plantation has come under the river course.
- (vii) At Daudpur near Danapur, there is both a shifting tendency of the river towards Danapur and also a widening tendency of the river. Earlier in the year 1974-76, a small channel having a width of 0.13 km and known by the name Sone Nadi used to pass through Danapur before meeting the river Ganga. Gradually in course of time, this auxiliary channel known as Sone Nadi has changed to main river Ganga having a width of 3.07 km in the year 1996 and 4.09 km in the year 2000. The right bank of the river has shifted towards Danapur and has come close to NH-30 in the year 1996. In the Diara land between the Sone river and Ganga river, there were a number of settlements in the year 1974-76. The changing of the auxiliary channel to the main channel resulted in the widening of the river course, thus endangering the people living in the Diara land. An area of about 26.09 km² had come under the river course during the period 1974-76 to 1996, while an area of about 29.16 km² has come under the river course during the period 1974-76 to 2000. Affected settlements at this location are Sarkari Patiapur, Hiratola, Navdiari, Chakkiyantola, Chakiya, Raghunathola, Dilip Chak, Jhaurtola, Qasim Chak, Gosaintola, Mangarpal, Taufir and Bathan. The villages/settlements which are likely to be affected in the near future are Ganghara and Chhota Qasim Chak. Thus, it is recommended that the people living in these villages in the Diara land should be cautioned about the event and appropriate preventive measures should be taken up. Also, the anti-erosion works near Danapur should be strengthened.
- (viii) Near Sabbalpur at Hajipur, it was observed that the river has shifted by 2.55 km from 1974-76 to 2000, while it has shifted by 0.22 km from the year 1996 to 2000. An area of about 7.87 km² has been eroded. Settlements like Bangalitola and Paschimtola and part of an embankment has come under the river course. However, the villages/settlements viz. Naikatola is likely to be affected in due course of time. Thus, it is recommended that the people living in these areas should be cautioned about the

event. It was also observed that the southern channel of river Ganga has shifted by 1.75 km in a North-Eastern direction from 1974-76 to 2000, while it has shifted by 0.44 km in the same direction from the year 1996 to 2000. However, due to this shifting no settlement has been affected.

- (ix) The shifting pattern of the river Ganga has been studied in detail at the five identified critical locations viz. Neknamtola, Jirakhantola and Daudpur on its right bank, and Ami and Hajipur on its left bank. For this, the data pertaining to the years 1974-76, 1989, 1996, 1998 and 2000 have been used. The magnitude of the year wise shifts (km) and the rate of shifting (km/year) have been evaluated for each of the five locations.
- (x) At Section 9 near Neknamtola, the total shift of river Ganga from 1974-76 to 2000 is 2.76 km. Further, the rate of shifting from 1974-76 to 1989 is 0.13 km/year; 1989 to 1996 is 0.08 km/year; and 1996 to 2000 is 0.08 km/year.
- (xi) At Section 33 near Jirakhantola, the total shift of river Ganga from 1974-76 to 2000 is 1.22 km. Further, the rate of shifting from 1974-76 to 1989 is 0.05 km/year; 1989 to 1996 is 0.02 km/year; and 1996 to 2000 is 0.09 km/year.
- (xii) At Section 39 near Daudpur, the total shift of river Ganga from 1974-76 to 2000 is 1.45 km. Further, the rate of shifting from 1974-76 to 1989 is 0.03 km/year; 1989 to 1996 is 0.14 km/year; and 1996 to 2000 is 0.00 km/year. Also, the total widening of the river Ganga at Daudpur from 1974-76 to 2000 is 3.8 km. Further, the rate of widening from 1974-76 to 1989 is 0.11 km/year; 1989 to 1996 is 0.19 km/year; and 1996 to 2000 is 0.25 km/year.
- (xiii) At Section 31 near Dighwara, the total shift of river Ganga from 1974-76 to 2000 is 2.18 km. Further, the rate of shifting from 1974-76 to 1989 is 0.11 km/year; 1989 to 1996 is 0.10 km/year; and 1996 to 2000 is -0.01 km/year. The negative sign indicates a shift in the reverse direction.
- (xiv) At Section 55 near Hajipur, the total shift of river Ganga from 1974-76 to 2000 is 2.43 km. Further, the rate of shifting from 1974-76 to 1989 is -0.05 km/year; 1989 to 1996 is 0.44 km/year; and 1996 to 2000 is 0.00 km/year. The negative sign indicates a shift in the reverse direction.