



## Variation in the Ravi River water quality

*Dr Khurshid Ahmad and Dr Waris Ali, Pakistan*

RIVER RAVI ENTERS Pakistan near Jassor and joins river Chenab after flowing a distance of 640 km and ultimately reaches the river Indus. The river receives untreated wastewaters from the city of Lahore and nearby industrial areas through a number of discharge points. The river is joined by U.C. canal and Q.B. link canal at 42 km and 60 km respectively downstream of Lahore. A line diagram of the river is given in Figure 1.

At present about 18 m<sup>3</sup>/s of wastewater from Lahore with a BOD of 440 T/d are being discharged directly into the river. In addition Deg Nullah carries wastewaters from Kala Shah Kaku industrial complex contributing about 27.2 T/d of BOD (Scott & Furphy, 1993). Some industries on Lahore-Sheikhupura road also discharge their wastewaters into the Nullah. Total BOD load being discharged into river Ravi through Deg Nullah is estimated to be 42.9 T/d (Ahmad & Ali, 1995). Hudiana nullah discharges wastewater from some areas of the city along with industrial wastewater with an estimated BOD load of 65 T/d (Balfours, 1987).

This paper presents an assessment of the water quality in the river at two points. One upstream of the city of Lahore (Ravi Syphon) and the other at downstream at Balloki Headworks, where the water is withdrawn for irrigation purposes.

### Methodology

The two sampling points selected are at a distance of 90 km apart (Figure 1). Between these two points all the untreated wastewater of the city is being discharged through six pump stations. These two sampling points are also the monitoring points for GEMS - Water Quality Programme (Ahmad, 1997).

Sampling was done once a month. Sampling for river at Balloki Headworks were done after 24 hours of the sam-

pling at Syphon. Sometimes during monsoon (rainy) season the sampling points become inaccessible due to floods. Flow data was collected from the daily flow register maintained by Punjab Irrigation Department. Samples were collected in 5 l polythene containers. All the tests were conducted according to Standard Methods (AWWA, 1989).

### Results and discussion

The flow characteristics of river Ravi at the two sampling points on the sampling dates is illustrated in Figure 2. The flows in the river are highly variable with time during the year. U.C. canal with a capacity of 220 m<sup>3</sup>/s at the tail and Q.B. link canal with a capacity of 410 m<sup>3</sup>/s are mainly responsible for higher flows during dry seasons.

BOD and DO concentrations in the river water at two sampling points are given in Figures 3 & 4. Dissolved oxygen concentrations vary within a year due to temperature and flow variations. Decreasing trend can be observed from Figure 3 indicating increasing pollution. Over time DO values are above 4 mg/l indicating recovery due to dilution by link canals and biodegradation and aeration with time as the river flows downstream. Biodegradation and dilution are also responsible for low BOD values at Balloki.

TDS concentrations at the two sampling points of the river are illustrated in Figure 5. An increasing trends can be observed from the figure with time. TDS concentrations are higher at Balloki than at Syphon and reflect the affect of pollution due to discharge of municipal and industrial wastes from Lahore and nearby industrial areas. Dissolved solids being conservative substances, their concentration are changed only due to the flow inputs from U.C. canal and Q.B. link canal by dilution. TDS concentration in the river meet the water quality requirements for irrigation purposes. SAR ratios at the two sampling points also meets

Figure 1. Schematic diagram of River Ravi

**Figure 2. Flow variations in River Ravi at Syphon and Balloki headworks**

**Figure 3. Dissolved oxygen variations in River Ravi at Syphon and Balloki headworks**

the criteria for irrigation water as given in Table 1. The values are always less than one.

Total and Faecal Coliforms in river Ravi at Syphon and Balloki are illustrated in Figures 6 & 7. Both the figures shows increasing trend with time indicating increased pollutional levels due to increased municipal pollution. Sharp increases in pollution are not indicated in the figures. This is due to high dilution and the bacteria die off as the river flows to Balloki. Coliforms and Faecal Coliform values are very high and do not meet the water quality criteria for most water uses.

### Conclusions

Investigations from 1992 to 1997 indicates that the flows in the river are highly variable with time during the year

which also results in variations of different pollution parameters in the river. A decreasing trend in DO levels and an increase trend in BOD, TDS, total and Faecal Coliforms has been observed over time. The discharge of untreated wastewater from the city and nearby industrial estates into the river is the main cause of deterioration in its water quality. Because of the joining of U.C. canal and Q.B. link canal marked variations in the water quality of Balloki Headworks are not observed. Water of River Ravi meet the chemical water quality requirements for irrigation.

### References

AHMAD, K. AND ALI, W., (1995), Pollution Levels in Deg Nullah. Procc. 31st All Pak. Sc. Conference, Lahore, Jan 17-19.

**Figure 4. BOD variations in River Ravi at Syphon and Balloki headworks**

**Table 1. SAR ratio's of River Ravi at the two sampling points**

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PROF. DR. KHURSHED AHMED, University of Engineering and Technology, Lahore, Pakistan.

PROF. DR. WARIS ALI, University of Engineering and Technology, Lahore, Pakistan.

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**Figure 5. TDS variations in River Ravi at Syphon and Balloki headworks**

**Figure 6. T. Coliform in River Ravi at Syphon and Balloki headworks**

**Figure 7. Faecal coliform variations in River Ravi at Syphon and Balloki headworks**