Quality of Groundwater, Proceedings of an International Symposium, Noordwijkerhout, The Netherlands, 23—27 March 1981, W. van Duijvenbooden, P. Glasbergen and H. van Lelyveld (Eds.), *Studies in Environmental Science*, Volume 17

POLLUTION OF UPPER AQUIFER IN PUNJAB (INDIA)

M.R.GOYAL, O.P.ABROL and A.K.VOHRA

Water Resources Directorate, Punjab, Chandigarh (India).

ABSTRACT

The quality of ground water is essential to evaluate its suitability for drinking / agricultural purposes. Out of the total groundwater reservoir in Punjab 76.5 percent groundwater is fit and the rest showing varying degree of salinity. The fit water zone being the main attraction for the intensive industrialisation and urbanisation in the State, is polluted by unsatisfactory disposal of industrial waste and lack of proper sewerage facilities.

The paper deals with source and concentration of pollutants in upper aquifers of industrial town of the State with special reference to Ludhiana. High concentration of nitrates, cyanides and trace elements like chromium(VI), copper, zinc and iron have been reported in the ground water samples from Ludhiana town. High values of biochemical oxygen demand have also been reported from the water samples of Budha Nala, Ludhiana.

INTRODUCTION

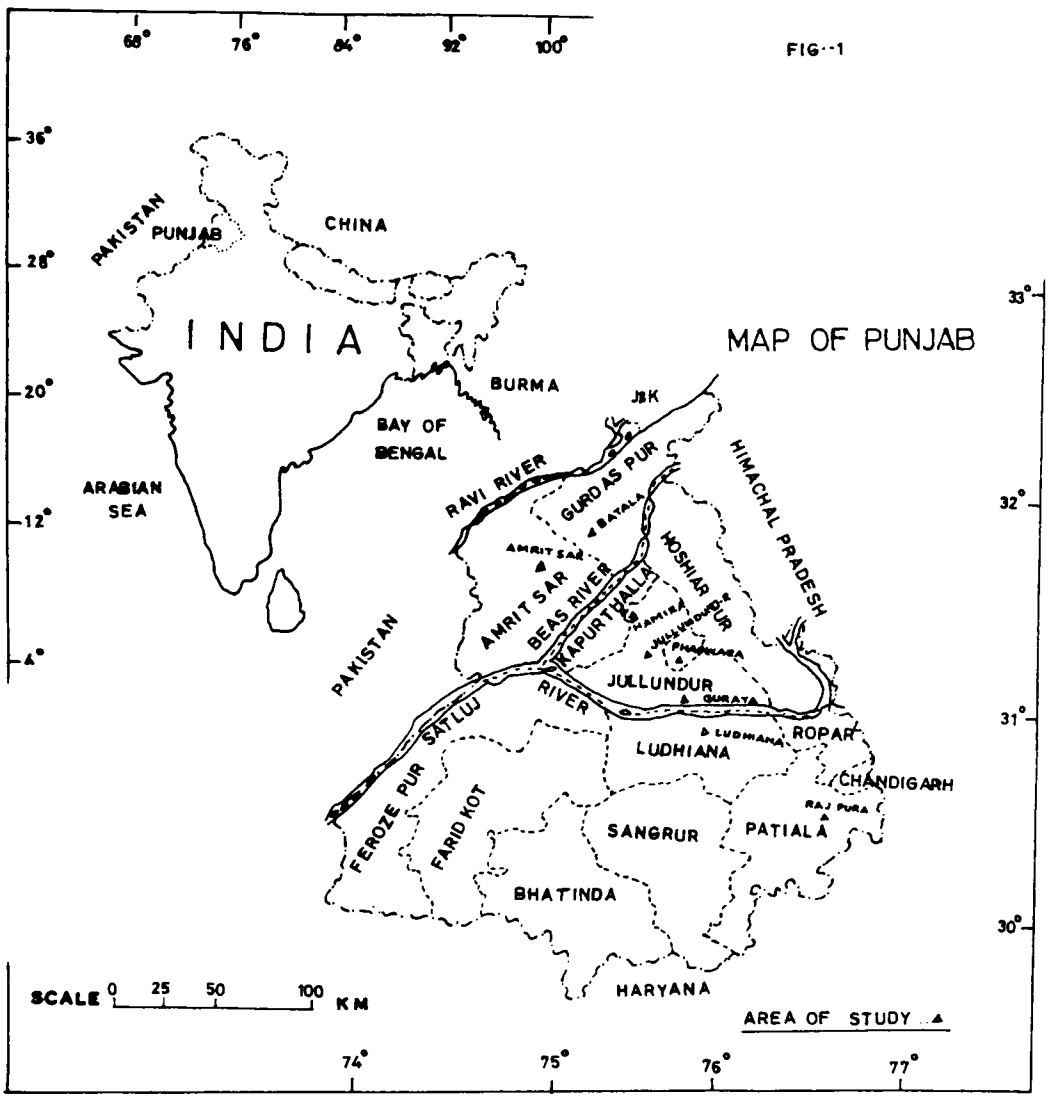
Punjab, which is the main agricultural producing State in the country is fast developing into an industrial State with the establishment of many medium to large industries. The haphazard establishment of industries is disturbing the environmental balance and is resulting in the pollution of ground water. Pollution causing activities have been occuring due to domestic wastes as well because there are no proper sewerage disposal systems. This has resulted in nitrate build up at Ludhiana. Industrial wastes have also resulted in pollution of groundwater in other towns like Phagwara, Hamira, Jullundur, Amritsar, Batala and Rajpura.

METHODOLOGY

Analysis of water and waste waters were carried out by usual prescribed methods(ref.1). Temperature, pH,Electric Conductivity and dissolved oxygen were determined at site. Quality monitoring stations for periodic study of quality changes were established for ambient trend and source monitoring (ref.2).

RESULTS AND DISCUSSION

Groundwater pollution has been observed in various industrial towns in the State. The quality of groundwater in some of these towns has been studied (Fig.1). The industrial units are discharging their



effluents on the surface which through seepage reaches the groundwater reservoir. Budha Nala in Ludhiana Town which runs through the town for a stretch of about nine kilometers forms the main source for the disposal of domestic and industrial waste through seven small nalas entering into it from various parts of the town. Around Budha Nala water table is ranging form 3.0 to 4.0 meters below ground level. In the area the surface clay is very thin ranging from 2.0 to 3.0 meters and the strata mainly consists of sand which being highly permeable, the wastes directly intercept the groundwater reservoir and pollute it.

The results of the samples collected from Budha Nala indicate that there is a high degree of oxygen depletion and D.O. varies from 0.2 to 8.7 mg/l. B.O.D. also increases in a regular pattern from 7.6 to 39.2 mg/l. Nitrate contents are low in the upper reaches but go on increasing as we move away from Budha Nala (Table 1 & fig.3).

TABLE I

Analytical results of Water Samples from Budha Nala (Ludhiana)

Particulars	Site 1	Site 2	Site 3	Site 4	Site 5
pH	7.2	7.1	6.7	7.25	7.1
Total dissolved solids	460	620	700	750	790
Alkalinity	384	378	402	624	433
Chloride	17.0	39	28.4	42.6	49.2
Sulphate	15	24	40	45	38
Total hardness as $CaCO_3$	238	282	346	272	258
Biochemical oxygen demand for 5 days at 20°C.	7.6	14.4	24.0	26.4	39.2
Dissolved Oxygen	8.6	0.4	1.75	0.2	0.1
Nitrate	Traces	3.15	3.15	5.90	5.5

All units except pH are in mg/l.

In the Industrial area of Ludhiana Town water samples taken from hand pumps have high concentrations of trace elements. The water samples are found to contain chromium (VI),copper, zinc and iron etc.ranging from 0.05 to 1.75 mg/l 0.04 to 0.16 mg/l, 0.05 to 0.17 mg/l,0.71 to 4.0 mg/l, respectively (Table 2).

Alarmingly high concentrations of cyanide-concentration ranging from 1.6 to 2.0 ppm have been reported in the ground water in area around cycle industries (ref.3). It is evident that such water would have highly detrimental effect on the health of the people if the water is used for drinking purposes.

FIG. 2 - POLLUTION EFEECT IN LUDHIANA TOWN

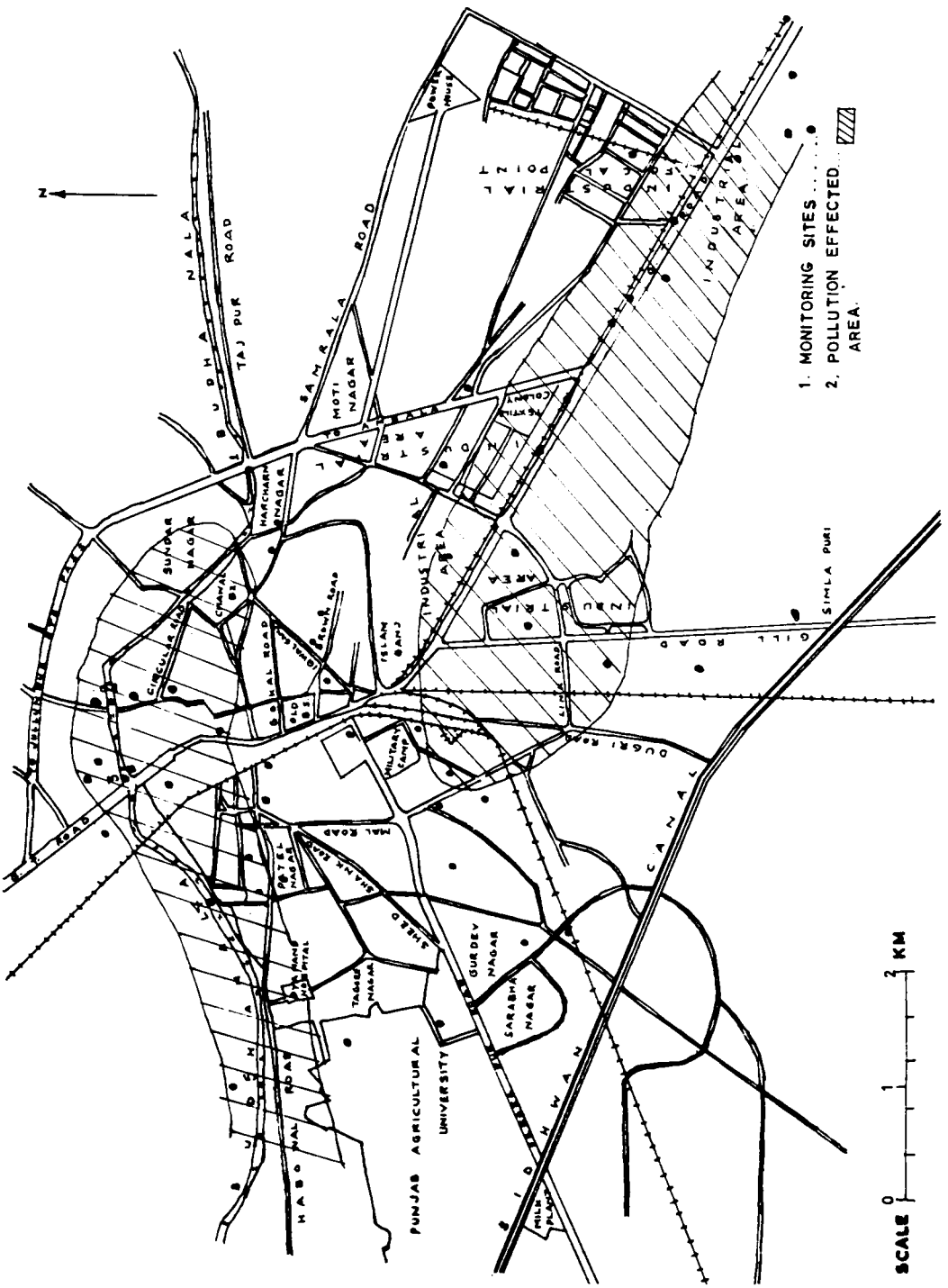


TABLE 2

Analytical results of Representative Water Samples of Ludhiana town

Site	pH	TDS	D.O.	Alkali nity	NO_3	Total hardness	Fe	Cr	Cu	Zn
Ram Lila ground	6.7	810	3.4	625	3.65	387	1.46	-	-	-
Near Budha nala	6.7	620	4.1	646	2.80	374	1.00	-	-	-
Chhawni Mohalla	7.4	1000	4.4	448	25.00	360	1.46	-	-	-
Haibowal	7.5	520	Tr	408	18.00	328	1.22	-	-	-
Gobind Nagar	7.3	710	4.8	424	9.00	344	0.71	-	-	-
Dayanand Road	7.05	890	2.8	366	36.50	435	1.22	-	-	-
Ashok Nagar	7.35	720	3.6	323	59.00	404	1.46	-	-	-
Jawahar Nagar	7.60	550	4.2	323	50.00	312	1.00	-	-	-
Dholewal Chowk	7.10	1100	3.2	842	25.00	223	2.30	-	-	-
Ambala Road	6.80	1400	Tr	702	9.00	280	4.00	0.05	0.05	0.06
Oswal Woolen Mills	7.10	1400	1.4	433	31.50	629	1.22	1.75	0.05	0.07
Avon Cycles	7.10	800	5.4	579	36.50	278	1.22	0.07	0.16	0.17
Dhandari Kalan	7.10	1050	4.6	457	87.00	415	1.46	-	-	-
Gill Road	7.25	900	3.4	444	29.00	193	1.00	-	0.04	0.05
Brown Road	7.25	790	5.7	353	50.00	210	0.71	-	-	-
Samrala Road	6.80	1500	5.4	522	91.00	286	0.71	-	-	-

All units except pH are in mg/l. Tr= Traces

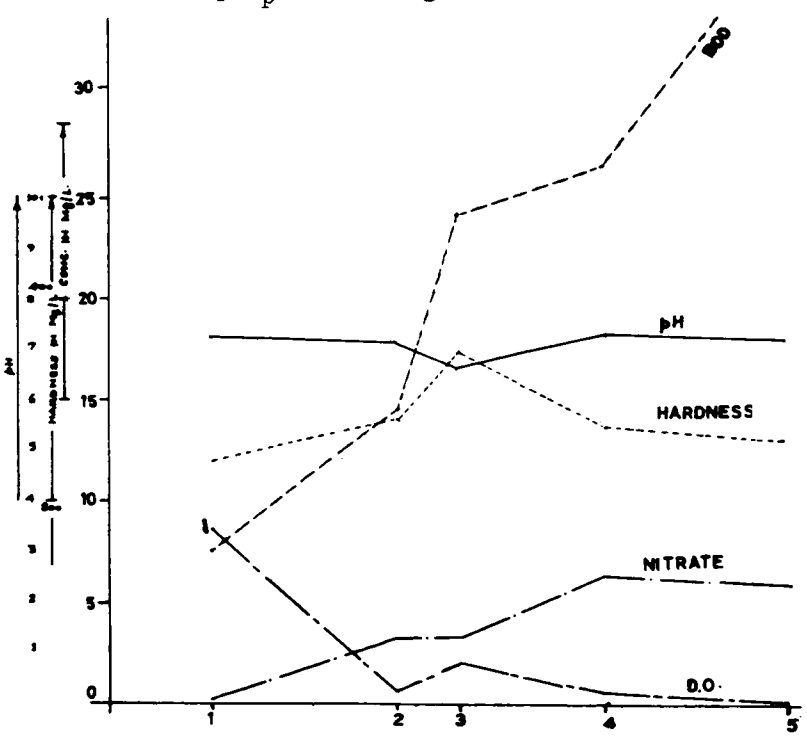


Fig. 3 Variation of Quality Characteristics in BUDHA NALA (Ludhiana)
Points 1,2...5 refer to the corresponding sites along BUDHA NALA in Fig. 2

Ih Hamira town of district Kapurthala, serious pollution ofground water has been observed in the villages around the distillary. Effluents from the distillary containing 30000 to 45000 ppm of B.O.D. are being discharged into the ground water resulting in deterioration of the ground water quality.

A pollution of ground water has also been observed in the villages on Amritsar-Verka Road due to the waste from the milk plant. The surface water in Batala town is also being effected due to industrialisation. The industrial wastes are effecting the ground water in Tobri area of Jullundur town. Similar effects are also being found in fast developing industrial towns like Phagwara, Goraya and Rajpura.

CONCLUSIONS

On the basis of field observations and chemical analysis of water samples, it is concluded that the sewerage system has not been fully developed in the industrial areas and the effluents are being discharged on the surface creating stagnant pools. During rainy season, the rain water dissolves the trace elements and percolates into the soil and ground water reservoirs. The main industries which are polluting ground water in this area are electroplating, wool dying, engineering, liquor etc.

REFERENCES

1. AWWA-Standard methods for the examination of water and waste waters. A PHA Inc. New York (1971).
2. FAO-ground water Pollution, Irrigation and Drainage paper No.31, Rome (1971) pp 20-29.
3. B.K.Baweja and R.K.Karenth, Ground Water Pollution Studies in India, Tech. Bull. 5,CGWB, Govt. of India, New Delhi (1980).