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Original Research Paper

A Pollutional Profile of Seer Stream in Lower Himalayas

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ABSTRACT

Water quality of Seer stream in Bilaspur district of Himachal Pradesh in outer Himalayan region was monitored. The study reveals that the water in stream is getting polluted by wastewater discharge from the town. The major water quality parameters of stream i.e., dissolved oxygen, BOD and coliforms are beyond the permissible limits.

INTRODUCTION

Towns and cities located on bank of rivers or streams tend to discharge their wastewaters, treated or untreated, into them. Phenomenal increase in pollution of river water due to such discharge from cities and towns is causing concern of pollution regulators and also people at large. Many instances of water pollution have been reported in newspapers of various regions (Thakur 2002). Severe pollution of Seer stream in Himachal Pradesh has been reported by Sharma & Gupta (2004). A large number of fish died during summer of 2010 in Seer stream near Ghumarwin town (Dainik Jagaran 2010, Amar Ujala 2010). Reports are available on pollution level of various Indian rivers (Rout et al. 2001, Chattopadhiyaya et al. 1984, Sinha 1985).

There has been a serious concern over the deterioration of water quality in streams of Himalayan region. However, there is dearth of scientific literature on water quality in this region. The present study was undertaken to assess the exact level of physico-chemical characteristics of Seer stream.

STUDY AREA

Seer is one of the sub-tributaries of River Satluj in Bilaspur district of Himachal Pradesh (India). It lies at latitude of 31°26’59’ north and longitude of 76°43’11’ east. The Ghumarwin town falls in Shivalik hills of lower Himalayan region at the altitude of 600m above mean sea level. The town is located on left bank of Seer stream. The stream is a small rain-fed perennial stream taking its origin from near Mandi district and joins River Satluj after travelling 20 km stretch in Bilaspur district. It swells during rainy season and gets reduced to a narrow stream during summers. The stream serves as the source of drinking water for Ghumarwin town and its surrounding areas; downstream has not been provided with the proper sewerage system. The wastewater from kitchen, bathrooms, and night soil from slum area flow in open drains and is being discharged in the local wastewater drains named as Ghumarwin nallah-I and Ghumarwin nallah-II.

MATERIALS AND METHODS

Monitoring of the stream: Monitoring of water quality was carried out at six stations along the stretch of 5 km of Seer stream from the point where water is lifted for supply to Ghumarwin town to 5 km downstream of the stream (Fig. 1).

Station S_1 was selected on upstream of Seer stream before the discharge of main town enter the stream. Station S_2 was selected on Seer stream just upstream of the meeting point of Ghumarwin nallah-I with Seer stream. Station S_3 was selected on downstream of Ghumarwin Nallah-I. Sampling station S_4 was selected on downstream of Ghumarwin nallah-II. Sampling station S_5 was located on downstream side of meeting point of Ghumarwin nallah-II with Seer stream, and Sampling station S_6 about 2 km downstream of Ghumarwin town.

Keeping in view the fact that stream flow and concentration do not change rapidly, grab samples were collected at each point from the centre of stream or nallah at a 0.6m depth. Glass bottles with glass caps were used for collecting samples for analysis of dissolved oxygen and other parameters. Each container was first rinsed with phosphate-free detergent and cold tap water three times. Samples were collected away from stream banks and free from bottom sediment by wading into centre of main current. The guidelines given by

Table 1: Physico-chemical characteristics of the stream.

Sampling Station	Temp.	pH	Electrical Conductivity	Total Alkalinity	Total Hardness	Chloride	DO	BOD	Discharge (lps)
S_1	9-28	7.0-8.0	340-496	145-200	130-300	7.6-22.0	6.0-11.0	2-6	210-13930
S_2	9-28	7.2-8.1	370-650	190-300	160-320	15-38	5.0-8.5	14-28	220-14500
S_3	9-28	7.51-8.23	600-1160	250-470	250-450	30-120	1.2-6.0	80-120	3.3-5.2
S_4	9-28	6.7-7.92	650-1000	200-450	260=450	30-120	1.2-6.5	80-160	9.0-50
S_5	9-28	7.4-8.10	390-740	160-340	140-390	12-46	4.0-8.5	6.8-45	232.3-14555
S_6	9-28	7.4-7.8	440-500	180-200	140-280	11-44	6.5-11.5	3.4-8.5	240-14560

All values are in mg/L except pH and temperature (°C) otherwise stated.

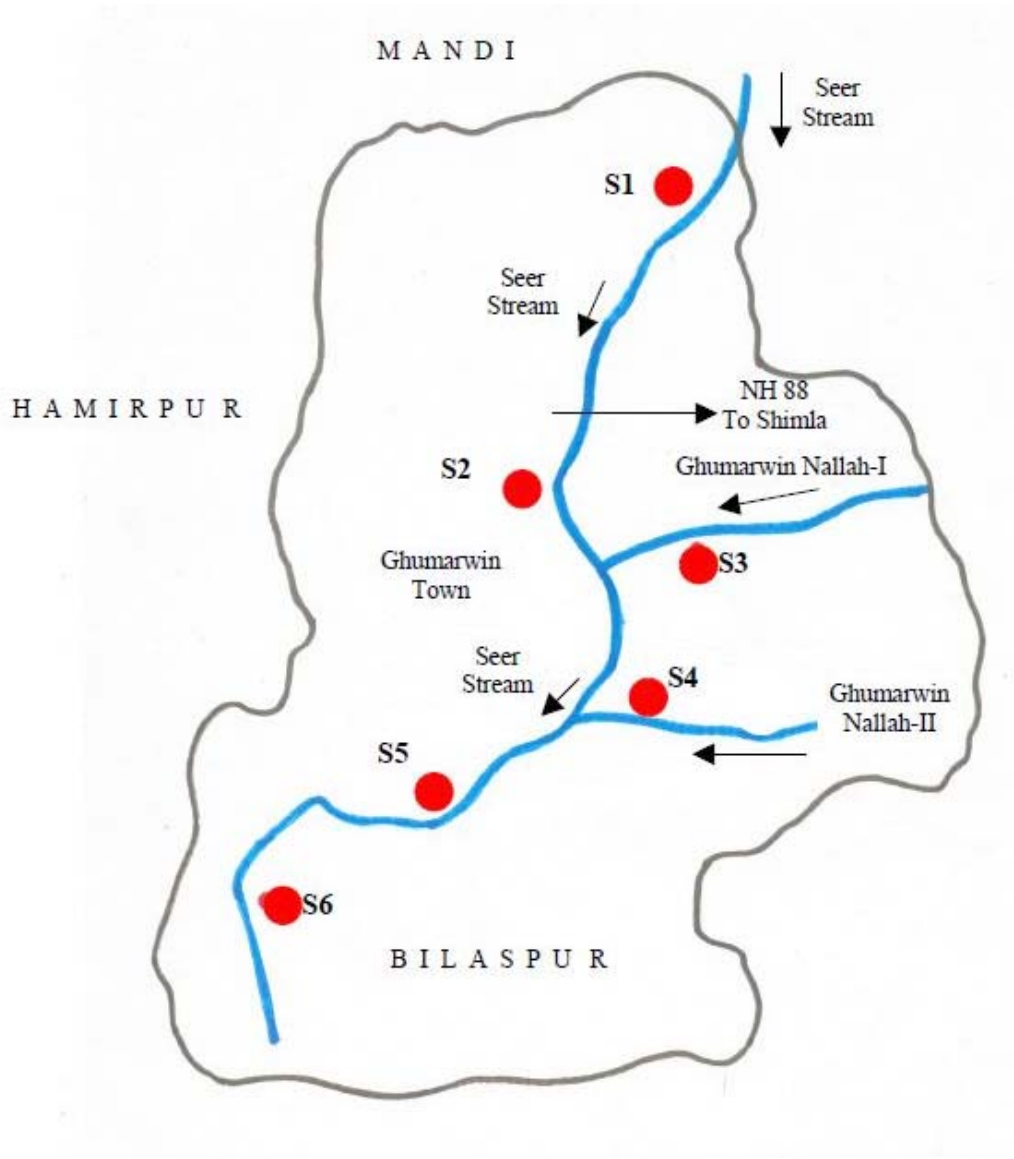

Fig. 1: Location of sampling stations on Seer stream.

Table 2: Results of MPN of coliforms of Seer stream.

Sampling Station	Coliform MPN/100 mL (as on 05/06/2010)
S_1	2400
S_2	45000
S_3	1250000
S_4	1200000
S_5	62000
S_6	13800

U.S.EPA (1997) were followed for sampling. The sampling was repeated after 15 days, and the present study was spread over a period of 12 months. All the physico-chemical parameters were determined following the standard methods (APHA 1992).

RESULTS AND DISCUSSION

Monitoring results: The monitoring data at various stations during the study period are given in Table 1. The observations at different stations are discussed below:

Station S_1: At upstream of station S_1, the water of stream is being lifted for drinking water supply for the town. The discharge at the station varies from 210 Lps to 13930 Lps. The stream has low BOD of 2.0 to 6.0 mg/L, and high DO of 6.0 to 11.0 mg/L. The magnitude of other parameters i.e., chloride, hardness, alkalinity, conductivity is fairly constant.

Station S_2: The discharge varies at this station in the range of 220-14500 Lps. The BOD ranges between 14.0 and 28.0 mg/L, and DO in the range of 5.0-8.5 mg/L. Since, the value of BOD in the stream has increased, the water is getting polluted through unidentified sources.

Station S_3: Station S_3 is located on Ghumarwin nallah-I which is a major source of wastewater from the town to Seer stream. Due to very low flow of nallah, dilution is not available to wastewater and high BOD of 80 to 120 mg/L and low DO of 1.2 to 6.0 mg/L are the main characteristics of wastewater. The other parameters also have high values.

Station S_4: Station S_4 is present on Ghumarwin nallah -II, the other source of wastewater from the town. Due to low flow of nallah, dilution is not available to wastewater and it shows high BOD (80-160 mg/L) and low DO (1.2-6.5 mg/L). The other parameters have also high values.

Station S_5: The BOD and DO vary in the range of 6.8-50 mg/L and 4.0-8.50 mg/L respectively.

Station S_6: Station S_6 is at the distance of 2km from station S_5. The monitoring results show a considerable level of BOD from 3.4-8.5 mg/L and DO from 6.5 to 11.5 mg/L. The other parameters do not show considerable changes in their values. All the samples show high bacteriological load especially coliforms (Table 2), and this is mainly due to the discharge from septic tanks, open defecation and washing of clothes in the stream.

Stream Geometry

Seer stream has a steep slope which varies greatly on different reaches. The stream has different velocities and X-sections in different reaches. The stream comprises of falls and small ponds. Ghumarwin nallah-I and Ghumarwin nallah-II, which are sources of wastewater to the stream, also have the steep slope. The DO available in the nallah and stream beside high BOD is due to the steep slopes causing high reaeration.

It has been observed that the summer period is most critical as far as water quality of the stream is concerned (BOD 45.0 mg/L at S_5). At present the wastewater generated in the town is discharged untreated in the stream through Ghumarwin nallahs (S_3) and (S_4). The DO in Ghumarwin nallah-I is observed at 1.2-6.2 mg/L along with a BOD of 80-120 mg/L.

Thus, it is recommended that in order to meet the stream standard of BOD < 5 mg/L and DO > 4 mg/L (IS: 2296-1982), the following measures may be adopted.

1. Augmentation of river flow before the Ghumarwin nallah.
2. Checking the unauthorized and undue abstraction from the stream.
3. Treatment of all wastewaters before discharging into the stream.

CONCLUSION AND RECOMMENDATIONS

It is clearly brought out from the findings of this study that the water of Seer stream in Ghumarwin town has already become highly polluted. The pollutant levels recommended by regulatory agencies have been exceeded. It is, therefore, evident that the disposal of liquid effluent must be stopped forthwith. The effluent must be properly treated and unauthorized disposing of these effluents in the surface water bodies should be firmly checked. The town and its adjoining areas can meet their water requirements for irrigation and kitchen gardening by recycling of the wastewater after proper treatment.

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