

Srinagar does not have a proper piped sewerage system. The town is partly covered by pucca drains at some places on road sides and majority of the drains are silted or blocked. The existing drains are disposing the sewage directly into the river Jehlum through contributory nallahs. The wastewater at number of places is pumped into river Jehlum with the help of Dewatering stations without any treatment. There are many open drains in the town formed with the natural course which finally reach river Jehlum. The project area in Srinagar is generating 525-575 m³ of solid waste per day out of which only about 160-175m³ of solids waste per day i.e. 30% of the total is handled by the Srinagar Municipality Committee. The remaining is causing public health nuisance in the city and finally reaches the river which deteriorates the quality of the river.

Following sites have been selected for the purpose of studies in Srinagar city:-

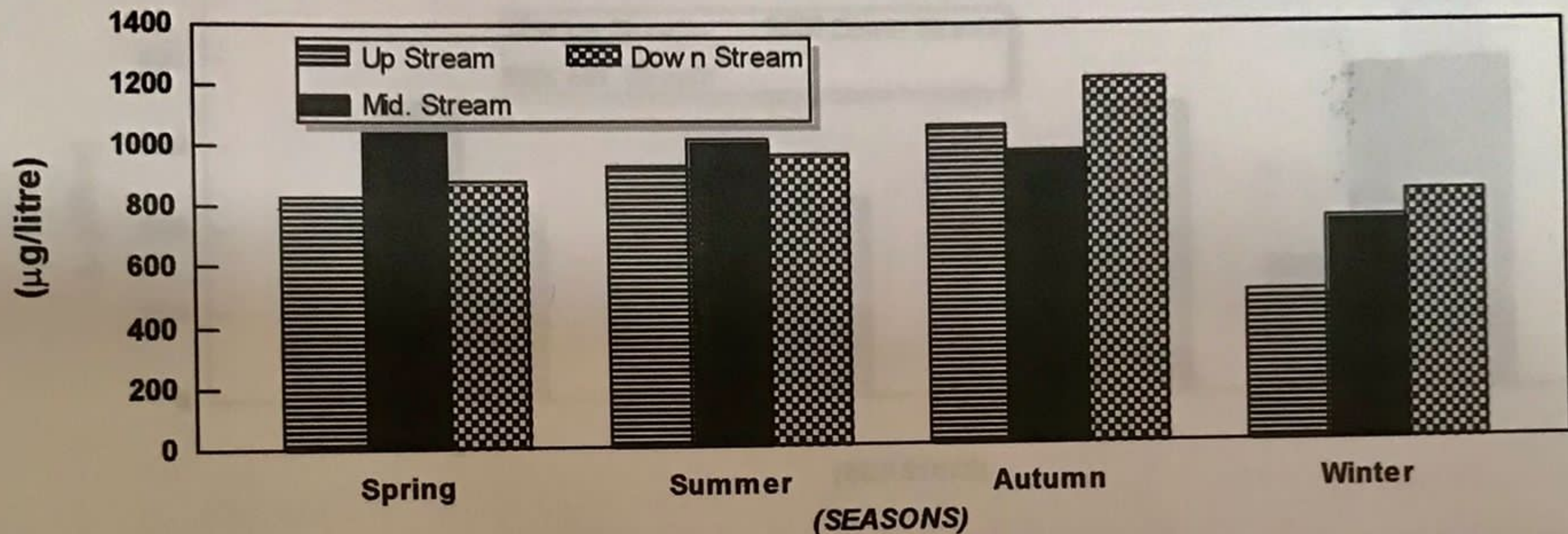
S.No.	Name of the site	Site code
(i).	Zero Bridge	Upstream
(ii).	Fatehkadal	Midstream
(iii).	Qamarwari (Cement Bridge)	Downstream

NITRATE-NITROGEN:

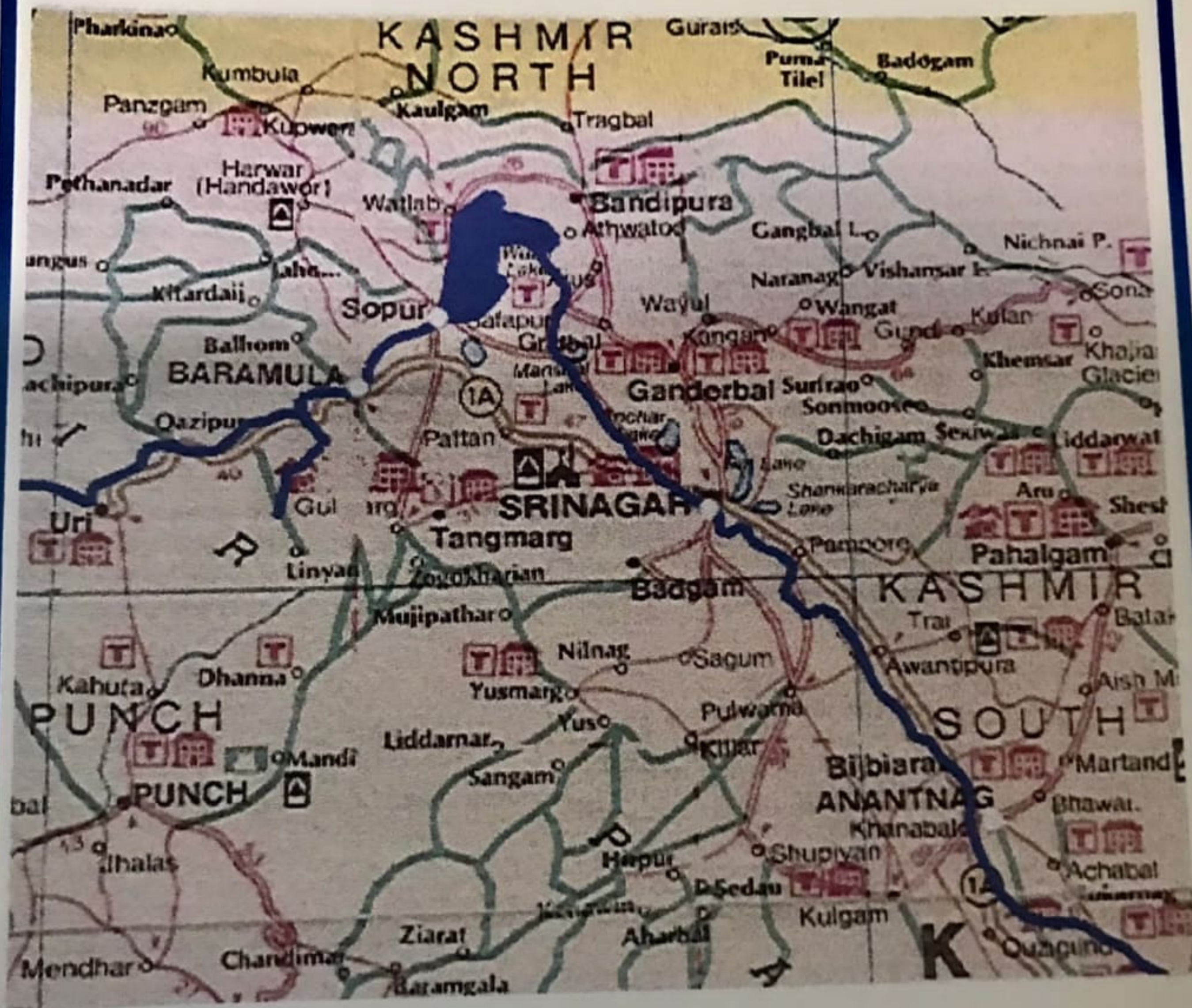
On monthly basis no significant variations were observed in nitrate-nitrogen concentration at the three investigated sites. On evaluating the annual averages the downstream depicted slight increase over upstream. Seasonally downstream depicted higher values in autumn and winter whereas in spring and summer midstream depicted higher values than the rest of the sites.

A definite seasonal pattern was observed in upstream and downstream with the nitrate-nitrogen values increasing from winter to autumn.

The overall annual average of $925\mu\text{g/litre}$ of nitrate-nitrogen was recorded at the three investigated sites.



SEASONAL VARIATIONS IN NITRATE -NITROGEN ($\mu\text{g/Litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (SRINAGAR)

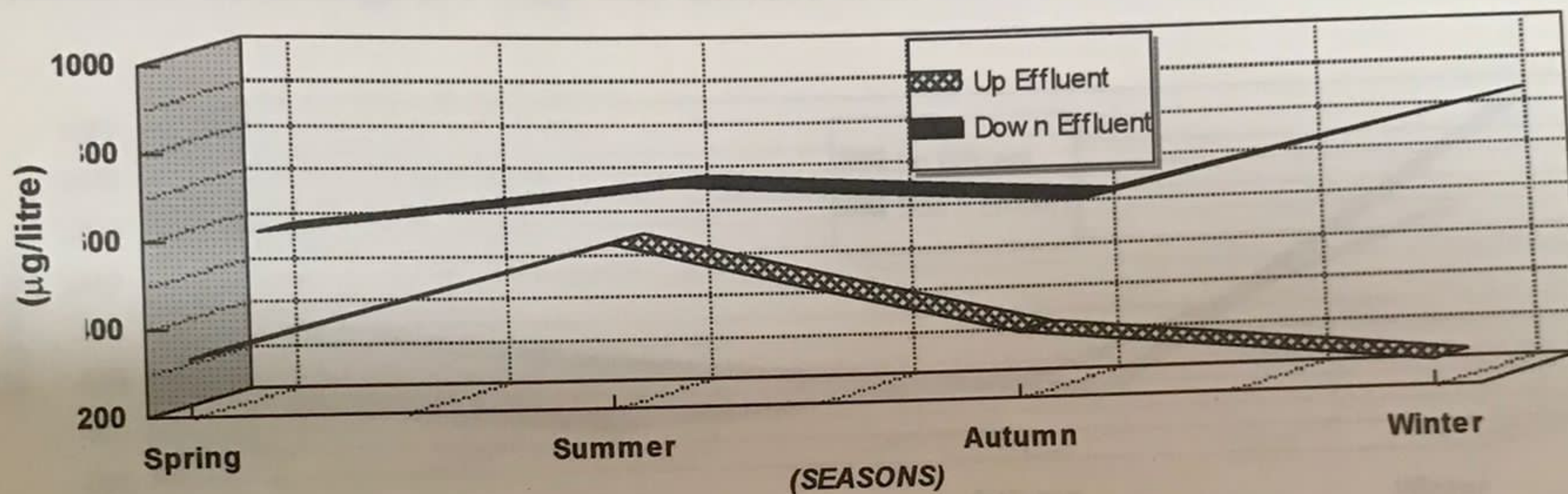


Map showing Jhelum Basin of Kashmir

SEASONAL VARIATIONS IN NITRATE-NITROGEN ($\mu\text{g/litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (ANANTNAG)

EFFLUENTS:

For upstream effluent the minimum of $119\mu\text{g/litre}$ (January) and a maximum of $752\mu\text{g/litre}$ (July) of nitrate-nitrogen content was recorded, while in downstream effluent the nitrogen-nitrogen values ranged between $148\mu\text{g/litre}$ (March) and $2126\mu\text{g/litre}$ (February). The values in the downstream effluent depicted a higher value in all the four seasons than upstream effluent. Overall annual average of $532\mu\text{g/litre}$ was recorded for the effluents.

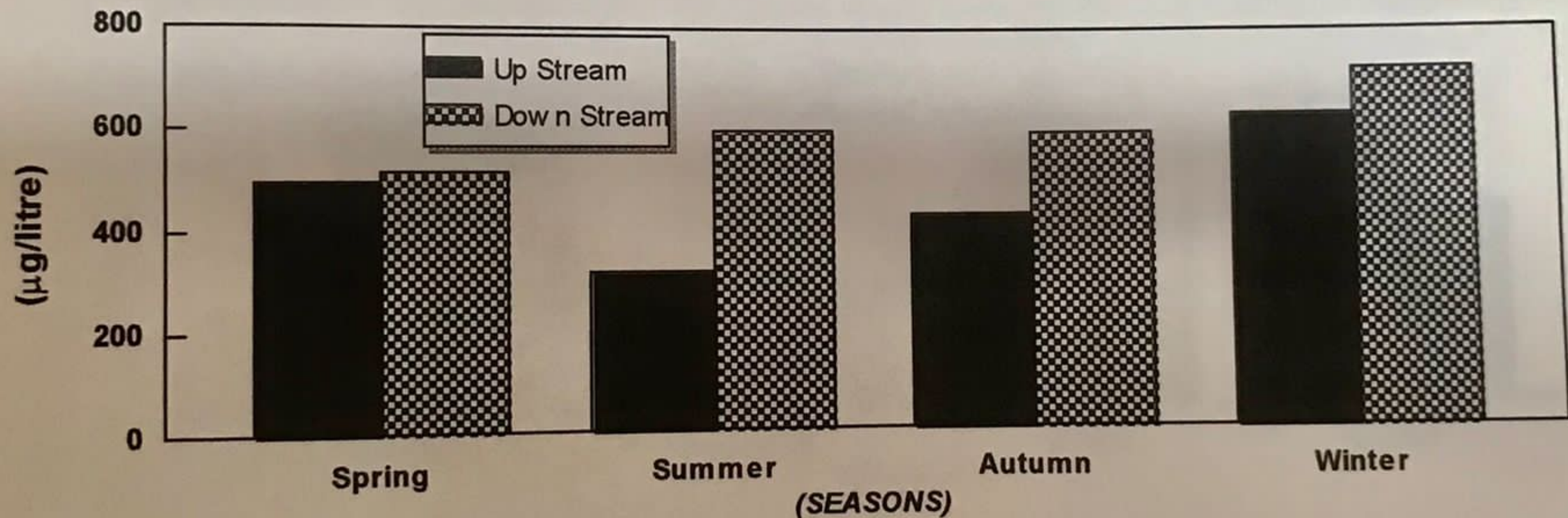


SEASONAL VARIATIONS IN NITRATE NITROGEN ($\mu\text{g/litre}$) OF THE EFFLUENTS ENTERING RIVER JEHLUM (ANANTNAG)

TOTAL PHOSPHORUS:

The concentration of total phosphorus was recorded to be higher in downstream than in upstream. On monthly basis (except in February and May) a lower concentration was observed in the downstream than the upstream. The annual averages of $479\mu\text{g/litre}$ and $606\mu\text{g/litre}$ was recorded for the upstream and downstream respectively. Seasonally the downstream showed a predominant increase in total phosphorus over the upstream. However no definite seasonal pattern was observed.

The overall annual average of $542\mu\text{g/litre}$ was observed at the two sites.



SEASONAL VARIATIONS IN TOTAL PHOSPHORUS ($\mu\text{g/litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (ANANTNAG)

Anantnag shares the major part of the east and south basin drainage system of the valley, consisting of rivers and rivulets, the Jehlum being the prominent amongst them. These rivers are the natural assets of this district, since they provide water for irrigation, fish, water transport, potable water supply, recreation etc. When, however, these rivers and rivulets swell in the rainy season, they cause havoc to the rich agricultural lands and human settlements.

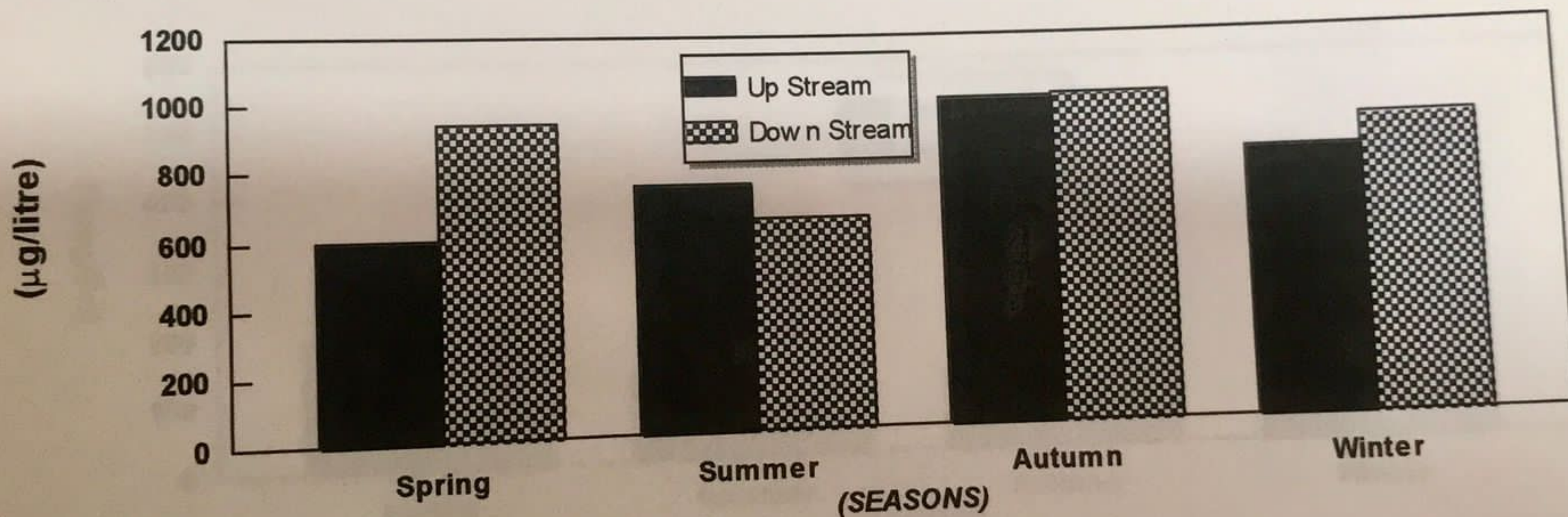
In Anantnag there are three major drains that have out falls into river Jehlum besides minor drains originating from households close to the river, which drain directly into the river. At present there is no organized solid waste management system in the town and the waste is disposed normally under the bridges. This inefficient and unplanned collection of solid waste has resulted in people dumping the waste of the houses directly into the open drains resulting in chokage. The town is generating 57m^3 of solid waste per day out of which only about 18m^3 of solid waste per day is collected by town area committee and dumped either near Eidgah or under the bridges into the river, resulting in pollution of the river. It has been estimated that the total domestic waste of 25 tons per day is generated from this town.

Following sites were selected for the purpose of monitoring of river waters including the effluents entering the river body :-

S.No.	Name of the site	Site code
(i).	Ashishpora	Upstream
(ii).	Khanbal (Boteing)	Downstream

NITRATES-NITROGEN:

The nitrate nitrogen concentration did not depict any significant variation on monthly basis, however on comparing the annual averages the downstream depicted higher value ($878\mu\text{g/litre}$) than upstream $794\mu\text{g/litre}$. Seasonally the downstream depicted predominance over the upstream. The overall annual average of $836\mu\text{g/litre}$ was recorded at investigated sites.



SEASONAL VARIATIONS IN NITRATE-NITROGEN ($\mu\text{g/litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (ANANTNAG)

pH = 8.0
 Sp. Cond. = 221
 D.Oxygen = 6.2
 Nitrate-N = 951
 Amm.-N = 293
 Ortho-P = 334
 T.P = 825
 Iron = 489
 C.O.D = 38
 B.O.D = 22.3

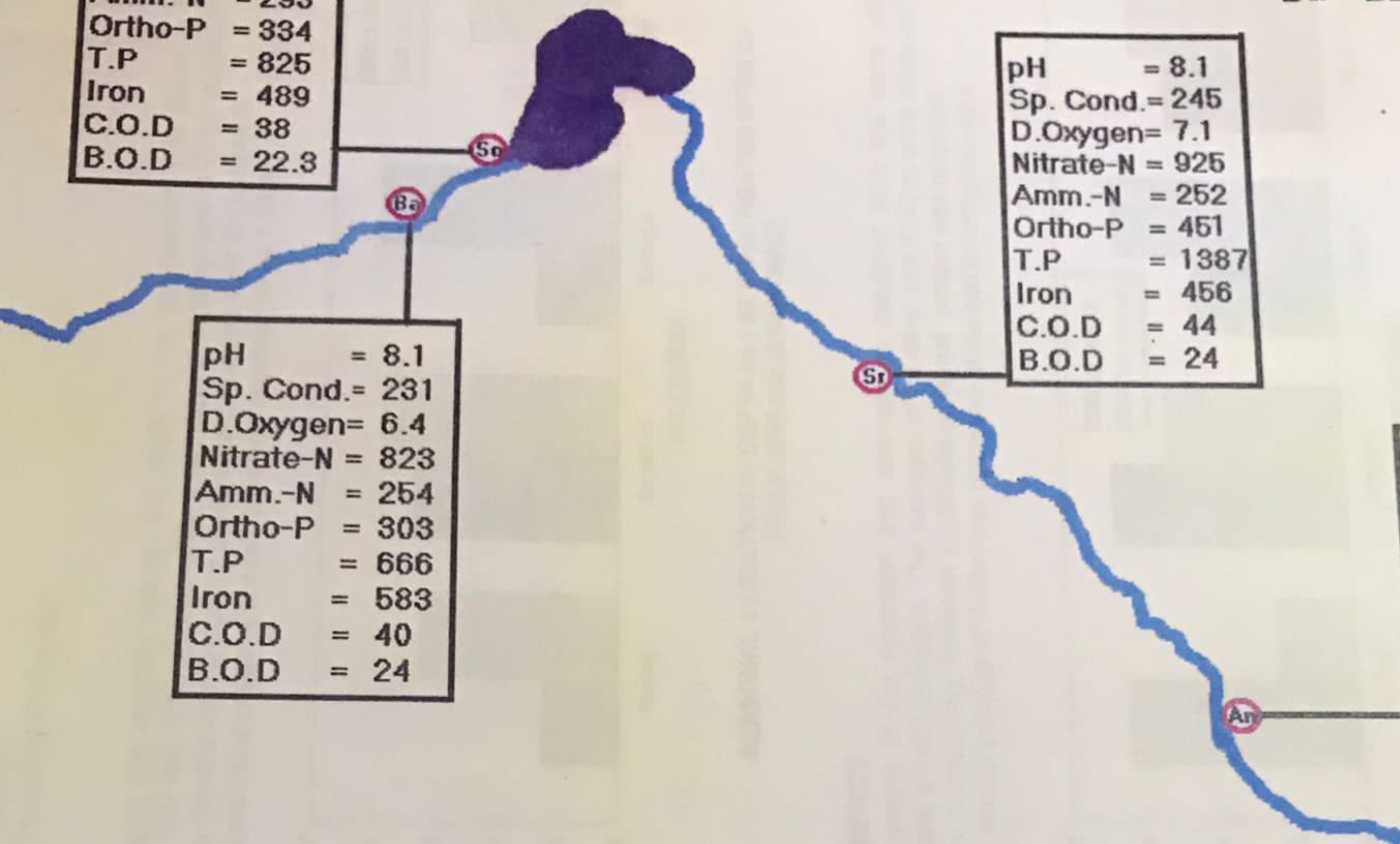


An. = Anantnag Town
 Sr. = Srinagar City
 So. = Sopore Town
 Ba. = Baramulla Town

pH = 8.1
 Sp. Cond. = 245
 D.Oxygen = 7.1
 Nitrate-N = 925
 Amm.-N = 252
 Ortho-P = 451
 T.P = 1387
 Iron = 456
 C.O.D = 44
 B.O.D = 24

pH = 8.1
 Sp. Cond. = 231
 D.Oxygen = 6.4
 Nitrate-N = 823
 Amm.-N = 254
 Ortho-P = 303
 T.P = 666
 Iron = 583
 C.O.D = 40
 B.O.D = 24

pH = 8.4
 Sp. Cond. = 261
 D.Oxygen = 7.3
 Nitrate-N = 836
 Amm.-N = 231
 Ortho-P = 263
 T.P = 542
 Iron = 427
 C.O.D = 43.5
 B.O.D = 24.4



sewage from human settlements. Open drains carrying concentrated sewage flow directly into the river, particularly from the old city of Srinagar and towns of Anantnag, Sopore and Baramulla. The excessive enrichment of water has depleted the fish catches and has posed health hazards to thousands of people living in boats along the both shores of the river.

IMPORTANCE OF RIVER JEHLUM:

The importance of the river Jehlum dates back to times to the present day because of its being the important highway of Kashmir. The value of the river and the development of internal trade and traffic can hardly be over-estimated. According to ancient history of Kashmir there were nowhere, not even in the flattest parts of the valley, roads fit for wheeled traffic. Carriages were practically things unknown to the population bred in the valley. The importance of river-traffic in Kashmir may be estimated from the fact that the number of boatmen engaged in it (and their families) amounted, according to the census of 1891, to nearly 34,000.

Equally eloquent testimony to the historical importance of river navigation in Kashmir is borne by the position of the ancient sites. We shall see that all the towns which from time to time were the capitals of the state, were built on the banks of the Jehlum and that great majority of the other important places of ancient date were similarly situated. It is certain that then all produce of the valley was brought to the great centres by water. Villages even when situated at a considerable distance, had no doubt, just at the present day, their regular landing places on the river or nearest navigable waterway. Kalhan's description of the semi-legendary city of Narapura shows how closely the busy "Coming and Going Ships" was connected in Kashmirian mind with the splendour of a large town.

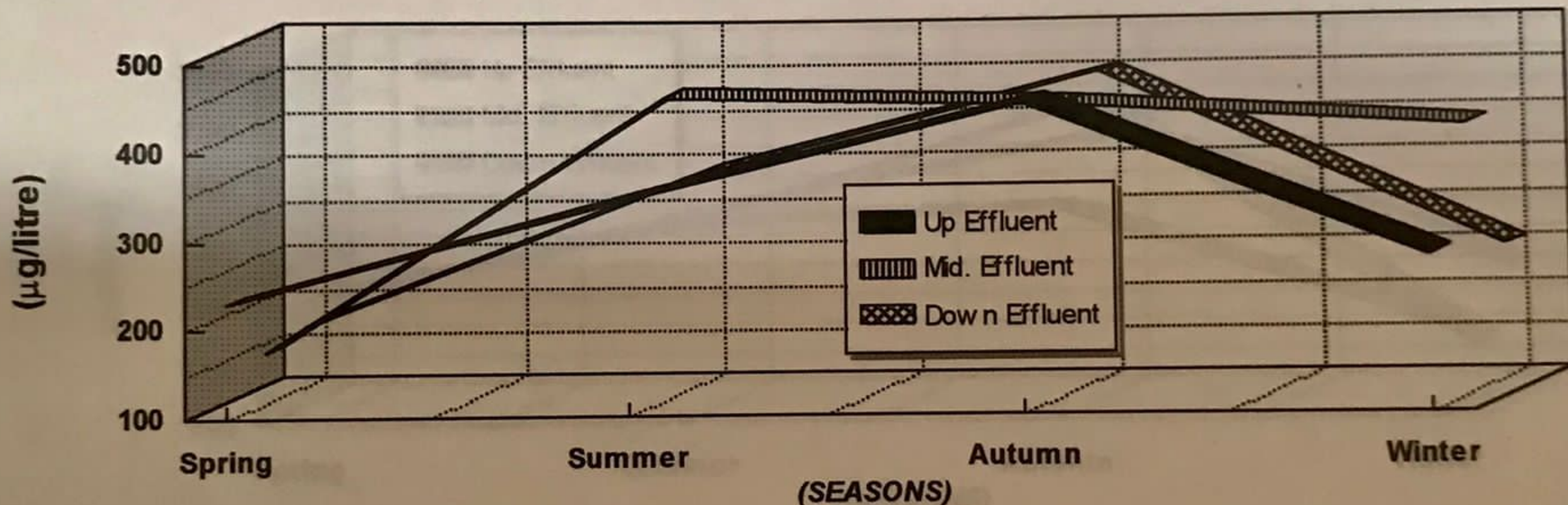
Dangerous floods may also follow long and heavy summer rains, and some times causes immense damage to the crops through a great portion of the cultivated area of the valley. The allusions found in the chronicle suffice to show that the construction of embankments, with the accompanying system of flood gates closing lateral drainage channels, has existed since ancient times.

SEASONAL VARIATIONS IN NITRATE -NITROGEN ($\mu\text{g/Litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (SRINAGAR)

EFFLUENTS:

In upstream effluent the nitrate-nitrogen concentration ranged from a minimum of $39\mu\text{g/litre}$ (April) and $633\mu\text{g/litre}$ (November). In midstream effluent the range fluctuated between $132\mu\text{g/litre}$ (May) and $735\mu\text{g/litre}$ (January) while in downstream effluent the nitrate-nitrogen content ranged from $118\mu\text{g/litre}$ (April) to $699\mu\text{g/litre}$ (September). On annual basis the midstream effluent depicted higher nitrate-nitrogen concentration than in up and downstream effluents. On seasonal basis values increased progressively from spring to autumn and then again decreased in winter. In summer season the midstream effluent depicted higher values than the autumn.

The overall annual average of $329\mu\text{g/litre}$ was recorded at the three effluent sites.

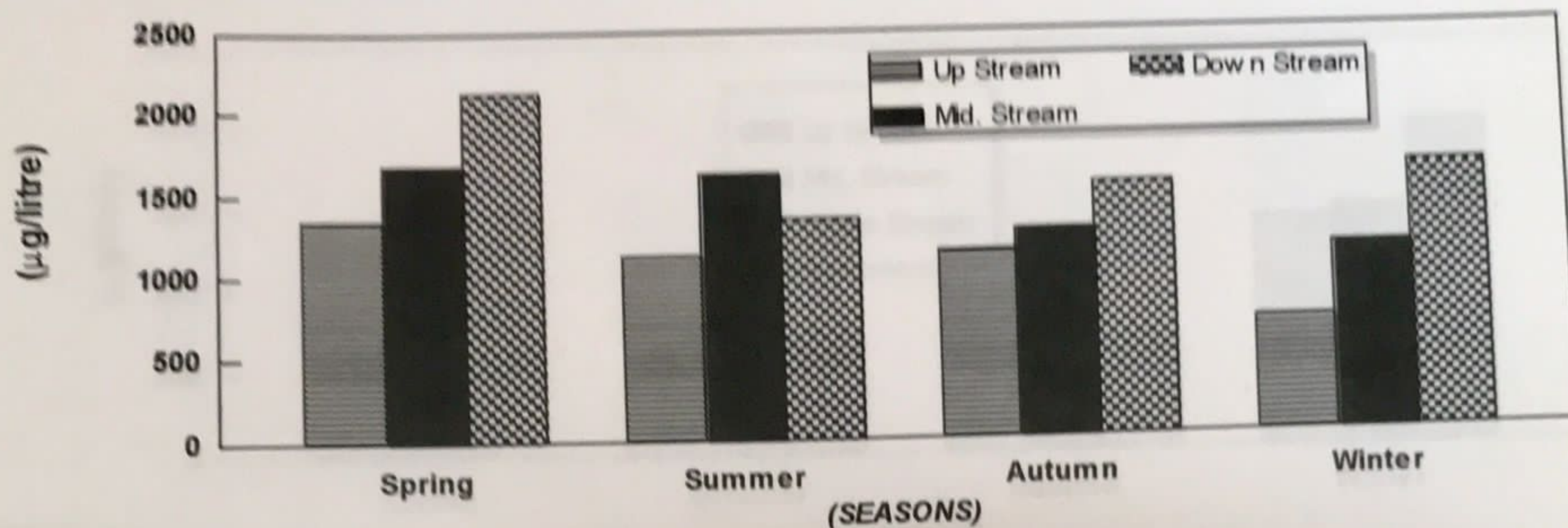


SEASONAL VARIATIONS IN NITRATE-NITROGEN CONTENT ($\mu\text{g/Litre}$) OF EFFLUENTS ENTERING RIVER JEHLUM (SRINAGAR)

TOTAL PHOSPHORUS:

On the basis of monthly values and annual averages the three investigated sites, the downstream depicted much higher values than midstream and downstream. On the seasonal basis two downstream depicted predominant increase in totalphosphorus values over up and midstream. However no definite seasonal trend was observed.

The overall annual average of the three investigated sites was recorded to be $1837\mu\text{g/litre}$

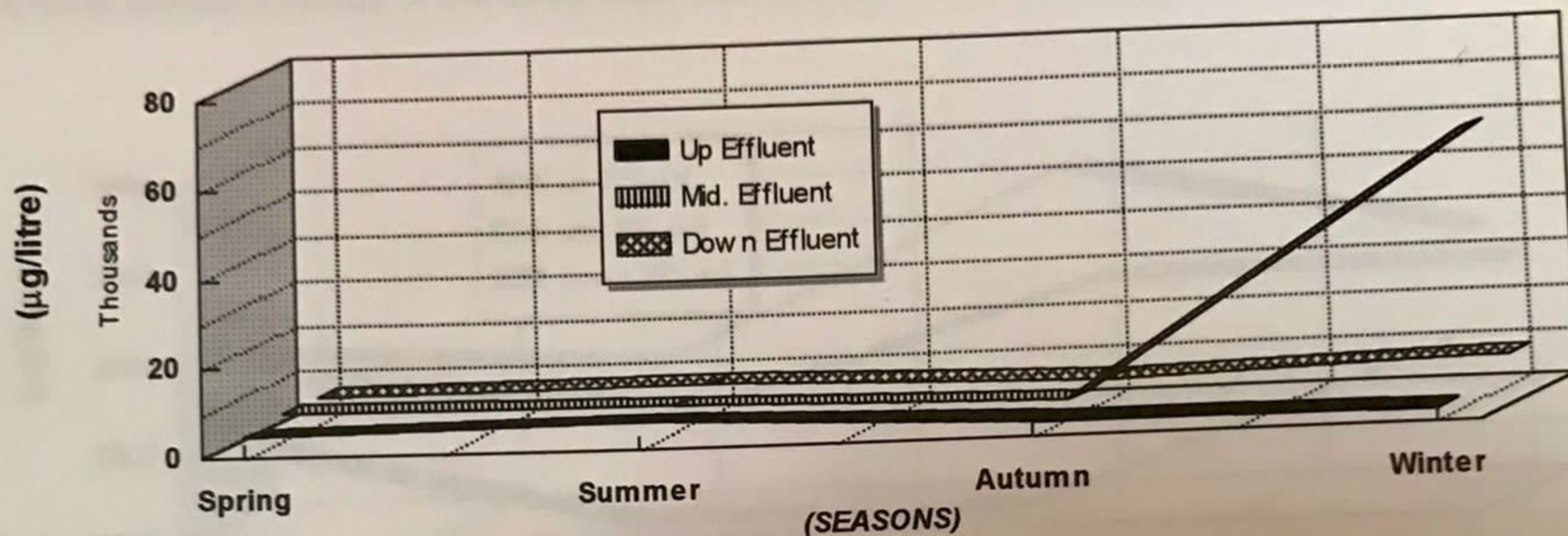


SEASONAL VARIATIONS IN TOTAL- PHOSPHORUS ($\mu\text{g/Litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (SRINAGAR)

SEASONAL VARIATIONS IN TOTAL- PHOSPHORUS ($\mu\text{g/Litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (SRINAGAR)

EFFLUENTS:

The concentration of total phosphorus in upstream effluent ranged between $1697\mu\text{g/litre}$ (November) to $6951\mu\text{g/litre}$ (August). In midstream the range fluctuated from a minimum of $1742\mu\text{g/litre}$ (November) to $7788\mu\text{g/litre}$ (April), while in downstream effluent the min and maximum values of $2333\mu\text{g/litre}$ (February) and $7984\mu\text{g/litre}$ (June) were recorded. On evaluating the annual averages the midstream effluent depicted concentrated character than up and downstream effluent. However seasonally downstream effluent depicted predominant increase in values over up and midstream effluents. The overall annual average of $5181\mu\text{g/litre}$ was recorded at the three investigated sites.



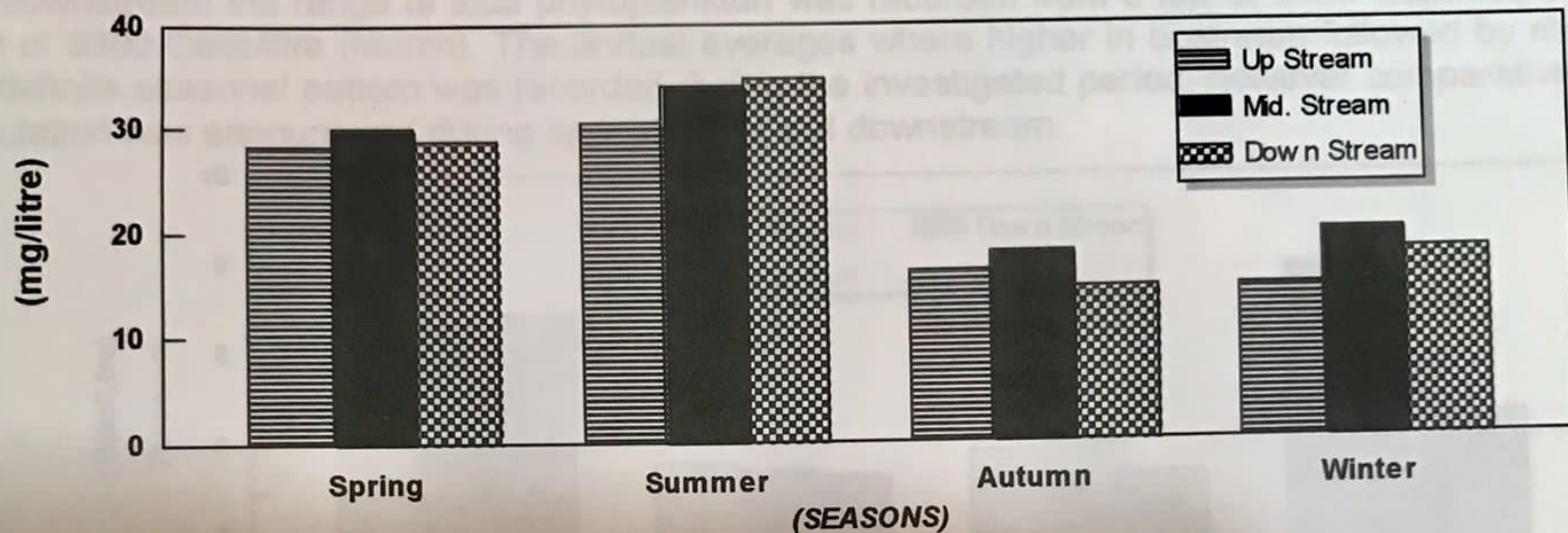
SEASONAL VARIATIONS IN TOTAL-PHOSPHORUS ($\mu\text{g/Litre}$) OF THE EFFLUENTS ENTERING RIVER JEHLUM (SRINAGAR)

B.O.D:

Like chemical oxygen demand, the midstream depicted higher B.O.D values in comparison to up and downstream with slight variations being observed in monthly values and annual averages.

Seasonally also midstream depicted slightly higher values than in up and downstream.

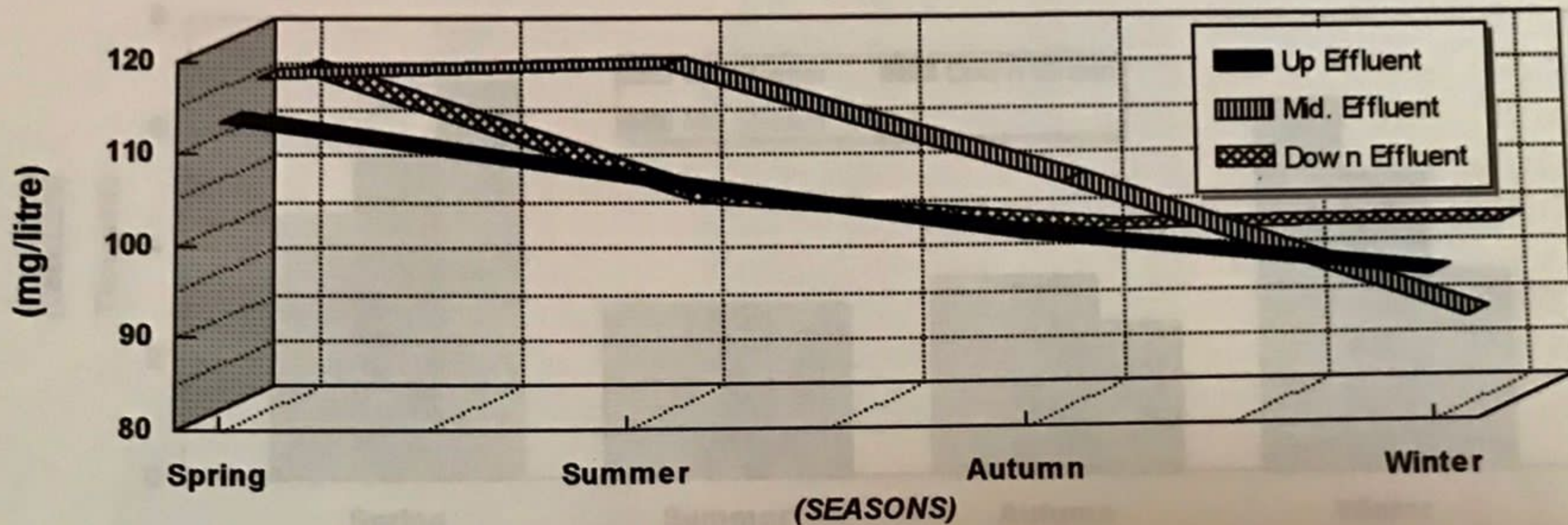
The overall annual average of the three sites was recorded to be 23.9mg/litre.



SEASONAL VARIATIONS IN B.O.D (mg/litre) AT INVESTIGATED SITES OF RIVER JEHLUM (SRINAGAR)

EFFLUENTS:

In upstream effluent the B.O.D values ranged from a min of 57.9 mg/litre (November) and a maximum of 137.4 mg/litre (July). In midstream the minimum of 82.7 mg/litre (January) and 132.3 mg/litre (June) was observed. While in downstream effluent the range of B.O.D was observed to lie between 79.8 mg/litre (November) and 138.4 mg/litre (March). Slight variations were observed in the monthly values and annual average of the three investigated sites. Strong character was observed in up and downstream effluents except in winter where downstream effluent depicted higher B.O.D levels. The overall annual average of 104.4 mg/litre was recorded at the three investigated sites.



SEASONAL VARIATIONS IN B.O.D (mg/litre) OF THE EFFLUENTS ENTERING RIVER JEHLUM (SRINAGAR)

In Sapore there is no piped sewerage system, the wastewater from households is discharged into open road side drains which lead to open Nallahs. There are other minor drains originating from households close to the river, which drain directly into the river. The town is generating 35-40 m³ of solid waste per day out of which only about 5-10m³ of solid waste per day i.e. 15-25% of the total is handled by the Town Area Committee. The remaining is causing public health nuisance in the city and finally reaches the river which deteriorates the quality of the river.

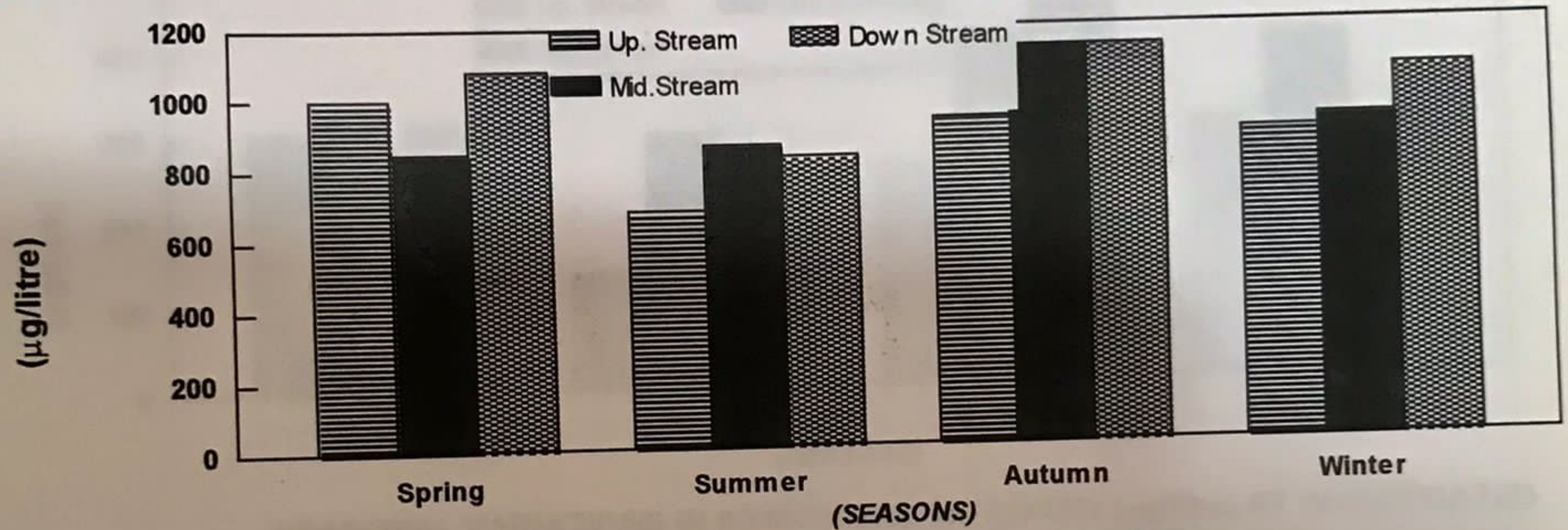
Following sites were selected for the purpose of present studies:

S.No.	Name of the site	Site code
(i).	Chankipora	Upstream
(ii).	Jamia Qadeem	midstream
(iii).	Douabgagh	Downstream

NITRATES- NITROGEN:

The nitrate nitrogen concentration in the downstream was observed to be higher in most of the months than up and midstream. The annual average of the nitrate-nitrogen content increased progressively from upstream to downstream. On seasonal basis downstream depicted predominant increase in spring and winter while midstream depicted higher values in summer and autumn. No definite seasonal pattern was observed.

The overall annual average at investigated sites was recorded to be $951.4\mu\text{g/litre}$.

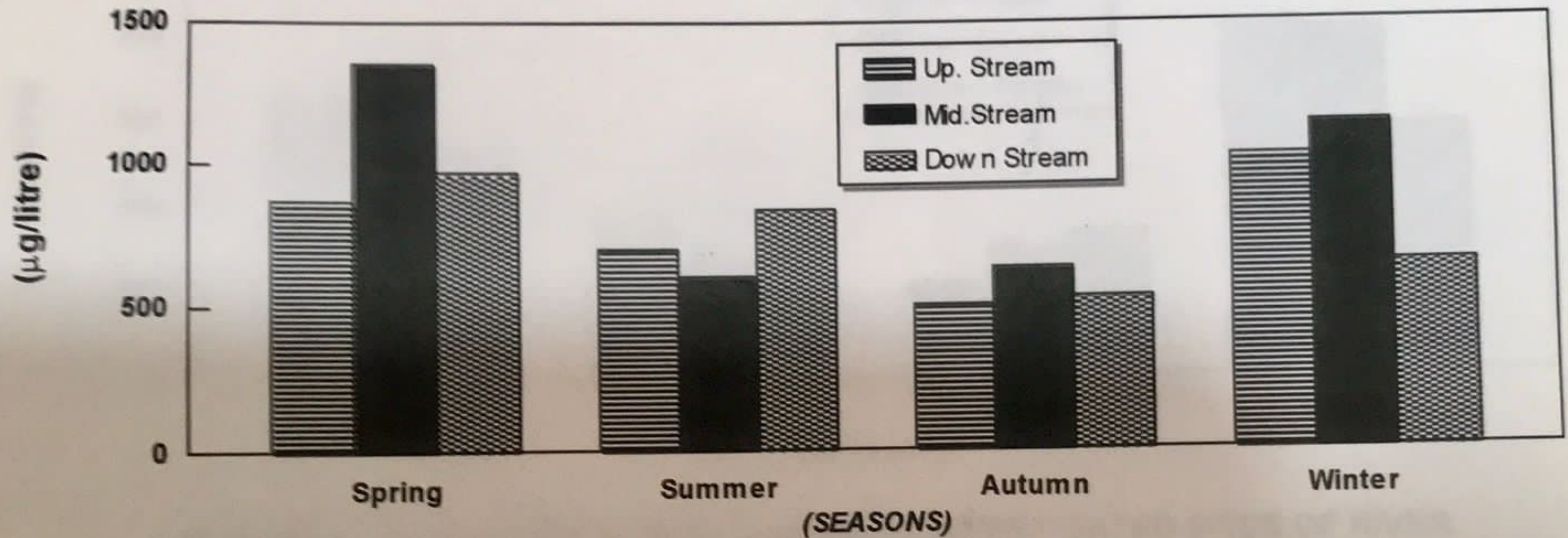


SEASONAL VARIATIONS IN NITRATE- NITROGEN ($\mu\text{g/litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (SOPORE)

TOTAL PHOSPHORUS:

The total phosphorus concentration remained in close conformity with the orthophosphate content with midstream depicting a higher annual average ($947.7\mu\text{g/litre}$) followed by upstream ($776.6\mu\text{g/litre}$) and downstream ($750\mu\text{g/litre}$). Seasonally also midstream depicted predominant increase except in summer wherein downstream was observed to have higher value. A definite seasonal pattern was observed with values decreasing progressively from spring to autumn.

The overall annual average of $825\mu\text{g/litre}$ was recorded at the investigated sites.

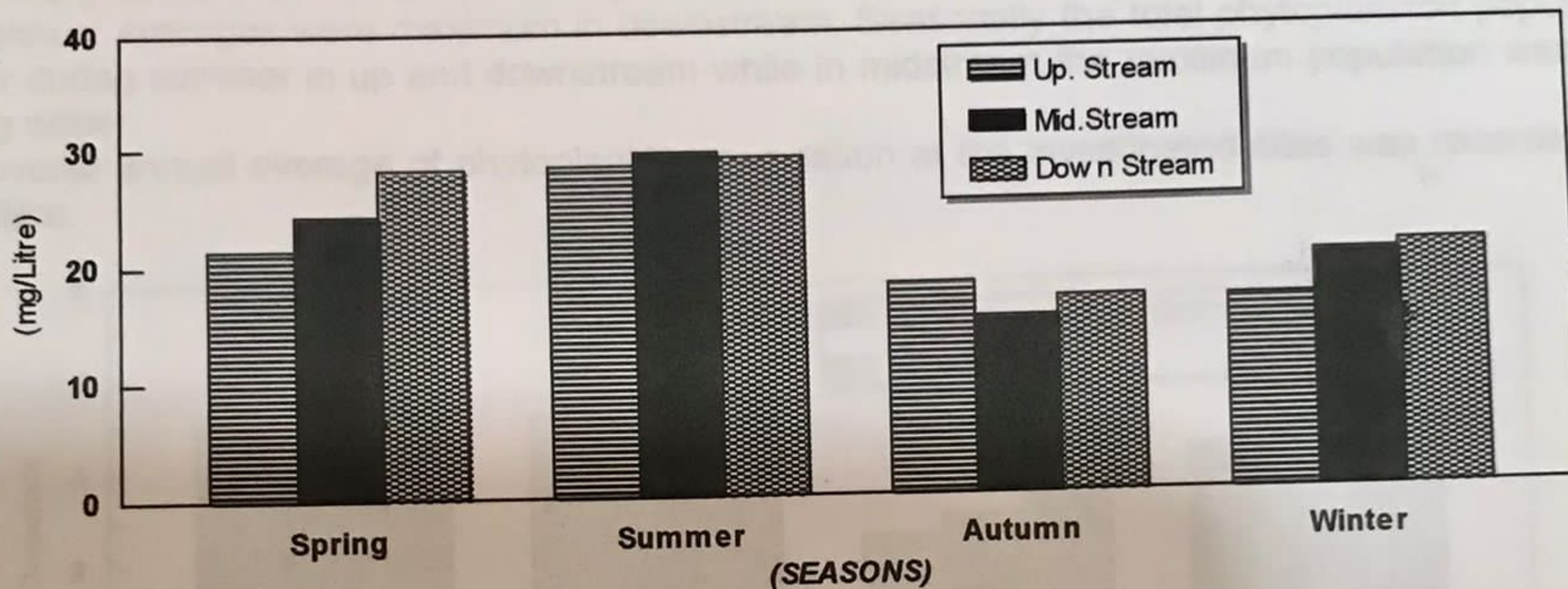


SEASONAL VARIATIONS IN TOTAL-PHOSPHORUS ($\mu\text{g/litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (SOPORE)

B.O.D:

The investigated sites did not reflect any significant variations on monthly basis however the B.O.D was observed to increase from upstream to downstream. The B.O.D values on seasonal basis were observed to be higher in downstream in spring and winter while in summer and autumn higher values were recorded in mid and downstream respectively.

The overall annual average of the investigated sites were recorded to be 22.3mg/litre.

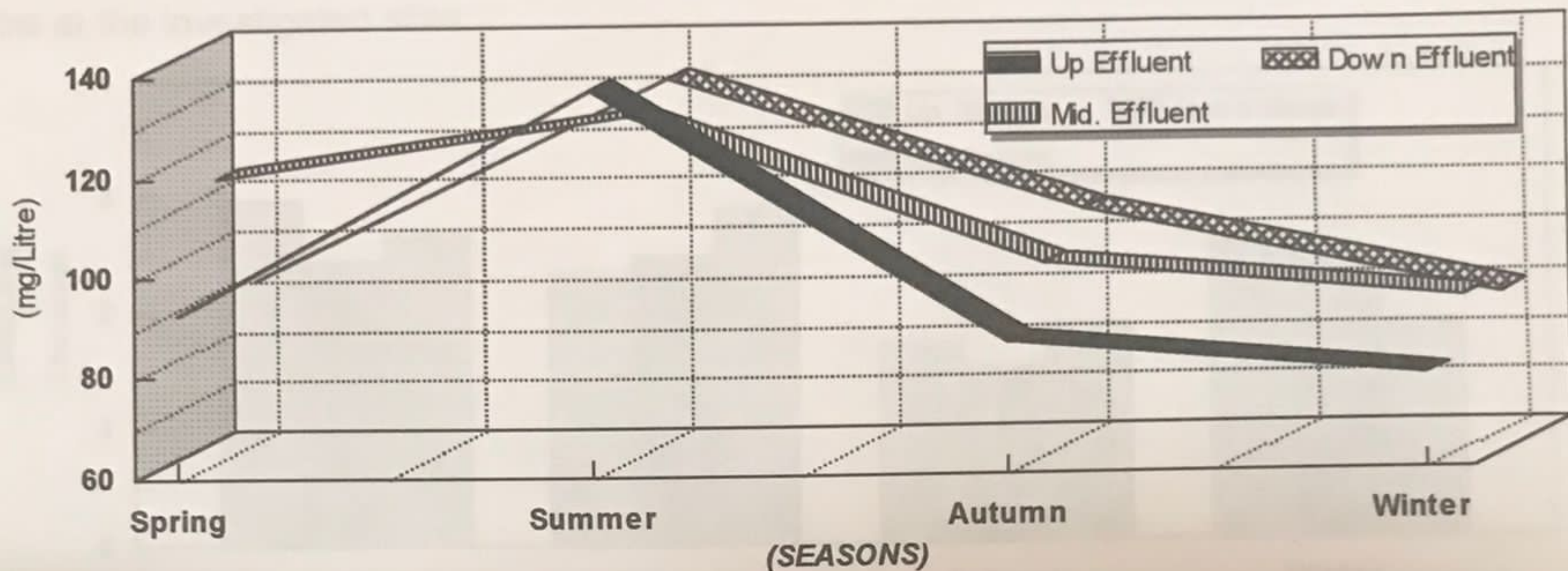


SEASONAL VARIATIONS IN B.O.D (mg/litre) AT INVESTIGATED SITES OF RIVER JEHLUM (SOPORE)

EFFLUENTS:

The B.O.D in upstream effluent ranged between 62.3mg/litre (February) and 200mg/litre (June), midstream effluent the range was between 58.3mg/litre (October) and 165mg/litre (June), while downstream effluent the values fluctuated from 70.3mg/litre (February) to 160mg/litre (July). downstream effluent depicted higher B.O.D values on annual basis.

The overall annual average of the three effluent sites was recorded to be 102.3mg/litre.



SEASONAL VARIATIONS IN B.O.D (mg/litre) OF THE EFFLUENTS ENTERING RIVER JEHLUM (SOPORE)

The town is partly covered by pucca drains at some places on road sides and otherwise there are natural Kucha drains. Majority of the drains are reported to be silted or blocked. Haphazard dumping of solid waste along the drains has resulted in chokage of some of the drains. The existing drains are disposing the sewage directly into the river Jehlum as well through nallahs. There are many open drains in the town formed with the natural course which finally reach the river Jehlum. The existing latrines are disposing the refuse directly in the river without any treatment. The number of existing lavatories are insufficient with respect of the population using it and are not in a condition to be used and need renovation with proper refuse treatment.

At present there is no organized Solid Waste Management System existing in the town. The town area committee does not have proper infrastructure and adequate funds for solid waste collection and disposal. The solid waste collection and disposal takes place in a haphazard manner and the waste is disposed normally under the bridges. This inefficient and unplanned collection of solid waste has resulted in people dumping the waste of the houses directly into the open drains which has finally resulted in their chokage. Solid waste disposed under the bridges is finding its ways into the river during the floods and rains. The chockage of the drains and nallahs further resulted in degradation of the drains due to spill over and change of course by the drain.

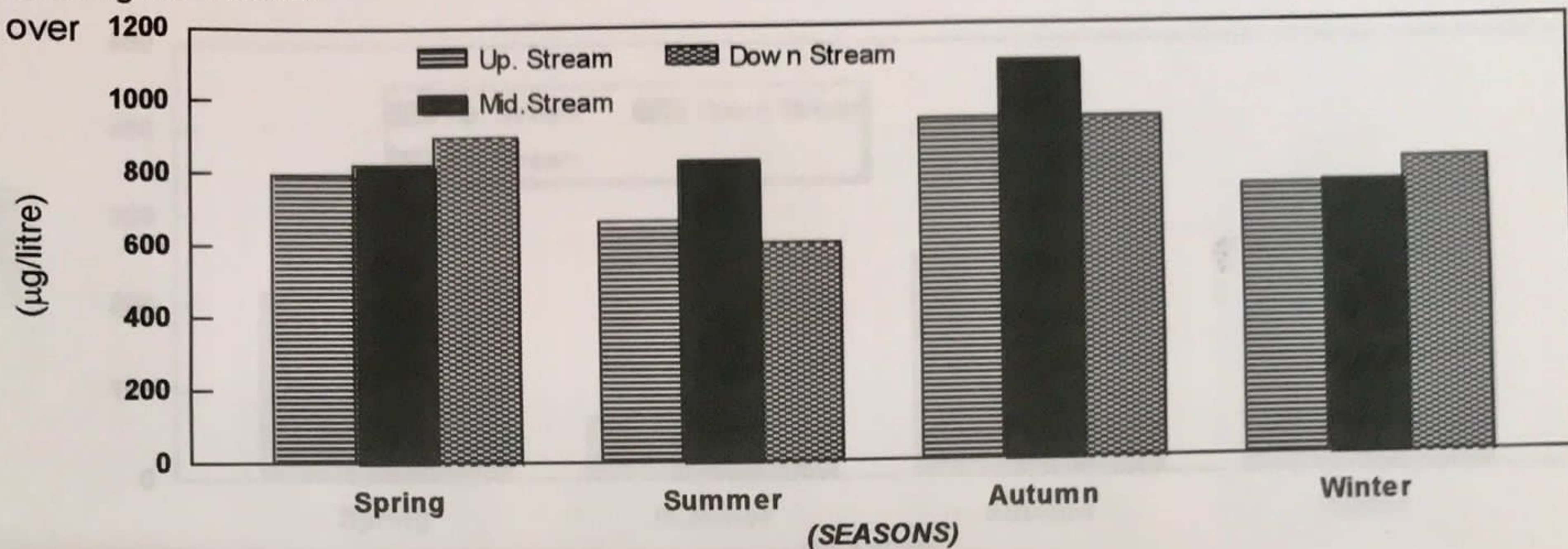
Following stations have been selected for the purpose of studies:

S.No.	Name of the site	Site code
(i).	Khawjabagh	Upstream
(ii).	Old Bridge (Noor-ul-huda Mosque)	Midstream
(iii).	Khan Sahib	(Dowstream)

NITRATE-NITROGEN:

On monthly basis nitrate-nitrogen concentration was recorded to be higher in midstream. The annual average of midstream two depicted predominant increase over up and downstream. On seasonal basis midstream depicted predominance only in summer and autumn while in rest seasons downstream depicted higher values.

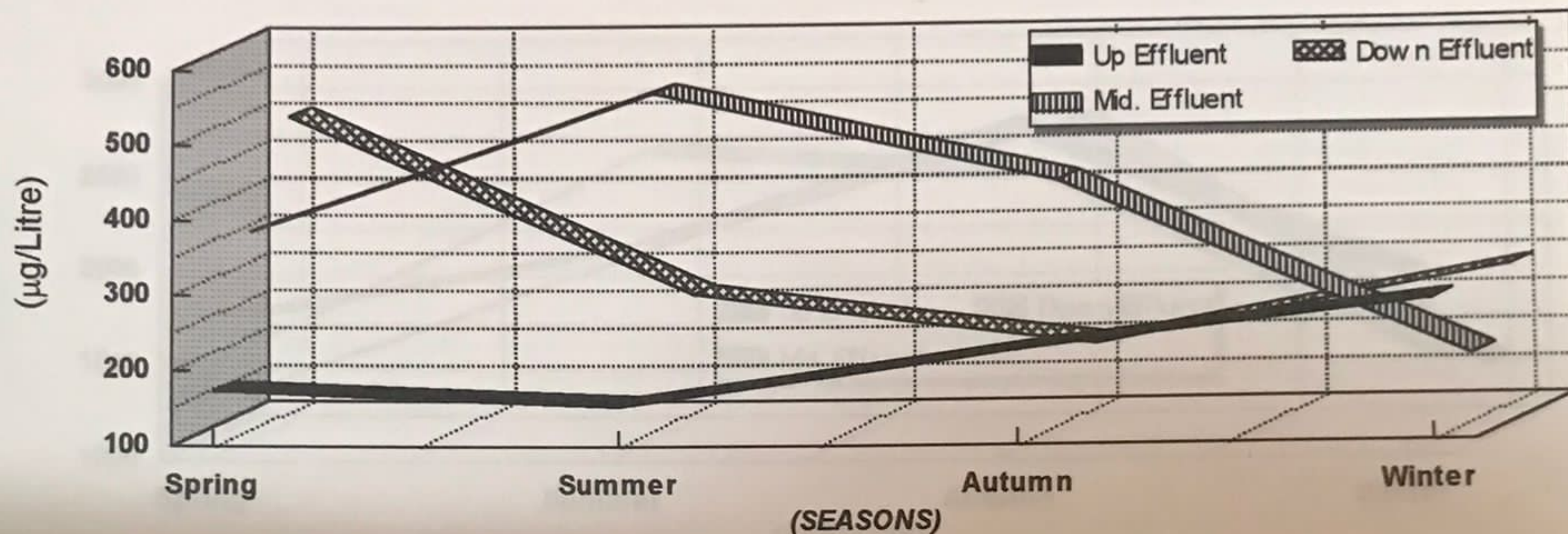
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SEASONAL VARIATIONS IN NITRATE- NITROGEN (µg/litre) AT INVESTIGATED SITES OF RIVER JEHLUM (BARAMULLAH)

EFFLUENTS:

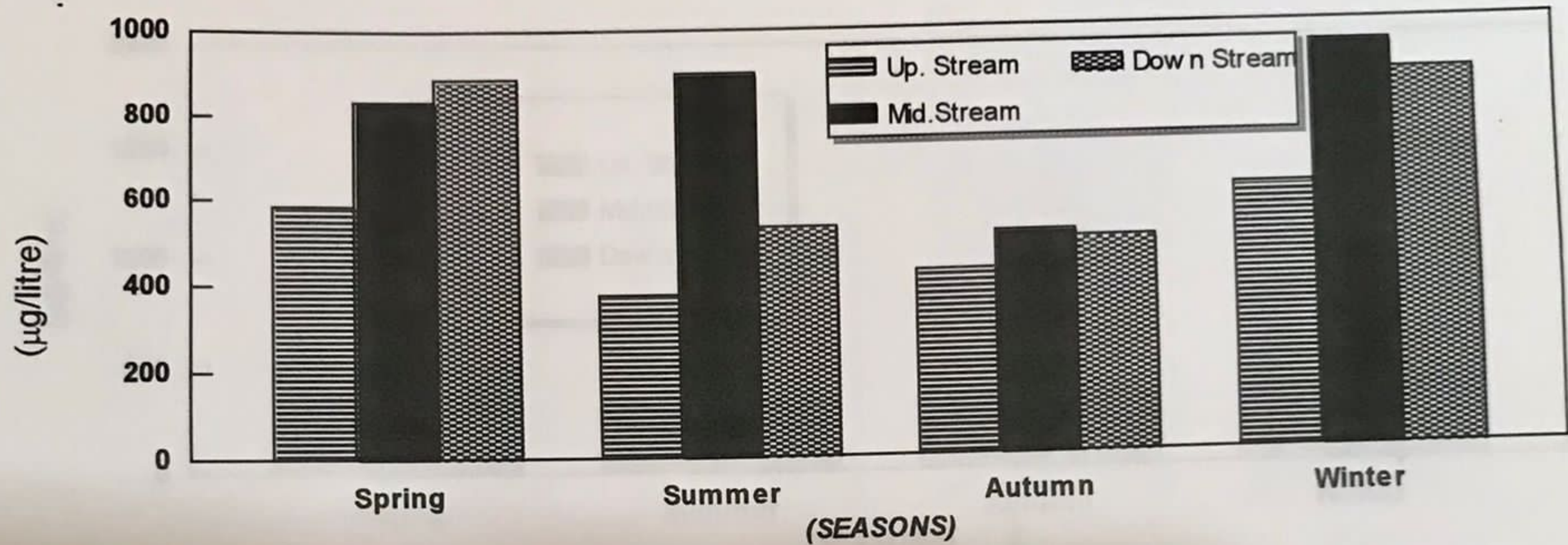
In upstream effluent the nitrate-nitrogen concentration ranged between $123\mu\text{g/litre}$ (July) and $499\mu\text{g/litre}$ (February). In midstream effluent the range was between $100\mu\text{g/litre}$ (January) and $982\mu\text{g/litre}$ (August), while in downstream effluent the values fluctuated from a minimum of $102\mu\text{g/litre}$ (September) to a maximum of $1256\mu\text{g/litre}$ (April). The annual averages of midstream effluent depicted a higher value than up and downstream effluents. Seasonally midstream effluent depicted predominance in summer but in up and downstream higher values were recorded during summer and winter respectively. The overall annual average of $293\mu\text{g/litre}$ was recorded at the monitored sites.



SEASONAL VARIATIONS IN NITRATE- NITROGEN ($\mu\text{g/Litre}$) OF THE EFFLUENTS ENTERING RIVER JEHLUM (BARAMULLAH)

TOTAL PHOSPHORUS:

On comparing the annual averages the total phosphorus concentration at the investigated sites. Midstream depicted predominant increase over up and downstream. Seasonally two midstream depicted predominant increase except in spring wherein downstream depicted higher value. The overall annual average of $666\mu\text{g/litre}$ was recorded at for the investigated sites.



SEASONAL VARIATIONS IN TOTAL-PHOSPHORUS ($\mu\text{g/litre}$) AT INVESTIGATED SITES OF RIVER JEHLUM (BARAMULLAH)

investigations on River Jehlum were carried out by Rajesh (1981) Raina *et.al.* (1982) Sunder (1988) Kundangar *et.al.* (1991).

LEGENDARY ORIGIN :

An ancient legend, related at length in the Nilamata represents the *Vitasta* as a manifestation of *Siva's* Consort *Parvati*. After Kashmir had been created, *Siva* at the request of *Kasyapa*, prevailed upon the goddess to show herself in the land in the shape of a river, in order to purify its inhabitants from the sinful contact with the *Picacas*. The goddess thereupon assumed the form of a river in the underworld and asked her consort to make an opening by which she might come to surface. This he did by striking the ground near the habitation of the *Nilanga*, with the point of his trident (*Sula*). Through the fissure thus made, which measured one *Vitashi* or span, the river gushed forth, receiving on account of this origin the name *Vitasta*.

The spring basin where the goddess first appeared was known by several designations of *Nilakunda*, *Sulaghata* or simply *Vitasta*. It is clear that the spring meant is the famous *Nilanga*, near the village of Vernag (Kalhan's *Rajatarangini*).

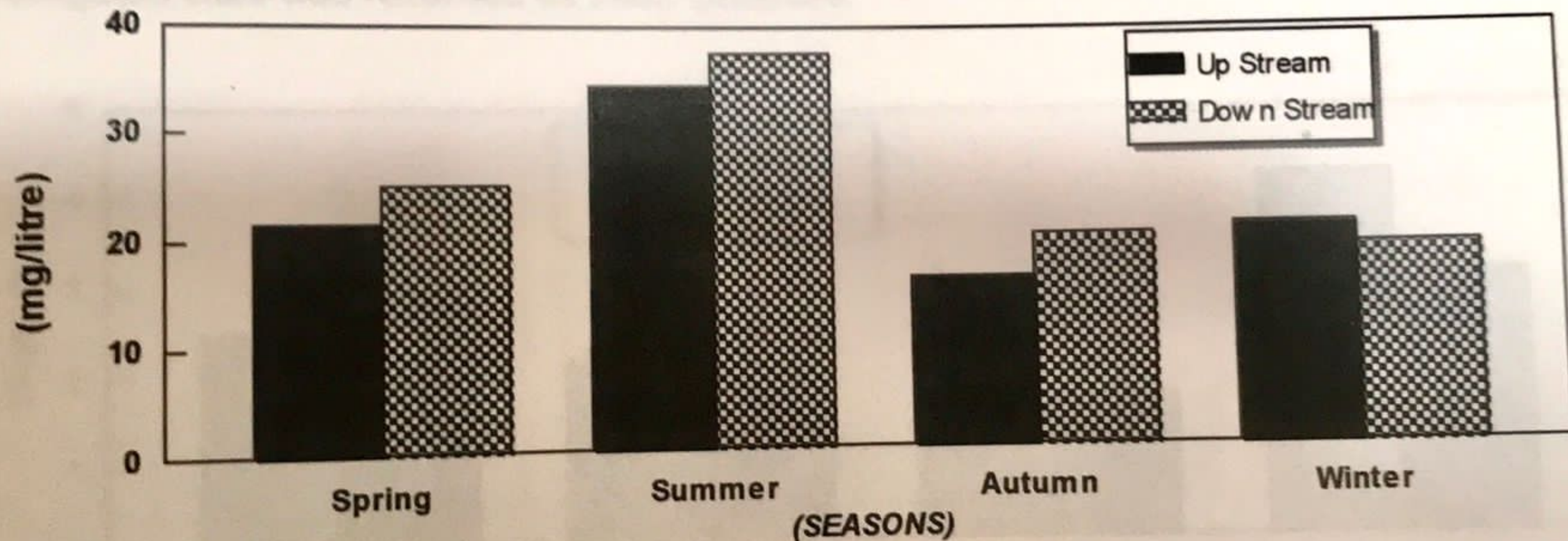
[The river Jehlum is the lifeline of the Kashmir state and drains the valley. As mentioned above the Jehlum arises from a small pool at Verinag though its true source is a few kilometers farther to Southeast (N.Lat. $33^{\circ}.30'$, E. long $75^{\circ}.25'$). The four streams viz. Sundran, Brang, Arapath and Lidder join the Jehlum close to Anantnag and near Khanabal. It also receives united waters of Veshara and Rambiar, a few kilometers north of Bijbihara. At Srinagar Tsunt-Khul, which drains the Dal to the east of the city joins the river and through it receives the superfluous water from the Lake. A few hundred meters down stream from Amira Kadal the river is joined on its left bank by Dudgana near Chattabal. Below the Srinagar the Jehlum is joined on right bank by the Sind besides number of other streams and mountains torrents. The whole length of the Jehlum from its source to Baramulla is 241 kms.

Over these years dense human settlements, industries and commercial establishments have come along the river shores and as a result large amounts of sewage and effluents are discharged without any treatment. Within the city of Srinagar including the proper towns the problems of pollution assumes greatest ecological importance as the river has been used as a dumping site for municipal garbage and

B.O.D:

The biological oxygen demand does not reflect any significant variation on monthly basis at the two investigated sites. on seasonal basis the B.O.D in the downstream depicted a significant predominance over upstream. The B.O.D values increased progressively from winter to summer and then again decreased in autumn at both the sites.

The overall annual average of 24.42mg/litre was recorded at the investigated sites.



SEASONAL VARIATIONS IN B.O.D (mg/litre) AT INVESTIGATED SITES OF RIVER JEHLUM (ANANTNAG)