CLEAN GANGES THE WAY FORWORD

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ABSTRACT

India is endowed with rich water resources. Approximately 45,000 km long riverine systems criss-cross the length and breadth of the country. major 46 medium river basins extending over the states of Uttarakhand , Uttar Pradesh, Haryana, Himachal Pradesh, Delhi, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh and West Bengal. Rapidly increasing population, rising standards of living and exponential growth of industrialization and urbanisation have exposed the water resources, in general, and rivers, in particular, to various forms of degradation. Many Indian rivers, including the Ganga in several stretches, particularly during lean flows, have become unfit even for bathing. Realising that the rivers of the country were in a serious state of degradation, a beginning towards their restoration was made with the launching of the Ganga Action Plan (GAP) in 1985.

I. GANGA BASIN

Ganga drains a basin of extraordinary variation in altitude, climate, land use and cropping pattern. Ganga has been a cradle of human civilization since time immemorial. It is one of the most sacred rivers in the world and is deeply revered by the people of this country. India has 12 river basins, and 14 minor and desert river basins. Ganga river basin is the largest of these, The Ganga basin lies between East longitudes 73°30 and 89° 0 and North latitudes of 22°30 and 31°30, covering an area of 1,086,000 sq km, extending over India, Nepal and Bangladesh. It has a catchment area of 8,61,404 sq. km in India, constituting 26% of the country's land mass and supporting about 43% of population (448.3 million as per 2001 census) .

Particularly in the stretch between Kannauj and Allahabad Ganga has many tributaries, both in the Himalayan region before it enters the plains at Haridwar and further downstream before its confluence with the Bay of Bengal. -May are the lean flow months. The surface water resource Ganga has been assessed as 525 billion cubic meters (BCM). Substantial abstraction of water for various purposes including irrigation, power generation and drinking water has impacted the quantity of flows in the river.

II. GANGA ACTION PLAN

The Ganga Action Plan was launched in 1985 with the objective of pollution abatement to improve the water quality in the river. The programme included 261 schemes spread over 25 Class I towns of U.P., Bihar and West Bengal. The main focus of the Plan was on Interception & Diversion and treatment of sewage generated from these identified towns. 34 Sewage Treatment Plants (STPs) with a treatment capacity of 869 mild have been set up under the Plan. GAP I was completed in March 2000 at a cost of Rs. 452 crores.

GAP II was started in 1993. It covers 59 towns located along the river in the five states of Uttarakhand, U.P, Jharkhand, Bihar and West Bengal. 319 schemes have been taken up under the Plan, out of which 200 have been completed. An expenditure of Rs. 370.40 crore has been incurred so far and sewage treatment capacity of 130 mild has been created. GAP II was expanded in 1996 into the National River Conservation Plan (NRCP), which presently covers polluted stretches of 36 rivers in 20 States in the country.

III. STATUS OF WATER QUALITY OF GANGA REVER

The Ganga river water quality evaluated on the basis of pollution indicators (DO, BOD and coliform) indicates that dissolved oxygen levels have improved in the main stem of Ganga. The values are mostly above the recommended value of 5.0 mg/l, except in the stretch between Kannauj and Kanpur where values below 5.0 mg /l have been noticed on several occasions. BOD values are also within stipulated limits in the upper and lower reaches of the Ganga but tend to be higher than 5.0 mg /l in the middle stretch from Kannauj to Varanasi. This can be described as the critical stretch. The faucal coliform remains the only parameter on which the observed values exceed the permissible limits of 2500 MPN/100 ml at most places except in the upper reaches up to Haridwar. Despite the problems of operation and maintenance, the river water quality shows discernible improvement (in terms of DO and BOD). over the pre-GAP period. This should be seen in the background of a steep increase in population with concomitant increase in organic pollution load.

IV. CRITICAL ANALYSIS OF GAP

The success of GAP has been in preventing further deterioration of water quality, generally maintaining it and improving it in some places, even though the pollution load draining into the river has substantially increased due to population growth, rapid industrialization and urbanization. It can be inferred that if the pollution abatement programme had not been implemented there would have been an inevitable deterioration in the quality of river water posing threat to public health and ecology. A positive outcome of the programme has been an increased public awareness of the need to protect our rivers.

V. FUTURE COURSE OF ACTION

Recognising the need to revamp the river conservation strategy, the Central Government has given Ganga the status of a 'National River' and has set up the National Ganga River Basin Authority (NGRBA) on 20 February 2009. It is an empowered planning, financing, monitoring and coordinating Authority for effective abatement of pollution and conservation of the river. The Authority would adopt a comprehensive and holistic approach for conserving the river Ganga with river basin as the unit of planning. The Authority would seek to maintain minimum ecological flows besides implementing pollution abatement activities.

VI. BACKGROUND

The Himalayas are the source of three major Indian rivers namely the Indus, the Ganga and the Brahmaputra. Ganga drains a basin of extraordinary variation in altitude, climate, land use, flora and fauna, social and cultural life. Ganga has been a cradle of human civilization since time immemorial. Millions depend on this great river for physical and spiritual sustenance. People have immense faith in the powers of healing and regeneration of the Ganga. It is one of the most sacred rivers in the world and is deeply revered by the people of this country.

The River plays a vital role in religious ceremonies and rituals. To bathe in Ganga is a lifelong ambition of many who congregate in large numbers for several rivers Ganga Basin 3 centered festivals such as Kumbh Mela and numerous Snan (bath) festivals.

VII. LOCATION

Ganga basin is the largest river basin in India in terms of catchment area, constituting 26% of the country's land mass (8,61,404 Sq. km) and supporting about 43% of its population (448.3 million as per 2001 census). The basin lies between East longitudes 73°30and 89° 0 and North latitudes of 22°30 and 31°30, covering an area of 1,086,000 sq km, extending over India, Nepal and Bangladesh. About 79% area of Ganga basin is in India. The basin covers 11 states viz., Uttarakhand, U.P., M.P., Rajasthan, Haryana, Himachal Pradesh, Chhattisgarh, Jharkhand, Bihar, West Bengal and Delhi.

VIII. CLIMATE

The annual average rainfall in the basin varies between 39 cm to 200 cm, with an average of 110 cm. Eighty percent of the rainfall occurs during the monsoon months i.e. between June and October. Because of large temporal variations in precipitation over the year, there is wide fluctuation in the flow characteristics of the river

COURSE OF GANGA

Bhagirathi is the source stream of Ganga. It emanates from Gangotri Glacier at Gaumukh at an elevation of 3,892 m (12,770 feet). Many small streams comprise the headwaters of Ganga. The important among these are Alaknanda , Dhauliganga, Pindar, Mandakini and Bhilangana. At Devprayag, where Alaknanda joins Bhagirathi, the river acquires the name Ganga. It traverses a course of 2525 km before flowing into the Bay of Bengal. It has a large number of tributaries joining it during this journey (Figure 1). In Uttarakhand, near Tehri, a dam, has been built on Bhagirathi for hydropower generation resulting in regulated additional water during the dry months. At Haridwar, Ganga opens to the Gangetic Plains, where a barrage diverts a large quantity of its waters into the Upper Ganga Canal, to provide water for irrigation. At Bijnore, another barrage diverts water into the Madhya Ganga Canal but only during monsoon months. At Narora, there is further diversion of water into the Lower Ganga Canal. Further down, River Ramganga joins Ganga near Kannauj, adding additional water to the river. Yamuna confluences Ganga at the Sangam in Allahabad, making a major contribution to the river flow. Beyond Allahabad, Ganga is joined by several tributaries, most of which are from the north and a few from the south. In the stretch between Allahabad in U.P. and Malda in West Bengal, Ganga, therefore, has considerable flow. The Farakka barrage in West Bengal regulates the flow of the river, diverting some of the water into a feeder canal linking Hooghly to keep it relatively silt-free. Downstream of this barrage, River Ganga splits into two, Bhagirathi (Hooghly) on the right and Padma on the left. Bhagirathi (Hooghly) meets the Bay of Bengal about 150 km downstream of Kolkata. Padma enters Bangladesh and meets river Brahmputra and Meghna before finally joining the Bay of Bengal.

HYDROLOGYOF GANGA BASIN

Rainfall, subsurface flows and snow melt from glaciers are the main sources of water in river Ganga. Surface water resources of Ganga have been assessed at 525 billion cubic meters (BCM). Catchment area, annual yield of water and mean flow of tributaries of Ganga are given in. Out of its 17 main tributaries Yamuna, Sone, Ghagra and Kosi contribute over half of the annual water yield of the Ganga. These tributaries meet the Ganga at Allahabad and further downstream. The river has a problem of low flows between the Haridwar - Allahabad stretch, as may be seen from Figures 2 and 3. December to May are the months of lean flow in the Ganga. The lean flow during these months, at some important towns along the river Ganga, is shown in Figure 4.

The average annual flow at various gauging stations and in major tributaries is shown in the line diagram in Fig. 5. The tributaries joining Ganga from the south are shown on the left of the diagram and those joining it from the north are shown on the right side. On an average, each square km of the Ganga basin receives a million cubic meter (MCM) of water as rainfall. 30% of this is lost as evaporation, 20% seeps to the subsurface and the remaining 50% is available as surface runoff. The deep channel of the river bounded by high banks facilitates the passage of ground water as base flow. Annual flooding is the characteristic of all rivers in the Ganga basin. The Ganga rises during the monsoon but the high banks restrict the flood water from spreading. The flood plain is usually 0.5 to 2 km wide. This active flood plain is flooded every year. There are many structures on the Ganga which divert its discharge. Major Water Resources Development Projects on the river are given in . Structurally, the Ganga basin comprises of three large divisions of the Indian subcontinent, namely: the Himalayan fold mountains the Central Indian highlands the Peninsular shield, and the Gangetic plain. The Himalayan Fold Mountains include numerous snow peaks rising above 7000 meters. Each of these peaks is surrounded by snow fields and glaciers. All the tributaries are characterized by well regulated flows and assured Annexure- supply of water throughout the year. The Gangetic plain, in which the main stem of Ganga lies, consists of alluvial formation and is a vast flat depositional surface at an elevation below 300 meters.

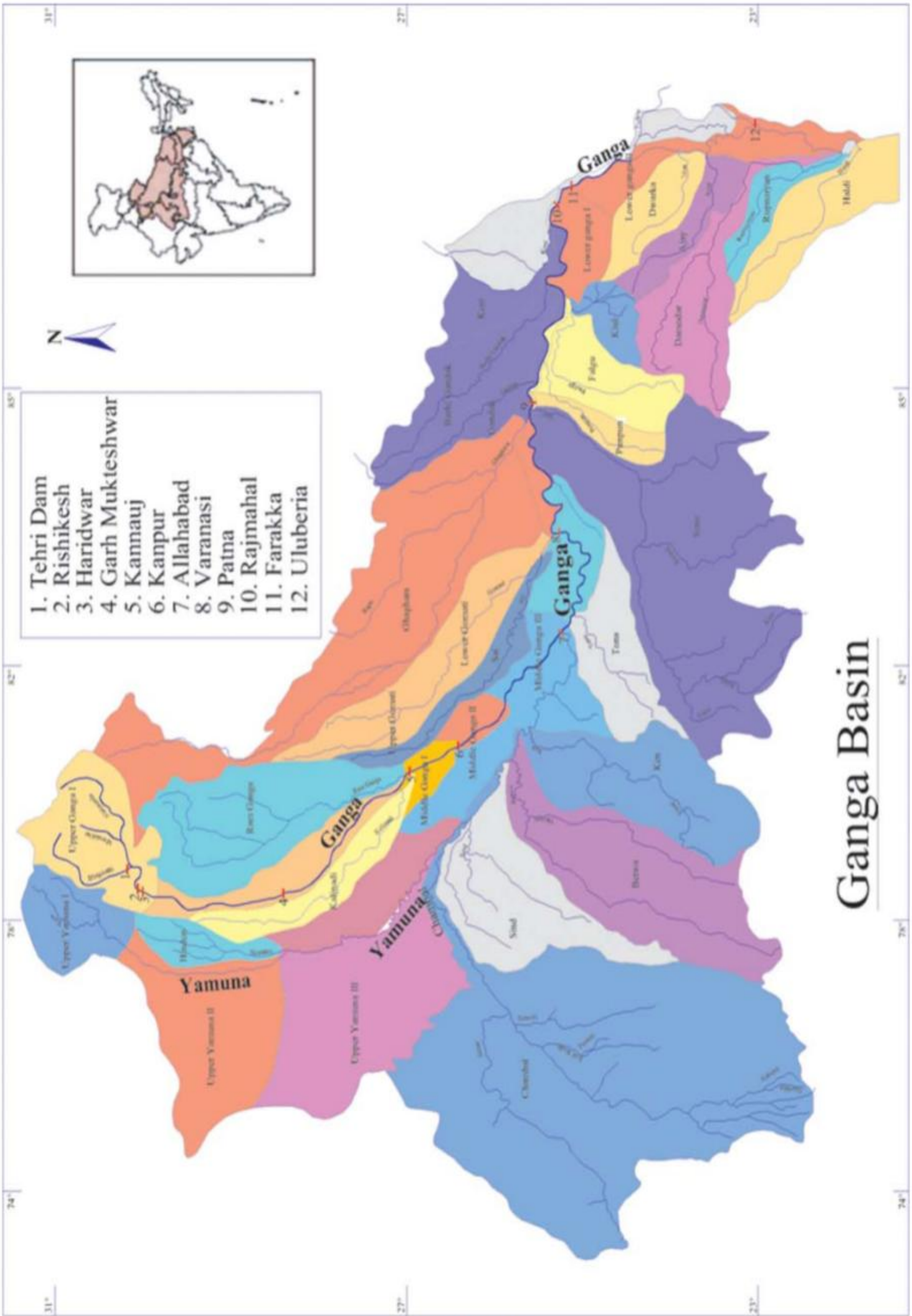

Fig. 1: Ganga Basin

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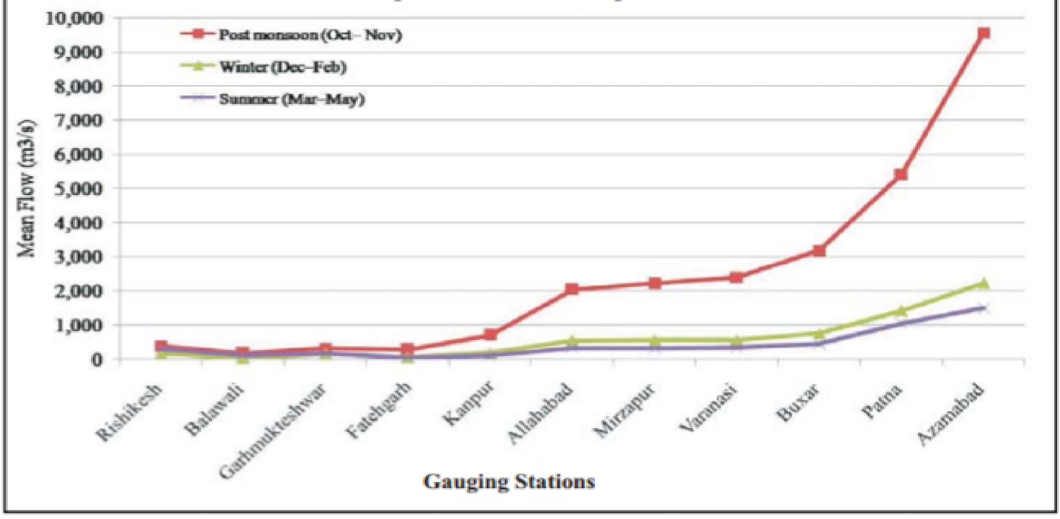

Fig. 2 : Mean Discharge Seasonal

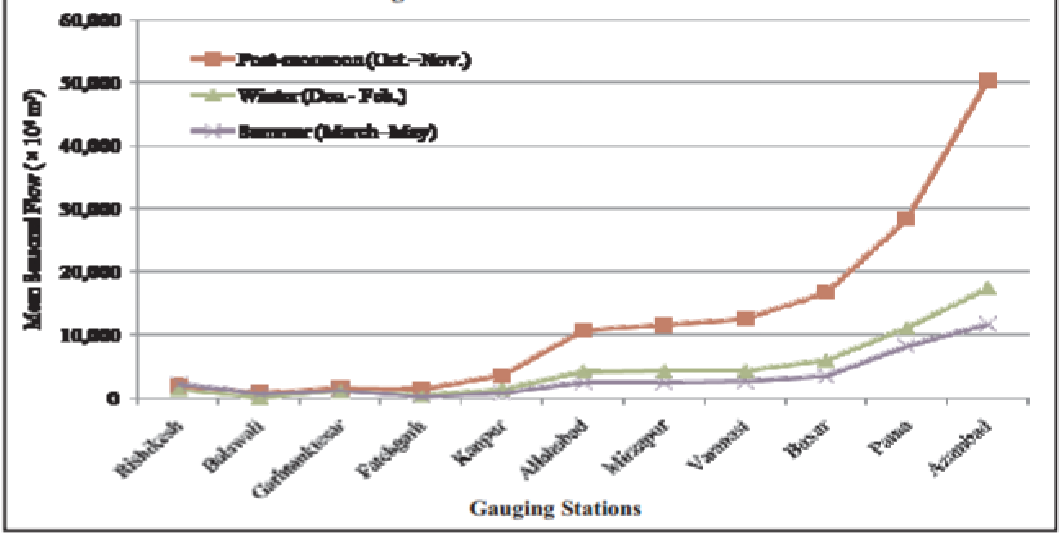

Fig. 3 : Seasonal Flow Variation

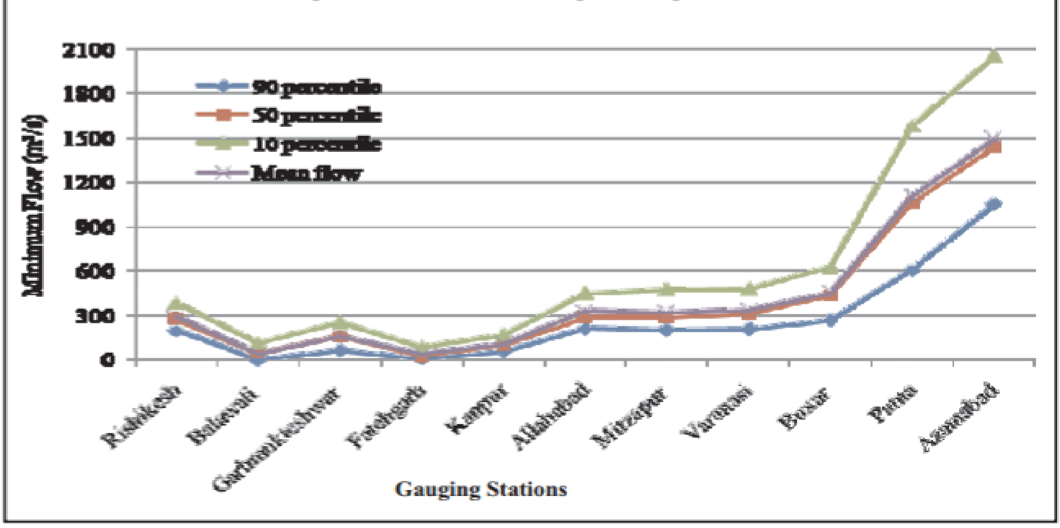

Fig. 4 : Lean Flow in Ganga during summers

SOIL CHARECTERSTICS OF GANGA BASIN

The Ganga basin consists of a wide variety of soils. While soils of the high Himalayas in the north are subject to continuous erosion, the Gangetic plain provides a huge receptacle into which thousands of meters of thick layers of sediments have been deposited to form a wide valley plain. The Deccan plateau in the south has a mantle of residual soils of varying thickness arising out of weathering of ancient rocks of the peninsular shield. Some of the soils are highly susceptible to erosion. Mountain soils, submontane soils and alluvial soils, covering 58 % of the basin area, have very high erodibility; red soils covering 12% of the basin area have high erodibility, red & yellow soils and mixed red and black soils covering an area of 8% have moderate erodibility, and deep black soils and medium black soils covering an area of 14% have low erodibility.Shallow black soils and lateritic soils covering an area of 6% have very low erodibility. Broadly, it can be said that soils in Haryana, Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, through which the main stem of Ganga and all its tributaries flow, have very high erodibility

IX. DEMOGRAPHY OFGANGA BASIN

Demography has an important bearing on the state of the river as it is significantly affected by the population living within the basin. Average population density in the Ganga basin is 520 persons per square km as against 312 for the entire country (2001 census). Major cities of Delhi, Kolkata, Kanpur, Lucknow, Patna, Agra, Meerut, Varanasi and Allahabad are situated in the basin. The cities in the basin have large and growing populations and a rapidly expanding industrial base. The summary of urban population in the basin is given in Table 2.2. It can be seen that between 1991 and 2001, urban population increased by 32%. This trend is likely to continue. The pollution load is also expected to increase correspondingly.

X. GANGA ACTION PLANE

To prevent the pollution of river Ganga and to improve its water quality, an Action Plan known as Ganga Action Plan was formulated in the year 1984 on the basis of a comprehensive survey of the Ganga Basin carried out by the Central Pollution Control Board under "Assessment and Development Study of River Basin Series (ADSORB)".

XI. OBJECTIVE OF GANGA ACTION PLANE

The objective, at the time of launching the Ganga Action Plan in 1985, was to improve the water quality of Ganga to acceptable standards by preventing the pollution load from reaching the river. Later, in 1987, on the recommendations of the Monitoring Committee of GAP, the objective of the Plan was modified to restoring the river water quality to the Designated Best Use class of Ganga, which is “Bathing Class” (Class B). The standards of water quality for Class B are given in the following box. The classification of designated best use of inland surface water as stipulated by CPCB.

XII. APROCH OF GANGA ACTION PLANE

Studies undertaken before the formulation of the Ganga Action Plan indicated that a large proportion of pollution load in the river came from the municipal wastewater generated in 25 Class I towns located on the banks of the Ganga, each with a population exceeding one lakh. Therefore, the emphasis under the Plan was on interception and diversion of wastewater and its treatment in Sewage Treatment Plants, before discharge into river or on land. In addition, works were also undertaken to prevent pollution of the river from non-point sources, improving aesthetics, and promoting public participation. The various types of schemes taken up under GAP are categorized into core and non-core schemes.

XIII. CONCLUSION

Our research supports our hypothesis that the level of pollution in the Ganges has been relatively constant over time due to the lack of effective sewage treatment plants. The amount of pollution, measured by faucal coliform and biological oxygen demand (BOD) levels, are impacted by a number of factors dependent on the location at which the sample was collected. These factors include the flow of the river, the amount of aquatic life, the local population, and the number of nearby industries. These factors, along with our limited time and knowledge, prevent us from concluding that the river's overall levels of FC and BOD show any directional trend. However we can conclude that the pollution levels have been constant in the sense that they are consistently measured above the levels permissible for human consumption.

While the local government has implemented waste treatment facilities and water monitoring stations, these plans have been largely ineffective in improving the water quality to a level safe for inhabitant usage. Many of the treatment plants were not designed to treat the amount of waste generated in that area, leaving some plants unable to treat all of their waste while others are capable of treating more waste than they actually have. Some of the treatment plants are completely inoperable due to clogged or disconnected pipes unable to be repaired because of the lack of funding and skilled workers. The plants that are functioning experience frequent power outages that temporarily debilitate their ability to treat water. When plants are capable of treating the waste water, the clean water is often used for agricultural purposes instead of being placed into the river. While this benefits malnourished inhabitants by providing them with more crops, it decreases the flow of the river resulting in more concentrated amount of pollutants.

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