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Ministry of Jal Shakti

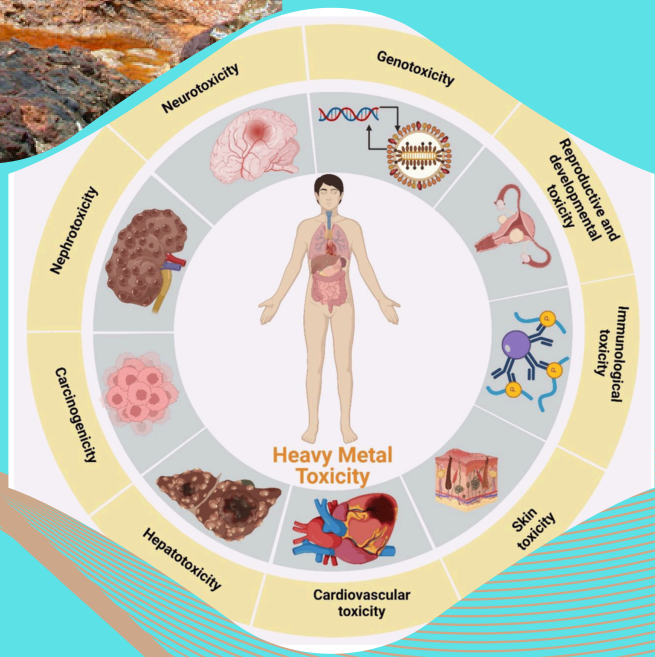
Department of Water Resources

River Development and Ganga Rejuvenation

STATUS OF TRACE AND TOXIC METALS IN RIVERS OF INDIA

9th Edition

(January to December 2025)



Central Water Commission

April, 2026

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Chairman,
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Ministry of Jal Shakti

Water is a vital resource that sustains ecosystems, supports economic development, and underpins human well-being. However, increasing anthropogenic pressures, coupled with natural processes, have significantly impacted both the availability and quality of water resources. Ensuring access to safe and adequate water is one of the most critical challenges of our time. Achieving sustainable development and long-term water security necessitates the responsible and scientific management of freshwater resources, supported by continuous monitoring of both water quantity and quality.

In India, rivers constitute the primary source of surface water. The Central Water Commission (CWC), through its extensive network of hydro-meteorological observation stations, has developed significant expertise in water resources assessment and management. CWC has been monitoring river water quality since 1963 and currently operates a robust network of 788 water quality monitoring stations (as of January 2025), supported by a three-tier laboratory system comprising 465 Level-I, 20 Level-II, and 5 Level-III laboratories across the country. The Level-III laboratories are equipped to analyse nine trace and toxic metals, namely Arsenic, Cadmium, Copper, Chromium, Iron, Lead, Mercury, Nickel, and Zinc.

In recent years, river water has increasingly been reported to be contaminated with trace and toxic metals arising from both anthropogenic activities and natural sources. The presence of these metals beyond permissible limits poses serious risks to aquatic ecosystems and human health due to their persistent and non-biodegradable nature. Recognizing this concern, CWC has undertaken systematic monitoring and assessment of these metals.

The present report, the 9th edition of "Status of Trace and Toxic Metals in Indian Rivers," presents the analysis of nine trace and toxic metals for the period January to December 2025, covering 767 monitoring stations across various river basins in the country. Earlier editions of this publication were brought out in May 2014, April 2018, August 2019, December 2021, August 2024, January 2025, and May, 2025, reflecting CWC's continued commitment to water quality assessment and knowledge dissemination.

I would like to place on record my sincere appreciation for the initiative taken by Shri Davendra Pratap Mathuria, Chief Engineer (P&DO), and the valuable contributions of Shri Pankaj Kumar Sharma, Director, RDC-II Directorate. I also commend the dedicated efforts of the officers of RDC-II Directorate and the scientific personnel of all CWC laboratories whose commitment and technical expertise have made this report possible.

It is expected that this publication will serve as a valuable reference for CWC offices, central and state agencies, policymakers, researchers, and other stakeholders engaged in water resource management. The findings of this report will aid in informed decision-making, formulation of effective pollution control strategies, and strengthening of water quality monitoring frameworks. Furthermore, the information presented herein will contribute to studies related to climate change, water security, and environmental sustainability.

I sincerely hope that this 9th edition will support ongoing efforts to protect and conserve river water quality in India and will encourage coordinated actions towards sustainable water resource management.

(Anupam Prasad)

Shri Davendra Pratap Mathuria

Chief Engineer
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River water quality monitoring is a fundamental pillar of sustainable water resources management. It entails the systematic collection, analysis, and interpretation of water samples to evaluate a wide range of physical, chemical, and biological parameters. Such monitoring provides critical insights into the health of river systems and enables the assessment of pollution levels arising from both natural processes and anthropogenic activities. Among these parameters, the assessment of trace and toxic metals—such as lead, mercury, cadmium, arsenic, chromium, nickel, copper, zinc, and iron—holds particular significance, as even trace concentrations of these elements can have profound implications for human health, aquatic ecosystems, and environmental sustainability.

Central Water Commission (CWC), as the premier technical organization in the field of water resources in India, plays a pivotal role in monitoring and assessing river water quality across the country. Under its integrated hydrological observation framework, CWC systematically collects and analyses water samples from multiple river basins. While the initial focus of monitoring was primarily on irrigation suitability and allied uses, the increasing pressures of urbanization, industrialization, and agricultural intensification have necessitated the inclusion of biological parameters, trace and toxic metals, and pesticide residues in the monitoring programme.

This publication presents a comprehensive assessment of nine trace and toxic metals in river water samples collected from 767 water quality monitoring stations of CWC during the period January to December 2025. In the absence of specific river water quality standards, the analytical results have been evaluated against the acceptable limits prescribed under BIS: 10500-2012, which serves as a reference benchmark. The report highlights locations where metal concentrations exceed acceptable limits, thereby identifying potential hotspots of concern and providing a scientific basis for targeted interventions.

I would like to place on record my sincere appreciation for the dedicated efforts of Dr. Jakir Hussain, Research Officer, and Ms. Geethu Krishna, Senior Research Assistant of the River Data Compilation-II (RDC-II) Directorate, for their meticulous work in compiling, analysing, and presenting the data in this report. I also extend my appreciation to all field Chief Engineers of the Central Water Commission for their consistent efforts in collection and timely submission of water quality data, which has been instrumental in the preparation of this publication.

It is expected that this report will serve as a valuable resource for policymakers, water resource managers, researchers, and other stakeholders. The findings will support evidence-based decision-making, strengthen pollution control strategies, and contribute towards the long-term goal of preserving and improving the quality of river water in the country.

(Davendra Pratap Mathuria)

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ABBREVIATION

µg/L	Microgram per Litre
mg/L	Milligram per Litre
AAS	Atomic Absorption Spectrophotometer
APHA	American Public Health Association
As	Arsenic
BCM	Billion Cubic meter
BIS	Bureau of Indian Standards
CDS	Centers for Disease Control and Prevention
Cd	Cadmium
Cr	Chromium
Cu	Copper
EFR	East Flowing Rivers
Fe	Iron
Hg	Mercury
ICMR	Indian Council of Medical Research
ICP-MS	Inductively Coupled Plasma Mass Spectrometer
IUPAC	International Union of Pure and Applied Chemistry
km	kilometers
M.ha	Million hectres
MCL	Maximum Contaminant Level
mm	millimeter
MSL	Mean Sea Level
Ni	Nickel
NRWQL	National River Water Quality Laboratory
Pb	Lead
ppb	Parts Per Billion
ppm	Parts Per Million
TEL	Tetra Ethyl Lead
USEPA	United States Environmental Protection Agency
WFR	West Flowing Rivers
WHO	World Health Organisation
WQ	Water Quality
Zn	Zinc

EXECUTIVE SUMMARY

River water is increasingly being reported as contaminated with trace and toxic metals due to both anthropogenic activities and natural (geogenic) processes. The presence of these metals above permissible limits poses serious risks to aquatic flora and fauna, primarily due to their toxic, persistent, and non-biodegradable nature. The Central Water Commission (CWC) is engaged in the monitoring and analysis of nine trace and toxic metals, namely arsenic, cadmium, copper, chromium, iron, lead, mercury, nickel, and zinc. The present study involves the analysis of river water samples collected during the period January 2025 to December 2025 from 20 river basins across India, including Barak & Other Basin; Brahmani & Baitarni Basin; Brahmaputra Basin; Cauvery Basin; East Flowing Rivers (EFR) between Mahanadi & Godavari; EFR South of Cauvery Basin; EFR between Pennar & Cauvery; Ganga Basin; Godavari Basin; Indus Basin; Krishna Basin; Mahanadi Basin; Mahi Basin; Narmada Basin; Pennar Basin; Sabarmati Basin; Subarnarekha Basin; Tapi Basin; WFR of Kutch & Saurashtra including Luni Basin; and WFR South of Tapi Basin.

The collected samples were analyzed at five designated water quality laboratories of CWC, namely:

- National River Water Quality Laboratory, New Delhi
- Upper and Middle Ganga Water Quality Laboratory, Varanasi
- Lower Cauvery Water Quality Laboratory, Coimbatore
- Krishna and Godavari River Water Quality Laboratory, Hyderabad
- Brahmaputra River Water Quality Laboratory, Guwahati

In the absence of specific standards for river water quality with respect to trace metals, the analytical results have been compared with the prescribed limits of Bureau of Indian Standards (BIS) IS 10500:2012 (Drinking Water Specification), which has been adopted as a reference benchmark for evaluation purposes. A parameter-wise summary of the analytical results is presented below.

Arsenic (As)

BIS (Bureau of Indian Standards) 10500:2012 has recommended an acceptable limit of 10 µg/L of arsenic in drinking water. Out of 6660 river water samples, 65 samples from 42 water quality stations were found to have arsenic concentrations beyond the acceptable limit. The arsenic concentration varies from 0.00 to 34.73 µg/L. Maximum arsenic concentration (34.73 µg/L) was observed at Chapra water quality monitoring station on Jalangi River on 02.07.2025.

As Acceptable Limit as BIS 10500: 2012	10 µg/L
No. of Samples Tested	6660
No. of samples where metal found above acceptable limit	65
No. of Stations where metal found above acceptable limit	42
No. of Basins / Rivers where metal found above acceptable limit	05/25

Cadmium (Cd)

Bureau of Indian Standards (BIS) has recommended an acceptable limit of 3 µg/L of cadmium in drinking water. Out of total 6667 river water samples analysed, 07 samples from 07 water quality stations were found to have cadmium concentrations beyond the acceptable limit. The cadmium concentration varies from 0.000 to 10.02 µg/L. Maximum cadmium concentration (10.02 µg/L) was observed at Musiri water quality monitoring station on Cauvery River on 11.06.2025.

Cd Acceptable Limit as BIS 10500: 2012	3 µg/L
No. of Samples Tested	6667
No. of samples where metal found above acceptable limit	07
No. of Stations where metal found above acceptable limit	07
No. of Basins / Rivers where metal found above acceptable limit	04/04

Chromium (Cr)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 50 µg/L of chromium in drinking water. Out of total 6660 river water samples analysed, 7 samples from 06 water quality stations were found to have chromium concentrations beyond the acceptable limit. The chromium concentration varies from 0.000 to 118.83 µg/L. Maximum chromium concentration (118.83 µg/L) was observed at Baleni water quality monitoring station on Hindon River on 02.04.2025.

Cr Acceptable Limit as BIS 10500: 2012	50 µg/L
No. of Samples Tested	6660
No. of samples where metal found above acceptable limit	07
No. of Stations where metal found above acceptable limit	06
No. of Basins / Rivers where metal found above acceptable limit	03/04

Copper (Cu)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 50 µg/L of copper in drinking water. Out of total 6667 river water samples analysed, 12 samples from 11 water quality stations were found to have copper concentrations beyond the acceptable limit. The copper concentration varies from 0.000 to 294.25 µg/L. Maximum copper concentration (294.25 µg/L) was observed at Paramakudi water quality monitoring station on Vaigai River on 15.01.2025.

Cu Acceptable Limit as BIS 10500: 2012	50 µg/L
No. of Samples Tested	6667
No. of samples where metal found above acceptable limit	12
No. of Stations where metal found above acceptable limit	11
No. of Basins / Rivers where metal found above acceptable limit	06/10

Iron (Fe)

Bureau of Indian Standards (BIS) 10500:2012 has recommended the acceptable limit of 1.0 mg/L (1000 µg/L) for Iron. Out of total 6459 river water samples analysed, 409 samples from 209 water quality stations were found to have iron concentrations beyond the acceptable limit. The iron concentration varies from 0.000 to 43692.32 mg/L.

Maximum iron concentration (43692.32 mg/L) was observed at Kuthnaur water quality monitoring station on Yamuna River on 02.09.2025.

Fe Acceptable Limit as BIS 10500: 2012	1000 µg/L
No. of Samples Tested	6459
No. of samples where metal found above acceptable limit	409
No. of Stations where metal found above acceptable limit	209
No. of Basins / Rivers where metal found above acceptable limit	17/116

Lead (Pb)

Bureau of Indian Standards (BIS) 10500:2012 has recommended that the acceptable limit for lead is 0.01 mg/L or 10 µg/L in drinking water. Out of total 6549 river water samples analysed, 41 samples from 38 water quality stations were found to have lead concentrations beyond the acceptable limit. The lead concentration varies from 0.000 to 46.13 µg/L. Maximum lead concentration (46.13 µg/L) was observed at T Bekuppe water quality monitoring station on Arkavathi River on 21.11.2025.

Pb Acceptable Limit as BIS 10500: 2012	10 µg/L
No. of Samples Tested	6549
No. of samples where metal found above acceptable limit	41
No. of Stations where metal found above acceptable limit	38
No. of Basins / Rivers where metal found above acceptable limit	07/29

Mercury (Hg)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 1 µg/L of mercury in drinking water. Out of total 5120 river water samples analysed, 13 samples from 8 water quality stations were found to have mercury concentrations beyond the acceptable limit. The mercury concentration varies from 0.000 to 2.39 µg/L. Maximum mercury concentration (2.39 µg/L) was observed at Galeta water quality monitoring station on Hindon River on 03.11.2025.

Hg Acceptable Limit as BIS 10500: 2012	1 µg/L
No. of Samples Tested	**5120**
No. of samples where metal found above acceptable limit	**13**
No. of Stations where metal found above acceptable limit	**08**
No. of Rivers where metal found above acceptable limit	**04/08**

Nickel (Ni)

Ni Acceptable Limit as BIS 10500: 2012	20 µg/L
No. of Samples Tested	**6648**
No. of samples where metal found above acceptable limit	**66**
No. of Stations where metal found above acceptable limit	**50**
No. of Basins / Rivers where metal found above acceptable limit	**07/28**

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 20 µg/L of nickel in drinking water. Out of total 6648 river water samples analysed, 66 samples from 50 water quality stations were found to have nickel concentrations beyond the acceptable limit. The nickel concentration varies from 0.000 to 83.60 µg/L. Maximum nickel concentration (83.60 µg/L) was observed at Kuthnaur water quality monitoring station on Yamuna River on 02.09.2025.

Zinc (Zn)

Bureau of Indian Standards (BIS) 10500:2012 has recommended acceptable limit of 5 mg/L (5000 µg/L) of Zinc in drinking water. Out of total 6691 river water samples analysed, no sample is found to have zinc concentration beyond the acceptable limit. The zinc concentration varies from 0.000 to 2797.65 µg/L. Maximum zinc concentration (2797.65 µg/L) was observed at Bardoh (Chhapriyal) water quality monitoring station on Manawar Tawi River on 21.10.2025.

Zn Acceptable Limit as BIS 10500: 2012	**5000 µg/L**
No. of Samples Tested	**6691**
No. of samples where metal found above acceptable limit	**0**
No. of Stations where metal found above acceptable limit	**0**
No. of Basins / Rivers where metal found above acceptable limit	**0/0**

The analysis results of 767 water quality (WQ) monitoring stations spread across various river basins were considered for the study. All metals were found to be within the acceptable limits at 494 out of 767 monitored stations, while at 273 stations studied, at least one metal was found to be beyond the acceptable limit.

The overall summary of the results is as under:

Sl. No.	Trace & Toxic Metal	Acceptable limit as per BIS:10500, 2012 (in µg/L)	Total No. of samples analysed	No. of samples where metal found within acceptable limit	No. of samples where metal found above acceptable limit	% of samples where metal found above acceptable limit
1	Arsenic (As)	10	6660	6595	65	0.98
2	Cadmium (Cd)	3	6667	6660	7	0.10
3	Chromium (Cr)	50	6660	6653	7	0.11
4	Copper (Cu)	50	6667	6655	12	0.18
5	Iron (Fe)	1000	6459	6050	409	6.33
6	Lead (Pb)	10	6549	6508	41	0.63
7	Mercury (Hg)	1	5120	5107	13	0.25
8	Nickel (Ni)	20	6648	6582	66	0.99
9	Zinc (Zn)	5000	6691	6691	0	0.00

1. INTRODUCTION

Environmental pollution is a pervasive issue caused by a wide array of pollutants present in water, air, and soil. Of particular concern within this complex web of pollutants are "Heavy Metals," a category encompassing metallic and metalloid elements with densities ranging from 3.5 to 7 g/cm³. In modern parlance, the term 'heavy metal' has come to signify metallic chemical elements and metalloids that exert toxicity on both the environment and human health. Notably, some metalloids and even lighter metals, such as selenium, arsenic and aluminum, are classified as heavy metals due to their toxic properties, while certain heavy metals, such as gold, are typically non-toxic.

Heavy metals represent a prevalent source of pollution in both water and soil, and the increasing concentration of these metals in the environment has raised significant public concern due to their well-documented toxicity. While defining heavy metals can vary in the literature, they are generally characterized by a high atomic number, atomic weight, and a density exceeding 5.0 g/cm³. In a broader context, metals are intrinsic components of the Earth's crust, and some, such as copper, selenium, and zinc, are essential trace elements necessary to maintain human metabolism. However, when present in higher concentrations, they can exhibit toxic effects. On the other hand, certain metals like mercury, cadmium, and lead have direct toxic impacts on human health.

The roster of common toxic 'heavy metals' includes Beryllium (Be), aluminum (Al), chromium (Cr), manganese (Mn), iron (Fe), cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), arsenic (As), selenium (Se), molybdenum (Mo), silver (Ag), cadmium (Cd), tin (Sn), antimony (Sb), barium (Ba), mercury (Hg), thallium (Tl), and lead (Pb). These metals have been identified as subjects of substantial public health concern by the World Health Organization (WHO).

Over the course of the last few decades, there has been a notable surge in the concentration of these heavy metals within river water and sediments. This escalating presence has the potential to exert adverse effects on crops, including grains and vegetables, grown in soil and water tainted with these heavy metals. Consequently, this situation poses a significant threat to both human health and the environment due to the inherent toxicity, non-biodegradability, and propensity for bioaccumulation associated with heavy metals.

1.1 Sources of Metal Pollution

Heavy metals are naturally occurring elements found in the Earth's crust since the planet's formation. Various natural processes can contribute to heavy metal pollution, including volcanic activity, metal corrosion, metal evaporation from soil and water, sediment re-suspension, soil erosion, and geological weathering. However, the substantial increase in the use of heavy metals has led to a significant upsurge in these metallic substances in both terrestrial and aquatic environments. The proliferation of heavy metal pollution is primarily attributed to human activities, such as metal mining, smelting, foundries, and other metal-based industries. Additionally, heavy metals are introduced into the environment through agricultural practices, including leaching from sources like landfills, waste dumps, livestock and chicken manure, runoff from automobiles, and roadwork.

Due to their chemical properties, metals often persist in the environment, undergoing chemical transformations while accumulating in the food chain. These pollutants find their way into the environment through various human activities, including mining, refining, and electroplating industries. The effluents produced by these industries contain an array of heavy metals, including cadmium, copper, chromium, nickel, lead, and zinc. The subsequent release of these effluents into water bodies significantly contributes to the increasing presence of toxic heavy metals in aquatic environments. Heavy metals, with their high-water solubility, are readily absorbed by living organisms. Their mobility within natural water ecosystems and their toxicity to living organisms have led to their classification as major inorganic contaminants in surface and ground waters. Even when present in low, almost undetectable quantities, their resistance to degradation implies that, through natural processes such as bio-magnification, their concentration may elevate to levels that trigger toxic effects.

1.2 Metal Pollution from Mining and Processing Ores

The activities involved in mining, including excavation, ore extraction, and mineral processing, can, at times, result in environmental damage. For instance, mining operations have the potential to harm the environment by destroying habitats, farmland, and homes, causing soil erosion, and contaminating waterways with toxic discharge. Smelting processes, such as those that emit toxic materials like arsenic (As), selenium (Se), lead (Pb), cadmium (Cd), and sulfur oxides, can lead to significant air pollution.

Surface mining, while producing about eight times more waste compared to underground mining, can still present environmental challenges. Deep mining, on the other hand, may exacerbate issues, including seismic activity. When underground mines collapse, it not only poses risks to miners' lives but also results in surface subsidence, potentially causing infrastructure, such as roads and houses, to collapse. As easily accessible minerals become depleted, miners are forced to dig deeper to access these resources. A study by the National Academy of Science projected that copper (Cu) mining operations in the year 2000 would generate three times more waste per ton of copper output compared to similar activities in 1978.

The exposure of pyrite (FeS) and other sulfide minerals to atmospheric oxygen and moisture leads to their oxidation and the formation of acid-mine drainage water. The release of acid-mine drainage from active and abandoned mines, especially coal mines, is widely recognized for its negative impact on water quality. This drainage dissolves toxic elements from tailings and soils, carrying them into water bodies and even groundwater. Water quality issues often involve elevated levels of metals such as iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), nickel (Ni), and cobalt (Co). Ore processing, smelting, and refining operations can result in the deposition of substantial quantities of trace metals, including lead (Pb), zinc (Zn), copper (Cu), arsenic (As), and silver (Ag), into drainage basins or their direct discharge into aquatic environments.

1.3 Metal Pollution from Domestic Wastewater Effluents

Domestic wastewater effluents typically contain substantial quantities of trace metals derived from metabolic waste byproducts, the corrosion of water pipes - copper (Cu), lead (Pb), zinc (Zn), and cadmium (Cd), and household products, including detergents - iron (Fe), manganese (Mn), chromium (Cr), nickel (Ni), cobalt (Co), zinc (Zn), boron (B), and arsenic (As). In general, wastewater treatment processes remove less than 50% of the metal content from the influent, resulting in effluents with significant metal loads. Moreover, the sludge produced as a byproduct of wastewater treatment is also enriched with metals. In essence, domestic wastewater and the disposal of both domestic and industrial sludge constitute the primary anthropogenic sources of cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), and mercury (Hg) pollution.

1.4 Metal Pollution from Stormwater Runoff

Stormwater drainage from developed urban regions is a notable contributor to the introduction of metal pollutants into the receiving bodies of water. The specific makeup of metals present in urban runoff is contingent upon numerous variables, encompassing urban layout, vehicular traffic patterns, road construction materials, land usage, and the topographical and climatic attributes of the surrounding watershed.

1.5 Metal Pollution from Industrial Wastes and Discharges

In most cases, the levels of heavy metals in industrial effluents far exceed the allowable limits set for discharges into aquatic environments. Therefore, it is imperative to implement effective treatment measures for effluents containing these metals before releasing them into water bodies. The types of metals and their concentrations in industrial wastewater vary significantly based on the specific industry's activities and processes.

Table 1: Anthropogenic sources of heavy metals in the environment

Sl. No.	Pollutant	Major sources
1.	**Arsenic**	Arsenic containing fungicides, pesticides and herbicides, metal smelters, byproducts of mining activities, chemical wastes
2	**Cadmium**	Cadmium producing industries, electroplating, welding. By-products from refining of Pb, Zn and Cu, fertilizer industry,

Sl. No.	Pollutant	Major sources
		pesticide manufacturers, cadmium–nickel batteries, nuclear fission plants.
3	**Chromium**	Metallurgical and chemical industries, processes using chromate compounds, cement and asbestos units
4	**Copper**	Iron and steel industry, fertilizer industry, burning of wood, discharge of mine tailings, disposal of fly ash, disposal of municipal and industrial wastes are the sources of copper in the atmosphere
5	**Iron**	Cast Iron, Wrought Iron, steel, alloys, construction, transportation, machine manufacturing
6	**Lead**	Automobile emissions, lead smelters, burning of coal and oil, lead arsenate pesticides, smoking, mining and plumbing
7	**Mercury**	Mining and refining of mercury, organic mercurials used in pesticides, laboratories using mercury
8	**Nickel**	Metallurgical industries using nickel, combustion of fuels containing nickel additives, burning of coal and oil, electroplating units using nickel salts, incineration of nickel containing substances
9	**Zinc**	Zinc refineries, galvanizing processes, brass manufacture, metal plating, plumbing

1.6 Sanitary Landfills

Sanitary landfills, where waste is carefully disposed of, can still contribute to environmental issues. The metal content and average concentrations in leachates from these landfills are notable. Specifically, you will find copper (Cu) at an average concentration of 5 parts per million (ppm), zinc (Zn) at 50 ppm, lead (Pb) at 0.3 ppm, and mercury (Hg) at 60 parts per billion (ppb). These metals can leach into the surrounding soil and potentially contaminate groundwater, posing a concern for the quality of local water sources.

1.7 Agricultural Runoff

Agricultural runoff, which occurs when water flows over cultivated fields, can carry a range of metals into the environment. These metals often originate in the sediment and soils that have absorbed residues from plants and animals, as well as various agricultural inputs. This can include the presence of copper (Cu), zinc (Zn), and other metals stemming from fertilizers, herbicides, and fungicides. Additionally, the use of sewage and sludge as fertilizers can introduce metals like copper and zinc into the agricultural ecosystem. It's crucial to manage agricultural runoff to mitigate the impact of these metals on water quality and surrounding ecosystems.

1.8 Fossil Fuel Combustion

Fossil fuel combustion, a prevalent source of energy, can have significant consequences for water quality. When fossil fuels like coal, oil, and natural gas are burned for energy, they release various metals into the atmosphere. These metals can later deposit into natural waters, including lakes and rivers. This contamination can have harmful effects on aquatic ecosystems and human health. It is essential to monitor and mitigate the release of these airborne metals to safeguard the quality of natural waters and the well-being of the environment and communities.

2. TOXICITY OF TRACE & TOXIC METALS

Heavy metals may enter the human body through various routes, including food, water, and air, or they can be absorbed through the skin when individuals come into contact with them in agriculture and various settings, including manufacturing, pharmaceutical, industrial, or residential settings. Despite the long-standing awareness of the adverse health effects of heavy metals, exposure to these substances continues and, in some parts of the world, is even increasing. Consequently, the management of heavy metal contamination and the removal of toxic heavy metals from water have become pressing challenges for the twenty-first century.

Out of the 35 metals recognized as hazardous to human health, 23 are categorized as heavy metals: antimony, arsenic, bismuth, cadmium, cerium, chromium, cobalt, copper, gallium, gold, iron, lead, manganese, mercury, nickel, platinum, silver, tellurium, thallium, tin, uranium, vanadium, and zinc. Nevertheless, the most severe health risks associated with heavy metals are linked to exposure to lead, cadmium, mercury, and arsenic (classified as a metalloid but often considered a heavy metal). Substantial quantities of any of these metals can result in acute or chronic toxicity, leading to damage or impairment of mental and central nervous functions, alterations in blood composition, lung, kidney, liver damage, and damage to other vital organs. Prolonged exposure to these heavy metals can lead to slowly progressing physical, muscular, and neurological degenerative processes that mimic diseases such as Alzheimer's, Parkinson's, muscular dystrophy, and multiple sclerosis. Allergies are not uncommon, and repeated long-term contact with certain metals or their compounds may even lead to cancer.

The toxicity of heavy metals depends on a multitude of factors, including the specific metal present, its chemical properties, its biological role, the organism exposed, and the stage of the organism's life during exposure. When one organism is affected, it can disrupt the entire food chain. Given that humans typically occupy the top of the food chain, we are particularly vulnerable as we can accumulate higher levels of heavy metals due to their concentration increasing up the food chain. Both industrial and domestic waste is commonly discharged into sewage systems, which often contain high concentrations of heavy metals. These heavy metals are not readily broken-down during sewage treatment. Instead, they are either removed in the final effluent or retained in the sludge produced during the treatment process. The characteristics and pollutants in the sewage that enters water bodies depend on the level of sewage treatment in place. In response to the problems arising from the untreated release of sewage into rivers and seas, various regulations and improved technologies have been implemented. To mitigate the discharge of pollutants into our waters, it is imperative to establish stringent regulations and adopt advanced technologies.

Important issues related to selected toxic metals like occurrences in nature, sources of water pollution, toxic effects etc. are described here under:

2.1 Toxicity of Arsenic

Arsenic is a widely distributed element, ranking 20th in natural abundance, constituting approximately 0.00005% of the Earth's crust, 14th in seawater, and 12th in the human body (Mandal and Suzuki, 2002). Arsenic is found in various environmental compartments, including rocks, soil, water, air, and biota.

Arsenic occurs in the environment in various oxidation states, such as As(V), As (III), As (0), and As(-III). The chemical forms and oxidation states of arsenic are of particular significance in terms of toxicity. Inorganic forms are generally more toxic and mobile than organo-arsenic species, with arsenite (As(III)) considered to be more toxic than arsenate (As(V)). Research has indicated that As (III) is 4 to 10 times more soluble in water than As(V) (Squibb and Fowler 1983; Xu et al. 1988; Lambe and Hill 1996; US EPA, 2002). Moreover, it has been observed that As (III) is 10 times more toxic than As(V) and 70 times more toxic than Mono Methyl Arsonate (MMA(V)) and Di Methyl Arsinate (DMA(V)). However, trivalent methylated arsenic species, such as MMA(III) and DMA(III), have been found to be more toxic than inorganic arsenic because they are more effective at causing DNA damage (Styblo et al. 2000; Dopp et al. 2004). Arsenic can enter the human body through ingestion, inhalation, or skin absorption. Most ingested and inhaled arsenic is readily absorbed through the gastrointestinal tract and lungs into the bloodstream.

Individuals who consume arsenic-contaminated water often display arsenical skin lesions, which are a late manifestation of arsenic toxicity. Prolonged exposure to arsenic-contaminated water can lead to various diseases, including conjunctivitis, hyperkeratosis, hyperpigmentation, cardiovascular diseases, disturbances in the peripheral vascular and nervous systems, skin cancer, gangrene, leucomelanosis, non-pitting swelling, hepatomegaly, and splenomegaly (Kiping, 1977; WHO, 2001; Pershagen, 1983). Chronic symptoms resulting from long-term arsenic exposure are nonspecific, such as weight loss and chronic weakness. Prolonged exposure can lead to arsenicosis, cardiovascular diseases, skin lesions, and other organ function disorders (Bissen and Frimmel 2003). Arsenicosis is a chronic illness that arises from prolonged consumption of water with high arsenic levels over an extended period (Kapaj et al. 2006). Advanced stages of arsenic toxicity can manifest in effects on the lungs, uterus, genitourinary tract, and other parts of the body. Additionally, elevated concentrations of arsenic in drinking water have been linked to an increase in stillbirths and spontaneous abortions (Csanady and Straub, 1995).

2.2 Toxicity of Cadmium

Cadmium is a naturally occurring element in the Earth's crust, distributed uniformly at an estimated average concentration of between 0.10 and 0.50 µg/L. In nature, cadmium is found in various inorganic compounds and as complexes with naturally occurring chelating agents. Organo-cadmium compounds are highly unstable and have not been observed in the natural environment. Cadmium is produced during the extraction of zinc and finds applications in the plating industry, pigments, the manufacturing of plastic materials, batteries, and alloys. The contamination of water with cadmium results from industrial discharges and leaching from landfilled areas. Drinking water can also become contaminated when it passes through galvanized iron pipes or plated plumbing fittings used in water distribution.

Cadmium is considered highly toxic, ranking just below mercury in terms of its toxicity. Exposure to low levels of cadmium typically does not produce immediate health effects but can lead to severe health problems over extended periods. The gastrointestinal tract is the primary route of cadmium uptake in both humans and animals. Cadmium is toxic to humans, animals, microorganisms, and plants. However, only a small portion of cadmium intake is absorbed by the body, mainly accumulating in bones, the liver, and, in cases of chronic exposure, the kidneys. Recent evidence suggests that relatively low cadmium exposure may lead to skeletal damage, resulting in low bone mineral density (osteoporosis) and fractures. The toxicity of cadmium lies in its accumulation in soft tissues. Animal studies have indicated that cadmium may be a risk factor for cardiovascular disease (Jarup, 2003).

For acute exposure, absorbed cadmium can cause symptoms such as salivation, difficulty in breathing, nausea, vomiting, abdominal pain, anemia, kidney failure, and diarrhea. Inhalation of cadmium dust or smoke may lead to dryness of the throat, headache, chest pain, coughing, increased discomfort, and bronchial complications (Lu et al., 2007). Adverse health effects resulting from the ingestion or inhalation of cadmium include renal tubular dysfunction due to high urinary cadmium excretion, high blood pressure, lung damage, and lung cancer.

Furthermore, cadmium accumulates in the bodies of animals and humans throughout their lifespans. The liver and kidneys are the primary stations of cadmium accumulation. After inhalation or absorption through the gastrointestinal tract, cadmium is concentrated in the kidneys, where its half-life can exceed 10 to 20 years. One of the most well-documented toxic effects of cadmium poisoning is nephrotoxicity. Adverse renal effects are more commonly observed with exposure to low levels of cadmium. These effects are manifested by the excretion of low-molecular-weight plasma proteins, such as β2-microglobulin and retinol-binding protein (RBP).

A widely reported case of cadmium poisoning, known as “itai-itai byo”, occurred in Japan after World War II. Cadmium pollution from mining and refinery factories contaminated the Jinzo River water, which was used for irrigation. Rice grown in these cadmium-affected fields absorbed the metal, and people consumed it through water and the food chain, leading to osteomalacia and skeletal deformations. Severe pain in the body and joints prompted people to cry out "ITAI-ITAI" (it hurts-it hurts).

2.3 Toxicity of Chromium

Chromium can exist in various valence states, ranging from -2 to +6, but it is predominantly found in the environment in either the trivalent (Cr [III]) or hexavalent

(Cr [VI]) state. Trivalent chromium (Cr [III]) is the most common naturally occurring state. Small amounts of chromic oxide (Cr_2O_3) are typically present in most soils and rocks. In contrast, hexavalent chromium (Cr [VI]) is frequently found in nature as chromates (CrO_4^{2-}) and dichromates ($Cr_2O_7^{2-}$). These hexavalent forms are often a result of industrial and domestic emissions.

Chromium is unique as it is considered both an essential nutrient and a potential health hazard, primarily because it can exist in different oxidation states. Specifically, chromium in the +6 oxidation state, denoted as Cr(VI), is regarded as harmful, even in small quantities. In contrast, chromium in the +3 oxidation state, written as Cr (III), is considered essential for maintaining good health when consumed in moderate amounts. Chromium (III) is recognized as an essential nutrient for humans. Shortages of this form of chromium can lead to various health issues, including heart conditions, metabolic disruptions, and diabetes. Chromium (III) plays a crucial role in fat synthesis from glucose and the oxidation of fat to carbon dioxide. However, excessive intake of chromium (III) can also result in health effects, such as skin rashes.

Individuals who smoke tobacco are at an elevated risk of exposure to chromium. Chromium (VI) is recognized for its capacity to induce various health issues. When encountered in compounds used in leather products, it can trigger allergic reactions, leading to skin rashes. Inhalation of chromium (VI) can result in irritations of the nose, often leading to nosebleeds. Other health concerns associated with chromium (VI) exposure include:

- Skin rashes
- Discomfort in the stomach and the development of ulcers
- Respiratory complications
- Weakening of the immune system
- Damage to the kidneys and liver
- Genetic material alterations
- Increased risk of lung cancer
- Mortality

The extent of health risks stemming from chromium exposure is contingent upon its specific oxidation state. The metallic form of chromium, as found in particular products, generally poses low toxicity, whereas the hexavalent form is considered toxic. Adverse effects of hexavalent chromium on the skin may manifest as ulcerations, dermatitis, and allergic skin reactions. Inhalation of hexavalent chromium compounds can lead to ulceration and perforation of the mucous membranes within the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasms, and edema. Respiratory symptoms may include coughing, wheezing, shortness of breath, and nasal irritation.

Hexavalent chromium is also detrimental to plant and animal life, inducing symptoms such as the yellowing of leaves in crops like wheat and paddy. The World

Health Organization (WHO) has recommended a maximum permissible limit of 0.05 mg/L for chromium in drinking water to safeguard public health and ensure safe drinking water sources.

2.4 Toxicity of Copper

Copper stands as an essential micronutrient, as recognized in studies by Underwood (1977) and Goyer (1991). The Food and Nutrition Board (FNB) recommends an adult dietary copper intake of 1.53 mg/day (NRC, 1989). Copper exhibits three significant valence states: copper metal Cu(0), Cu(I), and Cu(II). In the natural world, copper manifests both as the pure metal and within minerals, with notable occurrences in cuprite (Cu_2O) and malachite ($Cu_2CO_3(OH)_2$). Predominantly, copper is present in ores, encompassing sulphides, oxides, and carbonates.

Copper serves a dual role, being both essential and potentially toxic to living organisms. In its essential role, copper is vital for processes like proper growth, cardiovascular health, lung flexibility, neuroendocrine functions, neovascularization, and iron metabolism. On average, an adult human consumes approximately 1 mg of copper daily through their diet, with roughly half of that amount being absorbed (Harris 1997). Copper is obligatory for enzymes that partake in aerobic metabolism, including cytochrome oxidase in mitochondria, lysyl oxidase in connective tissue, dopamine mono-oxygenase in the brain, and ceruloplasmin. Acting as a co-factor for apo-copper-zinc superoxide dismutase (apoCuZnSOD), copper offers protection against free-radical damage to proteins, cell membrane lipids, and nucleic acids in a broad range of cells and organs.

While severe copper deficiencies are relatively rare in humans, they can lead to a spectrum of health issues, encompassing mental retardation, anemia, hypothermia, neutropenia, diarrhea, cardiac hypertrophy, bone fragility, impaired immune function, weakened connective tissue, compromised central-nervous-system (CNS) functions, peripheral neuropathy, and alterations in skin, fur (in animals), or hair color (Linder and Goode 1991; Uauy et al. 1998; Cordano 1998; Percival 1998).

Long-term exposure to elevated copper levels can induce irritations of the nose, mouth, and eyes, causing symptoms such as headaches, stomachaches, dizziness, vomiting, and diarrhea. Intentional high copper intake may lead to liver and kidney damage and, in extreme cases, fatal outcomes. The carcinogenic potential of copper remains undetermined, but there are scientific reports suggesting a correlation between long-term exposure to high copper concentrations and a decline in intelligence among young adolescents, a subject warranting further investigation. Industrial exposure to copper fumes, dust, or mists may lead to a condition known as metal fume fever, characterized by atrophic changes in nasal mucous membranes. Chronic copper poisoning can result in Wilson's disease, marked by hepatic cirrhosis, brain damage, demyelination, renal complications, and copper deposition in the cornea.

Moreover, excessive amounts of copper sulfate can negatively impact the botanical environment. In its ionic form, copper is highly toxic to the photosynthesis of green algae such as Chlorella pyrenoidosa and diatoms like Nitzchiz palea, even at concentrations typically found in natural waters. Soils in regions where copper fungicides are repetitively employed, notably in vineyards and orchards, may accumulate copper over time. This underlines the dual nature of copper: essential for life and health but also capable of causing adverse effects when in deficiency or excess.

2.5 Toxicity of Mercury

Mercury (Hg) is the only common metal that is liquid at room temperature. Mercury occurs naturally in the earth's crust. Although it may be found in air, water and soil, mercury is mostly present in the atmosphere as a gaseous element. Mercury's major natural source results from the degassing of the earth's crust, emissions from volcanoes and evaporation from natural bodies of water. Mining of metals also causes indirect mercury discharges to the atmosphere. Due to its long lifetime of approximately of 1 year in the atmosphere, mercury's dispersion, transport and deposition in the environment will cause harmful effects on ecosystems and human health. Mercury may be present in the environment in several forms: elemental or metallic mercury, inorganic mercury compounds and organic mercury compounds. Pure mercury is a volatile liquid metal. It has traditionally been used in products like thermometers, switches, barometers and instruments for measuring blood pressure. Mercury is naturally present in many rocks including coal. When coal is burned, mercury is released into the environment. For this reason, coal-burning power plants are one of the largest anthropogenic sources of mercury emissions to the air, in addition to all domestic human-caused mercury emissions. Burning hazardous wastes, producing chlorine, breaking mercury products, and spilling mercury, as well as the improper treatment and disposal of products or wastes containing mercury, can also contribute to its release into the environment (EPA, 2009). Mercury compounds are produced in small quantities for chemical and pharmaceutical applications. In ancient Greece mercury was used as a cosmetic to lighten the skin (Jarup, 2003): in some sub-Saharan African countries the use of cosmetic products to bleach or to lighten the skin is still frequent. The long term use of some pharmacologic compounds (hydroquinone, glucocorticoids and mercury) can cause severe health adverse effects (Jarup, 2003). Large quantities of mercury compounds are still used for amalgamation in illegal gold mining, in some developing countries. Anthropogenic sources of mercury and its compounds may result basically from the same sources as enunciated for Cadmium. In addition, underground mining, mining quarrying, opencast and, production of phytopharmaceutical products and biocides, pharmaceutical industry, landfills, urban waste treatment plants, industrial waste-water treatment plants, etc. (E-PRTR, 2010) also add to the list of sources of mercury.

Exposure to mercury may mainly occur as a consequence of the deposition from air into water or into soil. By natural biological processes certain microorganisms can change mercury into methyl mercury, a highly toxic and stable form that builds up in fish, shellfish and animals that eat fish, accumulating in the food chain. General population is exposed to methyl mercury through the food chain; fish and shellfish are the main source of exposure through the ingestion pathway (EPA, 2009). Breathing mercury vapor is another possible exposure pathway. This can occur when elemental mercury or products that contain elemental mercury break and release mercury into air, in especial in indoor spaces without enough ventilation. Nevertheless, the main exposure pathway is through food chain and not by inhalation (EPA, 2009). High level of mercury can cause harmful effects, such as nerve, brain and kidney damage, lung irritation, eye irritation, skin rashes, vomiting and diarrhea. Mercury has a number of effects on humans that can be simplified into the following main effects:

- Disruption of the nervous system
- Damage to brain functions
- DNA damage and chromosomal damage
- Allergic reactions, resulting in skin rashes, tiredness and headaches
- Negative reproductive effects, such as sperm damage, birth defects and miscar-riages

Damaged brain functions can cause degradation of learning abilities, personality changes, tremors, vision changes, deafness, muscle in coordination and memory loss. High levels of methylmercury in the bloodstream of little children may affect nervous system, affecting the normal thinking and learning (EPA, 2009). Chromosomal damage is known to cause mongolism. In Japan, human illness and death occurred in the 1950's among fisherman who ingested fish, crabs and shellfish contaminated with a simple alkali mercury compound from Japanese coastal industries. This mercury poisoning produced a crippling and often fatal disease known as "Minamata" disease. In minamata episode, crabs contained as much as 24 ppm, while kidney's from human victims contained 144 ppm. Chloro-alkali plants and primary mercury processing plants are known to emit mercury into the atmosphere in sufficient quantities to create a public health problem. Poisoning of mercury may cause anxiety, insomnia, muscular tremor and other psychological disturbances. Research work with plants has shown that mercury can produce genetic and chromosomal changes (Liptak, 1974).

2.6 Toxicity of Iron

Iron is essential for the well-being of nearly all life forms, ranging from micro-organisms to humans. As the fourth most abundant element in the Earth's crust, and the most prevalent heavy metal, iron mainly exists in the environment as either Fe (II) or Fe (III). In surface waters, iron typically takes the form of Fe (III) when the pH level exceeds 7, with most of these salts being insoluble. They settle out or are adsorbed onto surfaces, resulting in relatively low iron concentrations in well-aerated waters. However, under reducing conditions found in groundwater, certain lakes, reservoirs, and environments devoid of sulfides and carbonates, higher concentrations of soluble Fe(II) may emerge. The presence of iron in natural waters is attributed to processes such as rock and mineral weathering, acidic mine water drainage, landfill leachates, sewage effluents, and iron-related industries.

Iron is an indispensable component of human nutrition, playing a vital role in cytochromes, porphyrins, and metalloenzymes. Dietary iron needs vary by age and sex, with older infants, children, and menstruating women being particularly susceptible to iron deficiency. In the plant kingdom, iron is essential for metabolic processes. It is crucial for the synthesis of chlorophyll in green plants, although it is not part of the chlorophyll molecules. Most iron in plants exists within organic compounds, enzymes, and plays key roles in cellular metabolism, encompassing catalase, peroxidase, and cytochromes. Iron deficiencies in plants result in chlorosis, and it's known for its immobility within plant tissues.

Iron exists in the human body in both ionic (loosely bound, inorganic iron) and nonionic (tightly bound, organic form) states. Notably, it is a constituent of the hemoglobin molecule. Iron deficiency is linked to an increased susceptibility to lead poisoning, particularly among children. A deficiency in iron, along with other trace elements, can lead to pica, characterized by cravings for unusual or non-nutritive substances such as clay, chalk, ashes, or bricks, and it's commonly seen in individuals with hysteria, during pregnancy, or in cases of chlorosis. Iron deficiency can also affect the transport of lead within the body.
According to Dr. Ronald Hoffman, daily iron requirements vary by age, sex, and body weight, with recommendations as follows:

- Infants up to 6 months: 6 mg/day.
- Children from 6 months to 1 year: 10 mg/day.
- Children aged 1 to 10 years: 10 mg/day.
- Males aged 11 to 18 years: 12 mg/day.
- Males aged 19 to 51+ years: 10 mg/day.
- Females aged 11 to 50 years: 15 mg/day.
- Females over 51 years: 10 mg/day.
- Pregnant women: 30 mg/day.
- Lactating women: 15 mg/day.

While iron is essential in normal quantities, excessive iron intake can adversely affect the human system and may lead to conditions like hemochromatosis. Iron absorption is enhanced by factors like heme, ascorbic acid, and amino acids but is inhibited by tannins, calcium, phosphate, phytic acid, and dietary fibers.

In the human body, iron is central to life processes, with over half of it present in the form of hemoglobin, while the rest is stored mainly in the liver. Nutritional anemia, particularly iron-deficiency anemia, is a widespread deficiency condition worldwide. This condition often results from insufficient iron intake, and it is a significant public health concern in countries like India, affecting more than half of ever-married women. Addressing this issue is of utmost importance.

Natural water often contains iron in ferric and ferrous forms, with the ferric form predominating in most cases. The form of iron can change due to oxidation or reduction resulting from bacterial growth during water storage. Iron in water can be present in true solution, a colloidal state, or as relatively large suspended particles. Determining iron levels is crucial for evaluating the extent of corrosion and assisting in finding solutions to these problems. Research on corrosion and corrosion control involves various tests to assess metal loss, with iron determination being one of the most important (Sawyer, 1978). In drinking water, the highest desirable limit for iron is 1.0 mg/L.

2.7 Toxicity of Lead

Lead is among the most common heavy elements, with various stable isotopes found in nature. Notably, 208Pb is the most prevalent. Lead is primarily utilized in the production of lead-acid batteries, solder, and various alloys. Organo-lead compounds, such as tetraethyl and tetramethyl lead, were historically used as antiknock and lubricating agents in petrol, although many countries are phasing out their use for these purposes. With the diminishing use of lead-containing additives in petrol and lead-containing solder in the food processing industry, airborne and dietary lead concentrations are decreasing. As a result, the intake of lead from drinking water has become a more significant contributor to overall exposure.

Lead's toxic properties have been recognized for over two thousand years. The early Greeks used lead as a glazing material for ceramic pottery and discovered its harmful effects when it came into contact with acidic foods. There is evidence to suggest that some Roman emperors suffered illness and even death due to lead poisoning resulting from the consumption of wines contaminated with high levels of lead.

Lead is present in all human tissues and organs but is not required for nutritional purposes. It is considered a systemic poison because once it enters the bloodstream, it distributes throughout the body, affecting various organs and tissues. Lead inhibits hematopoiesis (the formation of blood or blood cells) by interfering with heme synthesis, potentially leading to anemia. It also impacts the kidneys by inducing renal tubular dysfunction, which can result in secondary complications. Gastrointestinal effects of lead poisoning include nausea, anorexia, and severe abdominal cramps (known as lead colic), often associated with constipation. Lead poisoning can also manifest as muscle and joint pain, lung damage, breathing difficulties, and conditions such as asthma, bronchitis, and pneumonia. Additionally, lead exposure can harm the immune system, impeding cell maturation and skeletal growth. Lead can cross the placental barrier and reach the fetus, increasing the risk of miscarriage, abortions, and stillbirths.

According to the CDC, lead poisoning is the most common and severe environmental health issue affecting young children. Children are more vulnerable to lead exposure than adults due to their rapid growth rate and higher metabolism. Children absorb more lead from the gastrointestinal tract (25% vs. 8% in adults), with ingested lead distributed to a smaller tissue mass. Children are also more likely to play and breathe closer to the ground, where lead dust accumulates. A significant problem arises from children ingesting lead-based paint flakes, accounting for up to 90% of childhood lead poisoning cases. The primary health concern in children exposed to lead is intellectual and brain damage, and high-level exposure can even be fatal. Plants grown in lead mining areas are known to accumulate high lead levels. Vegetation near highways can accumulate atmospheric dust containing lead as foliar deposits, originating from petrol combustion and absorption from soil.

2.8 Toxicity of Nickel

Nickel, the 24th most abundant element, accounting for approximately 0.008% of the Earth's crust, is a natural constituent of soil and water (Alloway 1995; Hostynek and Maibach 2002; Hedfi et al. 2007). It ranks as the 5th most abundant element in the biosphere and was initially discovered through the extraction of other metals. Principal nickel ores include nickelite (NiAs), millerite (NiS), and pentlandite ([Ni, Fe]S).

Nickel enters the environment from a range of natural and anthropogenic sources. Among industrial contributors, a significant portion of environmental nickel arises from the combustion of coal, oil, and other fossil fuels. Additional industrial sources of nickel emissions encompass mining and refining processes, nickel alloy production (steel), electroplating, and municipal waste incineration (Sharma 2005; Ensink et al. 2007). Wastewater discharged from municipal sewage treatment plants further adds to the accumulation of environmental nickel (van der Hoek et al. 2002).

While nickel is essential in small quantities, excessive uptake poses health risks to humans. Exposure to nickel can occur through air inhalation, water consumption, food intake, or smoking. Skin contact with nickel-contaminated soil or water can also lead to nickel exposure. One of the most prevalent modes of nickel exposure for the general public is through direct skin contact with nickel-plated materials. Notably, $Ni(CO)_4$ gas stands out as the most toxic compound among nickel compounds, with documented cases of fatalities in refineries. Initial symptoms include headaches, nausea, weakness, dizziness, vomiting, and epigastric pain, with a latency period of 1 to 5 days. Subsequent symptoms encompass chest constriction, chills, sweating, shortness of breath, coughing, muscle pains, fatigue, gastrointestinal discomfort, and in severe cases, convulsions and delirium.

Nickel fumes are known respiratory irritants and can lead to pneumonitis. Exposure to nickel and its compounds may result in the development of dermatitis referred to as "nickel itch" in sensitized individuals. Typically, itching appears up to 7 days before the onset of skin eruptions. Primary skin eruptions are erythematous or follicular and may progress to skin ulceration. Once acquired, nickel sensitivity appears to persist indefinitely. High-level occupational exposure has been associated with renal problems, vertigo, and dyspnoea (Commission of European Communities, 1976). Nickel, along with certain nickel compounds, has been classified by the National Toxicology Program (NTP) as having potential carcinogenic effects. The International Agency for Research on Cancer (IARC) categorizes nickel compounds within group 1 (indicating sufficient evidence of carcinogenicity in humans) and nickel within group 2B (representing agents that are possibly carcinogenic to humans).

2.9 Toxicity of Zinc

Zinc, the twenty-fifth most abundant element, constitutes approximately 0.02% of the Earth's crust by weight (Budavari, 1989). In its natural state, zinc typically appears dull grey due to its coating with oxide or basic carbonate, making it rare to find free zinc metal in nature (Beliles, 1994). Sphalerite, smithsonite, hemimorphite, and franklinite serve as the primary sources of zinc, with erosion being the largest natural contributor to zinc emissions in water. Zinc naturally enters the air mainly through igneous emissions and forest fires. Anthropogenic and natural sources contribute to zinc emissions to a similar extent, with key human-made sources including mining, zinc production facilities, iron and steel production, corrosion of galvanized structures, coal and fuel combustion, waste disposal and incineration, as well as the use of zinc-containing fertilizers and pesticides.

Zinc is an essential element for both animals and humans, playing a vital role in various enzyme systems. Reports of nutritional zinc deficiency in humans have emerged from various countries, with Egypt documenting an endemic zinc deficiency syndrome among young men (Prasad, et al., 1961; Halsted et al., 1972). This syndrome is characterized by stunted growth, signs of immaturity, and anemia, which are likely due to reduced intestinal zinc absorption. The condition was observed to be fully treatable with the administration of substantial doses of zinc sulfate.

Acute zinc toxicity can occur when excessive amounts of zinc salts are ingested, either accidentally or deliberately, such as through the use of zinc-containing emetics or dietary supplements. Vomiting is likely to ensue after the consumption of more than 500 mg of zinc sulfate. Instances of mass poisoning have been reported when acidic beverages were stored in galvanized containers, with symptoms including fever, nausea, vomiting, stomach cramps, and diarrhea occurring 3–12 hours after ingestion. Food poisoning attributed to the use of galvanized zinc containers in food preparation has also been documented. Symptoms in such cases arose within 24 hours and included nausea, vomiting, and diarrhea, occasionally accompanied by bleeding and abdominal cramps.

Symptoms of zinc toxicity in humans encompass vomiting, dehydration, electrolyte imbalances, abdominal pain, nausea, lethargy, dizziness, and impaired muscular coordination (Prasad and Oberleas, 1976). Reports of acute renal failure resulting from zinc chloride ingestion have also been documented (Csata, 1968). Unlike substances such as mercury (Hg), lead (Pb), or cadmium (Cd), zinc is an essential trace element for organisms, playing a crucial role in various physiological and metabolic processes. However, at high concentrations, zinc can become toxic to organisms.

Zinc is an essential trace element for both plants and animals, including humans, playing vital roles in various metabolic processes. Common effects of zinc poisoning in humans include non-fatal 'metal fume' fever from inhaling zinc oxide fumes and illnesses resulting from the consumption of acidic foods prepared in zinc galvanized containers. Specifically, zinc chloride in zinc salts can cause dermatitis upon skin contact.

3. WATER QUALITY CRITERIA

It is widely acknowledged that accessible sources of water on our planet are finite, and any form of pollution in these sources further diminishes their availability. Polluted water poses inherent health risks and cannot be safely used for drinking. Water with elevated salt levels is unsuitable for agricultural purposes and most industrial applications. Water quality also has a profound impact on the aesthetic and economic aspects of water bodies, affecting marine and freshwater ecosystems. Nevertheless, water that may not meet the standards for irrigation can often be suitable for industrial cooling. Every application of water necessitates a minimum quality standard concerning the presence of dissolved and suspended materials, encompassing both chemical and biological constituents. Ensuring this desirable water quality standard is essential to prevent harm to end-users.

The need to uphold a minimum quality standard for various water uses has led to the development of water quality criteria and water quality standards. Water quality criteria represent specific requirements that serve as the basis for making decisions or judgments to support a particular use. These criteria for different uses are established based on experimental data and our current understanding of health, ecological, and other considerations, considering their overall economic impact. It's crucial to note that these criteria are not rigid, but rather subject to adjustment as scientific knowledge evolves and more data is collected. The term "standard" refers to a specific principle or guideline set by an authority to restrict the concentration of various constituents in water, ensuring the safe utilization of water and safeguarding the environment.

3.1 Drinking Water Standards

Considering that people directly use water for drinking, providing water for domestic use is the most important purpose, and ensuring safe drinking water is the top priority in the National Water Policy. In India, organizations like the Bureau of Indian Standards (BIS) and the Indian Council of Medical Research (ICMR) have created rules for what is safe to drink. The World Health Organization (WHO) has also set international rules for safe drinking water. Below, we list the rules for safe levels of certain metals in drinking water based on the BIS code 10500:2012, in Table 2.

Table 2: Drinking Water Standards for Trace & Toxic metals (BIS-10500:2012)

S. No.	Toxic metal	Requirement (Acceptable Limit)		Permissible Limit in the Absence of Alternative Source	
		(mg/L)	(µg/L)	(mg/L)	(µg/L)
1	**Total arsenic as As**	0.01	10	No Relaxation	
2	**Cadmium as Cd**	0.003	3	No relaxation	
3	**Total Chromium as Cr**	0.05	50	No relaxation	
4	**Copper as Cu**	0.05	50	1.5	1500
5	**Iron as Fe**	1.0	1000	No relaxation	
6	**Lead as Pb**	0.01	10	No relaxation	
7	**Nickel as Ni**	0.02	20	No relaxation	
8	**Zinc as Zn**	5	5000	15	15000

3.2 Regulatory Limits of Heavy Metals US Environmental Protection Agency (US EPA)

Various toxic heavy metals often contaminate surface water sources, and the maximum levels allowed, as per WHO and US EPA standards, are detailed in Table 3. These limits are compulsory for all water supply systems. In many cases, naturally occurring water, whether from surface or groundwater sources, contains some of these heavy metals at concentrations that are 100 to 1000 times higher than the recommended MCL values. As these heavy metals have various industrial uses, it becomes more important to focus on their removal, recovery, and recycling.

Table 3: Maximum acceptable limits of several toxic heavy metal ions based on WHO and US EPA regulations

Heavy Metal	Toxicity rank	WHO (µg/L)	USEPA (µg/L)
Arsenic	1	10	10
Lead	2	10	15
Mercury	3	6	2
Cadmium	7	3	5
Chromium	78	50	100
Nickel	57	70	100
Zinc	74	NGL	5000
Copper	120	2000	1300
Iron	-	-	300
Note: NGL = NO Guideline			

Based on data from human clinical studies and a range of other research, including animal experiments, governmental authorities have established drinking water standards. A concise overview of these standards can be found in Table 4, compiled by Hattingh in 1977.

Table 4: Drinking water quality criteria for trace metals which might affect public health

Parameter (unit-µg/L)	USPHS (1962)	Japan (1968)	USSR (1970)	WHO European (1970)	WHO Intern. (1971)	SABS (1971)	NAS (1972)	Australia (1973)	US EPA (1975)	FRG (1975)		BIS 10500:2012
Arsenic	10	50	50	50	50	50	100	50	50	40		10
Barium	1,000	-	4,000	1,000	-	-	1,000	1,000	1,000	-		700
Cadmium	10	-	10	10	10	50	10	10	10	6		3
Chromium	50	50	100	50	-	50	50	50	50	50		50
Copper	1,000	10,000	100	50	50	1,000	1,000	10,000	-	-		50
Lead	50	100	100	100	100	50	50	50	50	40		10
Mercury	-	1	5	-	1	-	2	-	2	4		1
Selenium	10	-	1	10	10	-	10	10	10	8		10
Silver	50	-	-	-	-	-	-	50	50	-		100
Zinc	5,000	100	1,000	5,000	5,000	5,000	5,000	5,000	-	2,000		5000

World Health Organisation (WHO)
US Public Health Service (USPHS)
South African Bureau of Standards (SABS)
Russisa (USSR)
USA National Academy of Sciences (NAS)
Australia, Japan and Environmental Protection Agency (EPA) of the USA

It is important to mention that maximum permissible concentrations (USSR) and threshold limit values (US) have been defined for occupational hygiene (as indicated by Roschin and Timofeevskaya in 1975). These values are primarily related to regulating workplace exposure to airborne particles and are not directly relevant to our current discussion.

3.3 Quality Criteria for Livestock

A safe water supply is vital for maintaining healthy livestock. Contaminated water has the potential to adversely affect the growth, reproduction, and overall productivity of animals, as well as the safety of animal products intended for human consumption. Moreover, polluted water sources for livestock and poultry have the potential to contaminate human drinking water supplies. As a result, it is essential to safeguard farm water sources from contamination by harmful agents like bacteria, nitrates, sulfates, and pesticides. While the Environmental Protection Agency has established drinking water standards for human consumption, there are currently no specific standards in place for drinking water provided to livestock or poultry. However, The National Academy of Sciences has issued recommendations for maximum allowable levels of certain contaminants.

The acceptable daily intake of various substances greatly depends on their concentrations and the overall water quality consumed. Animals' daily water requirements can vary based on several factors, including temperature, humidity, the water content of their food, their level of physical activity, and the salinity of the water source. Consequently, the recommended concentration levels for specific substances are determined considering these typical usage conditions. Excessive salinity in the drinking water provided to livestock can disrupt the animals' water balance and may even lead to fatalities. Elevated levels of certain ions in the water can result in health issues and potentially be fatal for animals. The National Academy of Sciences has established upper limits for toxic substances present in water (see Table 5).

Table 5: Recommendations for levels of toxic substances in drinking water for livestock

Sr.	Toxic metal	Upper Limit in mg/L	Sr.	Toxic metal	Upper Limit in mg/L
1.	Arsenic	0.2	5.	Iron as Fe	-
2.	Cadmium as Cd	0.05	6.	Mercury as Hg	0.01
3.	Chromium as Cr	1.0	7.	Zinc as Zn	24
4.	Copper as Cu	0.5			

Sources: Environmental Studies Board, Nat. Acad. Of Sci., Nat Acad of Eng., Water Quality Criteria, 1972
Ayers, R.S. and D.W. Wescot, Water Quality for Agriculture, Food and Agriculture Organization of the United Nations, Rome, 1976

3.4 Water Quality for Irrigation

Most water sources naturally contain dissolved salts and trace elements, with many of these substances originating from the Earth's surface weathering processes. Furthermore, water quality can be influenced by drainage from irrigated farmlands and the discharge of sewage and industrial wastewater from urban areas. In the context of irrigation, salinity levels are usually the primary concern, as high salt concentrations can have adverse effects on both soil structure and crop yields. Nevertheless, irrigation water can also contain various trace elements that may limit its suitability for agriculture.

The required quality of irrigation water can vary significantly based on factors such as salinity, soil permeability, toxicity, and other considerations like excessive nitrogen content or unusual water pH. Some elements in irrigation water can directly harm crops. Determining toxicity thresholds in water is a complex task due to chemical reactions that occur when the water interacts with the soil. When an element is introduced to the soil through irrigation, it can either be neutralized through chemical reactions or accumulate in the soil until it reaches harmful levels. If water contains a certain element at a specific concentration, it may cause immediate harm to crops through foliar effects, particularly when sprinkler irrigation is employed. Alternatively, in the case of furrow irrigation, it might take several years for the element to accumulate to toxic levels, or it could become immobilized in the soil, never reaching harmful concentrations. The recommended water quality standards for irrigation are outlined in Table 6.

Table 6: Recommended limits for constituents in reclaimed water for irrigation

Constituent	Long-term use (mg/L)	Short-term use (mg/L)	Remarks
Aluminum (Al)	5.00	20	Can cause nonproductivity in acid soils, but soils at pH 5.5 to 8.0 will precipitate the ion and eliminate toxicity.
Arsenic (As)	0.10	2.0	Toxicity to plants varies widely, ranging from 12 mg/L for Sudan grass to less than 0.05 mg/L for rice.
Beryllium (Be)	0.10	0.5	Toxicity to plants varies widely, ranging from 5 mg/L for kale to 0.5 mg/L for bush beans.
Boron (B)	0.75	2.0	Essential to plant growth, with optimum yields for many obtained at a few-tenths mg/L in nutrient solutions. Toxic to many sensitive plants (e.g., citrus) at 1 mg/L. Most grasses relatively tolerant at 2.0 to 10 mg/L.
Cadmium (Cd)	0.01	0.05	Toxic to beans, beets, and turnips at concentrations as low as 0.1 mg/L in nutrient solution. Conservative limits recommended.
Chromium (Cr)	0.1	1.0	Not generally recognized as essential growth element. Conservative limits recommended due to lack of knowledge on toxicity to plants.
Cobalt (Co)	0.05	5.0	Toxic to tomato plants at 0.1 mg/L in nutrient solution. Tends to be inactivated by neutral and alkaline soils.
Copper (Cu)	0.2	5.0	Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solution.
Fluoride (F)	1.0	15.0	Inactivated by neutral and alkaline soils.
Iron (Fe)	5.0	20.0	Not toxic to plants in aerated soils, but can contribute to soil acidification and loss of essential phosphorus and molybdenum.
Lead (Pb)	5.0	10.0	Can inhibit plant cell growth at very high concentrations.
Lithium (Li)	2.50	2.50	Tolerated by most crops at up to 5 mg/L; mobile in soil. Toxic to citrus at low doses recommended limit is 0.075 mg/L.
Manganese (Mg)	0.2	10.0	Toxic to a number of crops at a few-tenths to a few mg/L in acid soils.
Molybdenum (Mo)	0.01	0.05	Nontoxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high levels of available molybdenum.
Nickel (Ni)	0.2	2.0	Toxic to a number of plants at 0.5 to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Selenium (Se)	0.02	0.02	Toxic to plants at low concentrations and to livestock if forage is grown in soils with low levels of added selenium.
Vanadium (V)	0.1	1.0	Toxic to many plants at relatively low concentrations.
Zinc (Zn)	2.0	10.0	Toxic to many plants at widely varying concentrations; reduced at increased pH (6 or above) and in fine textured or organic soils.

Source: Rowe and Abdel-Magid, 1995

4. WATER QUALITY MONITORING BY CWC

Central Water Commission (CWC) is playing an important role in the field of water quality monitoring of river water and is observing water quality at various rivers since 1960's. As on January, 2025, CWC is observing water quality at 788 key locations in different rivers across the country: 678 on Hydrological Observation network and 110 Water Quality Sampling Stations (WQSS). In addition, CWC has started monitoring of water quality of water bodies across India since 01.03.2023. Till date, 88 water bodies have been identified for water quality monitoring purpose across various states of the country. The GIS map of the above-mentioned water quality stations monitored by CWC is given as Figure 1.

The details of distribution of WQ stations among different states of India can be seen in Table 7 and Figure 2. Details of distribution of WQ stations among 14 organisations of CWC are represented in Table 8 and Figure 3; and distribution among 23 basins of CWC is represented in Table 9 and Figure 4.

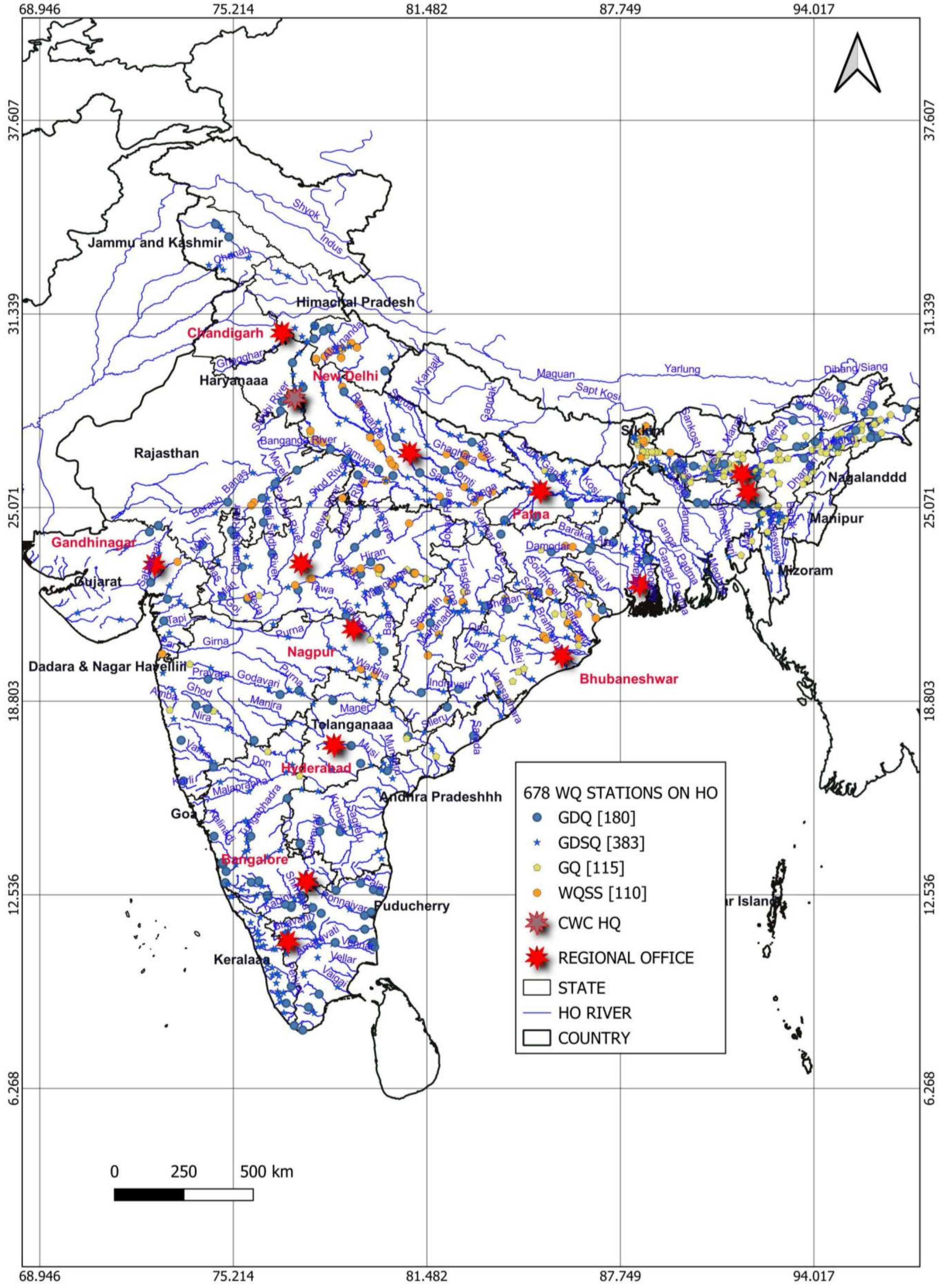

***Figure 1**: Water quality network of CWC (01.01.2025)*

Table 7: State–wise distribution of Water Quality Stations of CWC

Sl. No.	State/UT	GDQ	GDSQ	GQ	WQSS	Water Bodies	Total
1	Andhra Pradesh	5	14	2	-	7	28
2	Arunachal Pradesh	11	9	10	-	3	33
3	Assam	20	26	54	-	11	111
4	Bihar	6	22	1	-	2	31
5	Chhattisgarh	3	18	2	9	4	36
6	Delhi	1	2	-	3	3	9
7	Gujarat	4	9	-	2	6	21
8	Haryana	3	1	-	-	-	4
9	Himachal Pradesh	-	6	-	-	1	7
10	Jammu & Kashmir	2	7	-	-	2	11
11	Jharkhand	6	6	1	7	2	22
12	Karnataka	15	25	2	-	4	46
13	Kerala	2	24	-	-	3	29
14	Madhya Pradesh	18	26	4	12	2	62
15	Maharashtra	12	30	4	6	10	62
16	Manipur	-	-	1	-	-	1
17	Meghalaya	5	3	1	-	2	11
18	Mizoram	-	5	-	-	-	5
19	Odisha	5	22	9	14	4	54
20	Puducherry	3	-	-	-	-	3
21	Rajasthan	8	8	-	2	1	19
22	Sikkim	-	11	5	6	1	23
23	Tamil Nadu	21	21	-	-	5	47
24	Telangana	4	8	1	-	4	17
25	Tripura		3	2	-	1	6
26	Uttar Pradesh	13	48	4	30	6	101
27	Uttarakhand	5	8	1	15	3	32
28	West Bengal	8	21	11	4	3	47
29	**Total**	**180**	**383**	**115**	**110**	**90**	**878**
	Grand Total	**788**				**90**	**878**

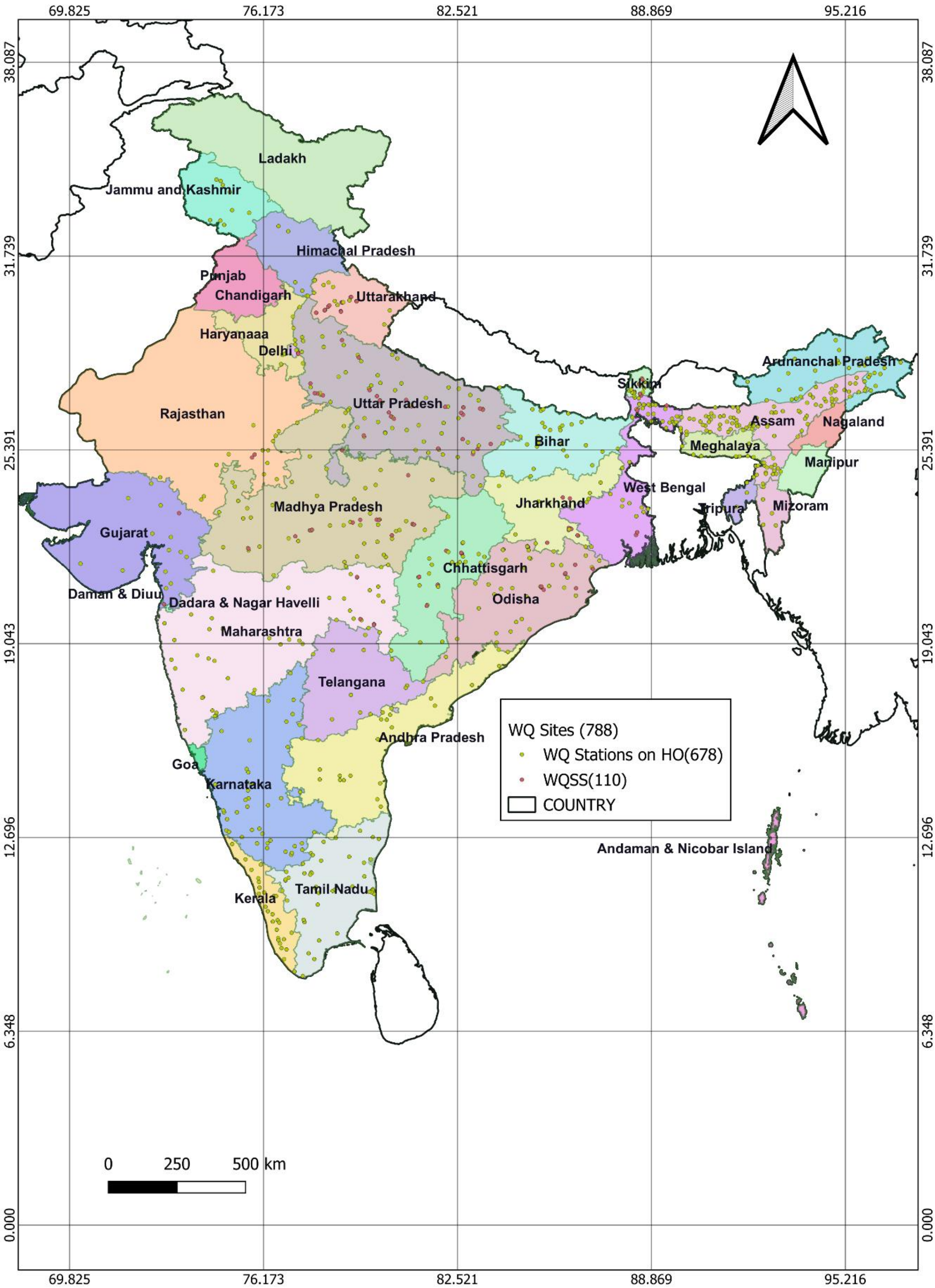

Figure 2: State-wise distribution of Water Quality Stations monitored by CWC

Table 8: Organisation–wise distribution of Water Quality Stations of CWC

Sl. No.	Organisation	GDQ	GDSQ	GQ	WQSS	Water Bodies	Total
1	Barak and Other Basins Organisation, Shillong	7	22	8	-	4	41
2	Brahmaputra Basin Organisation, Guwahati	28	24	59	-	13	124
3	Cauvery and Southern rivers Organisation, Coimbatore	35	53	-	-	11	99
4	Indus Basin Organisation, Chandigarh	2	9	-	-	3	14
5	Krishna & Godavari Basin Organisation, Hyderabad	18	35	7	-	15	75
6	Lower Ganga Basin Organisation, Patna	9	33	1	6	5	54
	Monitoring Central Organisation, Nagpur	4	20	1	6	5	36
7	Mahanadi and Eastern Rivers Organisation, Bhubaneswar	7	43	12	28	7	97
8	Monitoring South Organisation, Bengaluru	9	19	-	-	3	31
9	Mahi & Tapi Basin Organisation, Gandhinagar	6	15	-	2	6	29
10	Narmada Basin Organisation, Bhopal	8	9	4	11	1	33
11	Teesta & Bhagirathi Damodar Basin Organisation, Kolkata	14	32	18	12	6	82
12	Upper Ganga Basin Organisation, Lucknow	6	31	2	33	5	77
13	Yamuna Basin Organisation, New Delhi	27	38	3	12	6	86
15	**Total**	**180**	**383**	**115**	**110**	**90**	**878**
	Grand Total	**788**				**90**	**878**

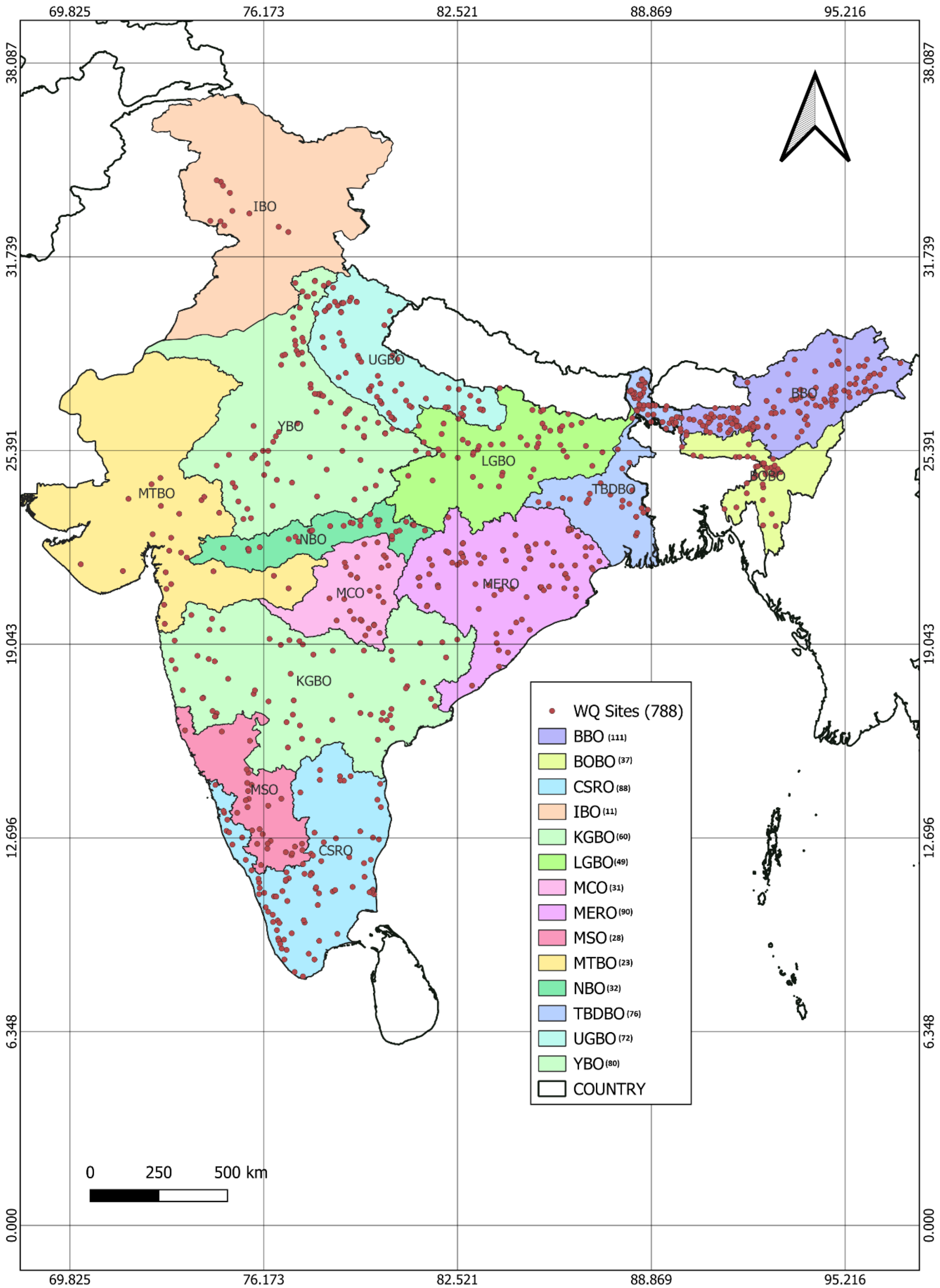

Figure 3: Organisation-Wise Distribution of Water Quality Stations Monitored by CWC

Table 9: Basin-wise water-quality stations monitored by CWC

Sl. No.	Basin	GDQ	GDSQ	GQ	WQSS	Water Bodies	Total
1	Barak and Others Basin	7	19	8	-	2	36
2	Brahmani and Baitarni Basin	1	11	3	12	1	28
3	Brahmaputra Basin	34	43	76	7	18	178
4	Cauvery Basin	20	22	-	-	3	45
5	EFR between Pennar and Cauvery	7	5	-	-	5	17
6	EFR between Krishna and Pennar	-	1	-	-	-	1
7	EFR between Mahanadi and Godavari	1	3	5	-	1	10
8	EFR South of Cauvery	2	4	-	-	-	6
9	Ganga Basin	50	115	7	56	19	247
10	Godavari Basin	12	33	4	6	14	69
11	Indus (Up to border) Basin	2	9	-	-	3	14
12	Krishna Basin	10	31	3	-	6	50
13	Mahanadi Basin	3	22	3	10	4	42
14	Mahi Basin	2	3	-	-	-	5
15	Narmada Basin	8	11	4	11	3	37
16	Pennar Basin	4	4	-	-	2	10
17	River draining into Bangladesh Basin	-	1	-	-	-	1
18	River draining into Myanmar Basin	-	2	-	-	-	2
19	Sabarmati Basin	1	1	-	1	2	5
20	Subarnarekha Basin	2	6	1	6	1	16
21	Tapi Basin	1	3	-	-	2	6
22	WFR of Kutch and Saurashtra including Luni Basin	2	3	-	-	-	5
23	WFR South of Tapi	11	31	1	1	4	48
24	**Total**	**180**	**383**	**115**	**110**	**90**	**878**
	Grand Total	**788**				**90**	**878**

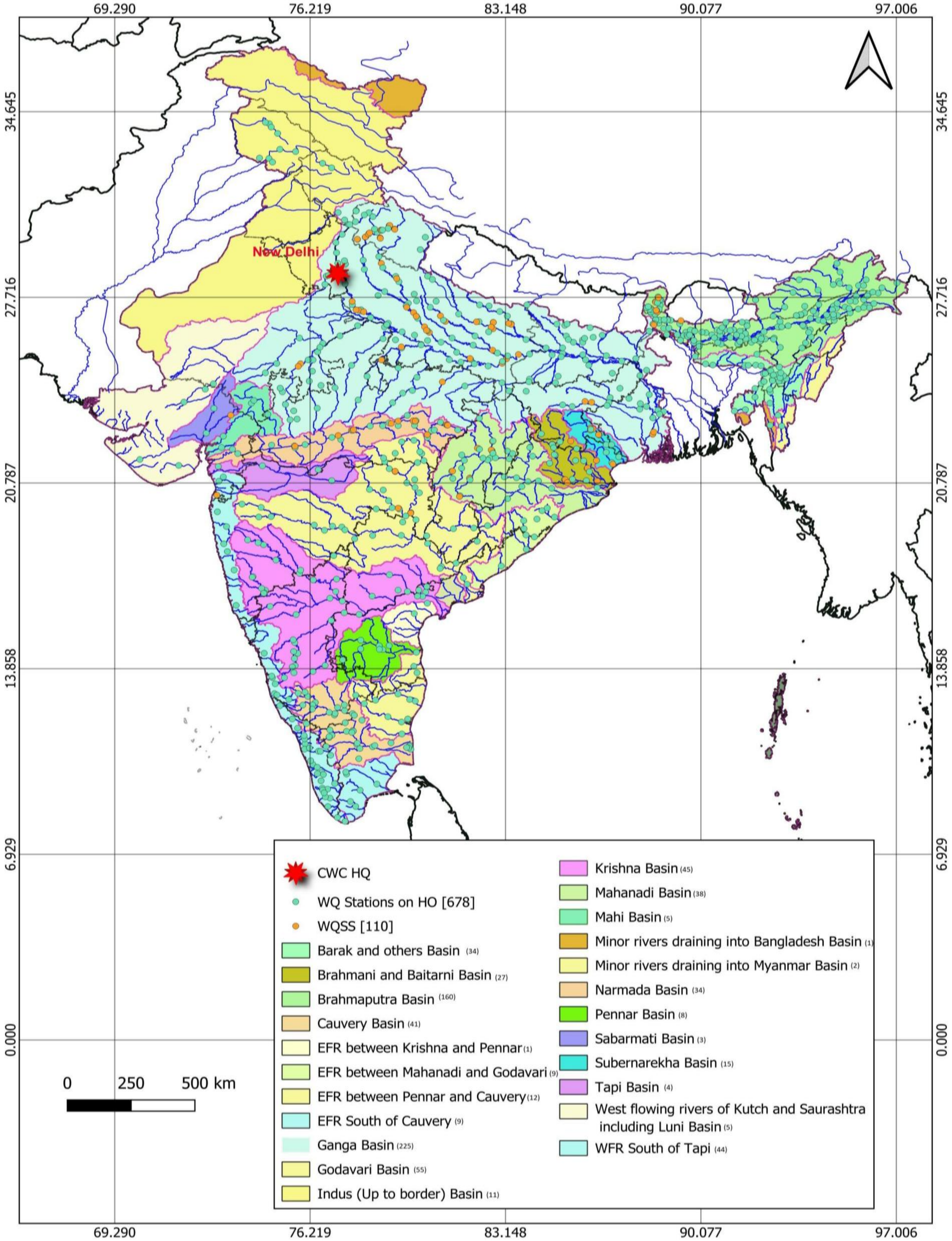

***Figure 4*: Map showing the basin-wise distribution of water quality Stations monitored by CWC**

The water quality samples collected at these stations are analysed at laboratories of CWC. At present, CWC follows a three-tier laboratory system which consists of Level I, II and III types of laboratories for providing analytical facilities for the analysis of river water samples collected from water quality monitoring stations covering all the important river basins of India.

The three-tier laboratory system consists of:

1. **Level-I Laboratories:** 465 level-I laboratories located at field water quality monitoring stations on various rivers of India for monitoring of 14 in-situ parameters: Colour, Odour, Temperature pH, Electrical Conductivity and Dissolved Oxygen (a map showing 465 Level-I labs can be seen at Figure 5).

2. **Level-II Laboratories:** 20 level-II laboratories located at division offices to analyse 32 physico-chemical and bacteriological parameters of river water.

3. **Level-III Laboratories:** 5 regional labs located at New Delhi, Varanasi, Hyderabad, Coimbatore and Guwahati for analysis of 56 parameters including trace & toxic metals and pesticides.

Out of 25 level-II/III laboratories of CWC, 22 laboratories are accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in the field of testing in accordance with Standard ISO/IEC 17025:2017. A map showing level-II/III labs can be seen at Figure 6. The details of monitoring parameters in each level labs are depicted in Table 10.

Table 10: List of Water Quality Parameters monitored by CWC

Sl. No.	Level-I (14 Parameters)	Level-II (32 Parameters)	Level-III (56 Parameters)
1	Temperature	Temperature	Temperature
2	Colour and Intensity	pH	pH
3	Odour	Electrical Conductivity	Electrical Conductivity
4	pH	Dissolved Oxygen (DO)	Dissolved Oxygen (DO)
5	Electrical Conductivity	Turbidity	Turbidity
6	Dissolved Oxygen	Biochemical Oxygen Demand (BOD)	Biochemical Oxygen Demand (BOD)
7	Weather	Chemical Oxygen Demand (COD)	Chemical Oxygen Demand (COD)
8	Depth of main stream/depth of water table	Total Dissolved Solids (TDS)	Total Dissolved Solids (TDS)
9	Visible effluent discharge	Sodium	Sodium
10	Human activities Around station	Calcium	Calcium
11	Station details	Magnesium	Magnesium
12	Velocity	Potassium	Potassium
13	Discharge	Phenolphthalein Alkalinity (Carbonate)	Phenolphthalein Alkalinity (Carbonate)
14	Water Level	Total Alkalinity	Total Alkalinity
15		Chloride	Chloride
16		Sulphate	Sulphate
17		Fluoride	Fluoride
18		Boron	Boron
19		Ammoniacal Nitrogen	Ammoniacal Nitrogen
20		Nitrate	Nitrate
21		Nitrite	Nitrite
22		Phosphate	Phosphate
23		Silicate	Silicate
24		Total Coliform MPN/100 ml	Total Coliform MPN/100 ml
25		Fecal Coliform MPN/100 ml	Fecal Coliform MPN/100 ml
26		E.Coli	E.Coli
27		Faecal Streptococci	Faecal Streptococci
28		Hardness	Hardness
29		NO_2+NO_3	NO_2+NO_3
30		Sodium Adsorption Ratio	Sodium Adsorption Ratio
31		% Sodium	% Sodium
32		Residual Sodium Carbonate	Residual Sodium Carbonate
33			Arsenic
34			Cadmium
35			Chromium
36			Copper
37			Iron
38			Lead
39			Nickel
40			Mercury
41			Zinc
42			Alpha BHC
43			Beta BHC
44			Gama BHC (Lindane)
45			OP DDT
46			PP-DDT
47			Alpha Endosulphan
48			Beta Endosulphan
49			Aldrin
50			Dieldrin
51			Carbaryl (Carbamate)
52			Malathion
53			Methyl Parathion
54			Anilophos
55			Chloropyriphos
56			2-4 D

Figure 5: Level-I Water quality laboratories of CWC

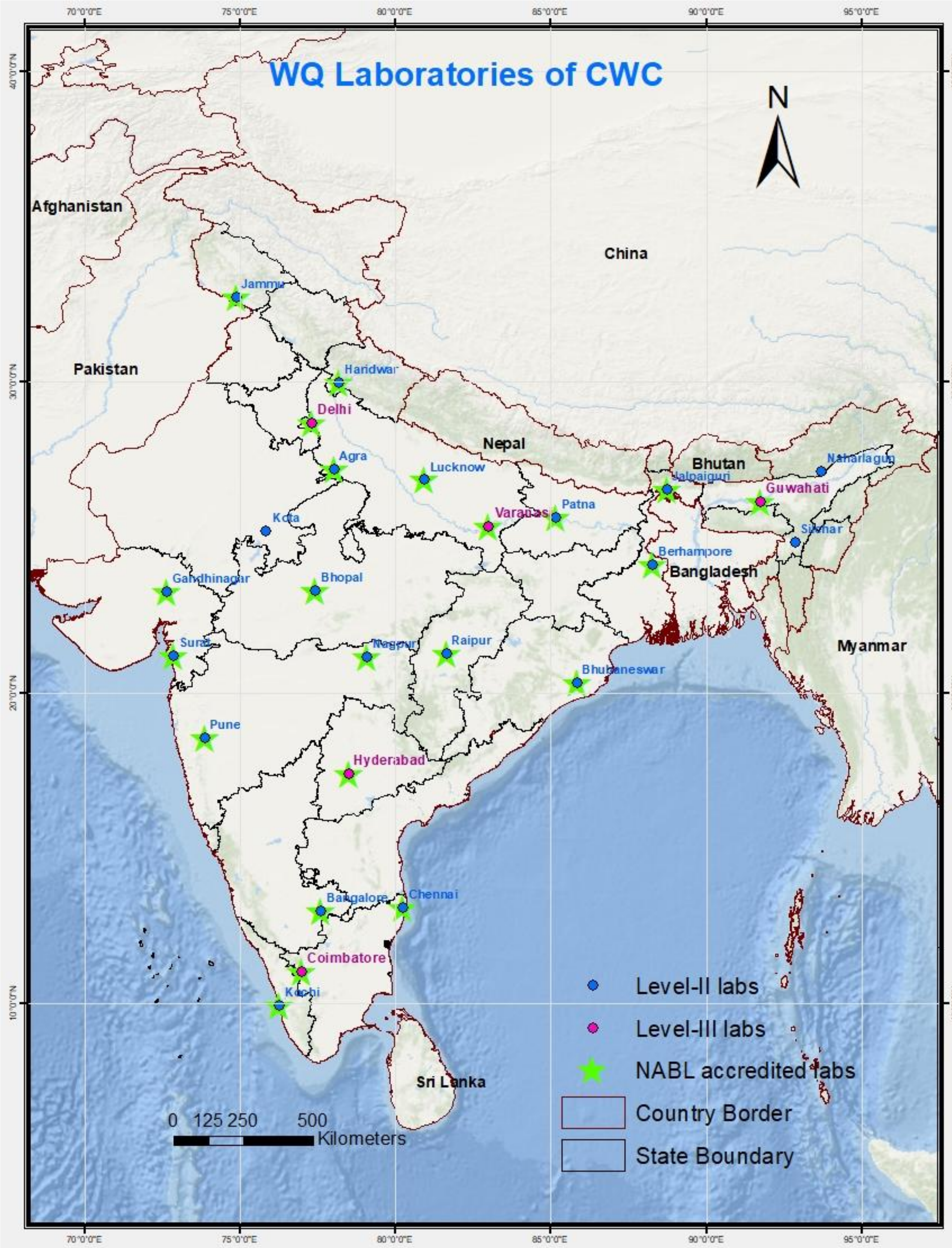

Figure 6: Level-II/III Water quality laboratories of CWC

5. STUDY AREA

The analysis results of 9 trace & toxic metals of water samples from 767 water quality monitoring stations of CWC are considered for the study (Figure 7). This involves the data analysis of 6691 samples collected during January, 2025 to December, 2025 from 20 river basins of India.

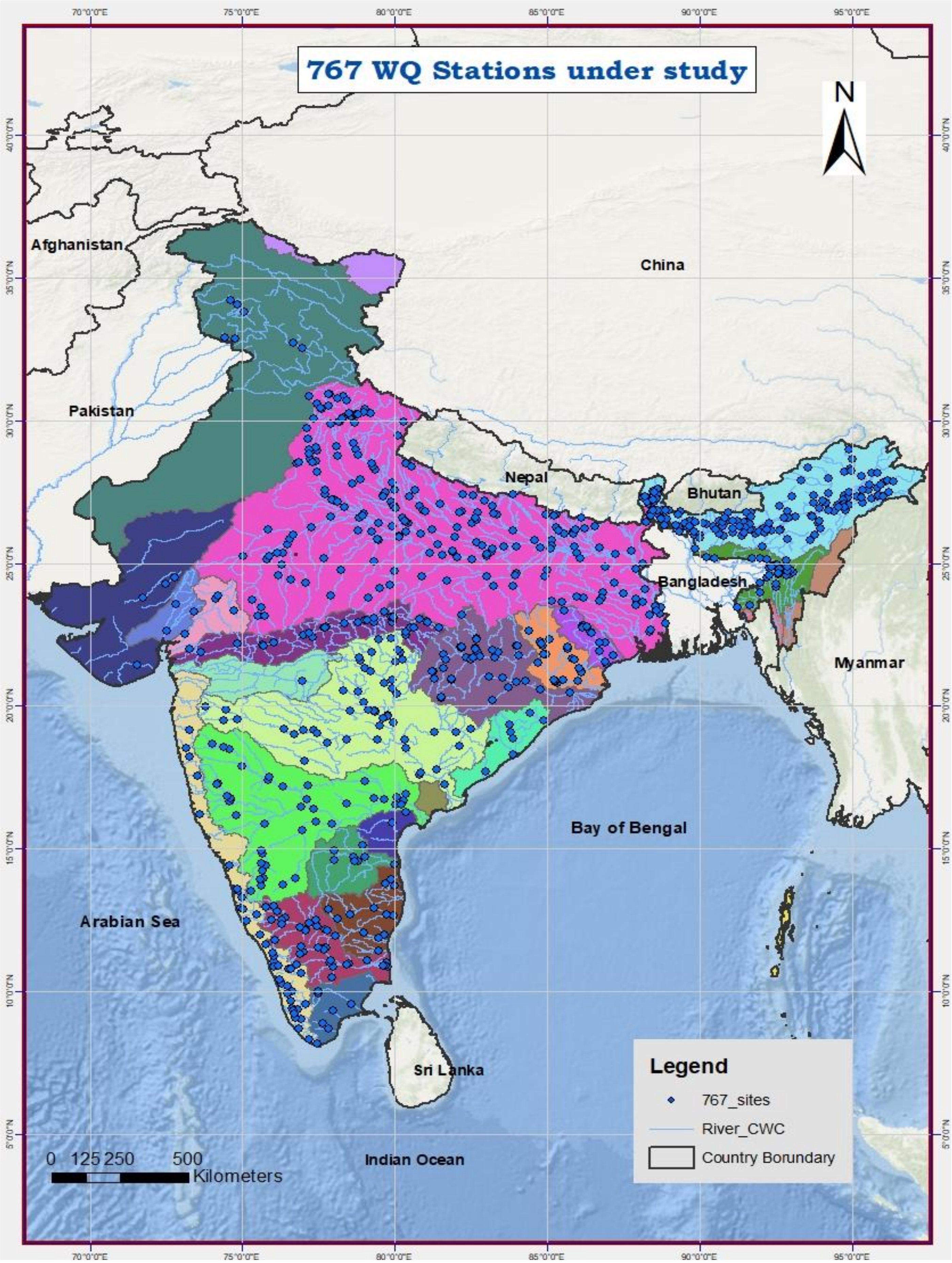

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Figure 7: 767 Water quality stations monitored

The details of the 767 monitoring are enclosed as Annexure-I. The details of 20 basins considered for the study has been given below.

1. ***Brahmaputra Basin***

The Brahmaputra River originates from the Mansarovar lake region near Mount Kailash, northern part of the Himalayas in Tibet. It fows through Tibet, India and Bangladesh. Brahmaputra basin in India stretches across the states of Arunachal Pradesh, Assam, West Bengal, Meghalaya, Nagaland, and Sikkim. The basin lies between 88°11′ - 96°57′ E longitudes and 24°44′ - 30°3′ N latitudes. After flowing through Tibet, it enters India through Arunachal Pradesh, where the river is called Siang. It is joined by two mountain streams namely the Lohit and the Dibang near Sadiya town to form the mighty Brahmaputra River. As the river follows its course through the valley, it receives a number of tributaries at its north and south banks. The principal tributaries of the river are Lohit, Dibang, Subansiri, Jiabharali, Dhansiri(North), Manas, Torsa, Sankosh, Teesta, Burhidihing, Desang, Dikhow, Dhansiri(South), Raidak-I, Raidak-II and Kopili. Torsa and Jaldhaka rivers flowing through the northern West Bengal also join the main stream of Brahmaputra but, in the plains of Bangladesh.

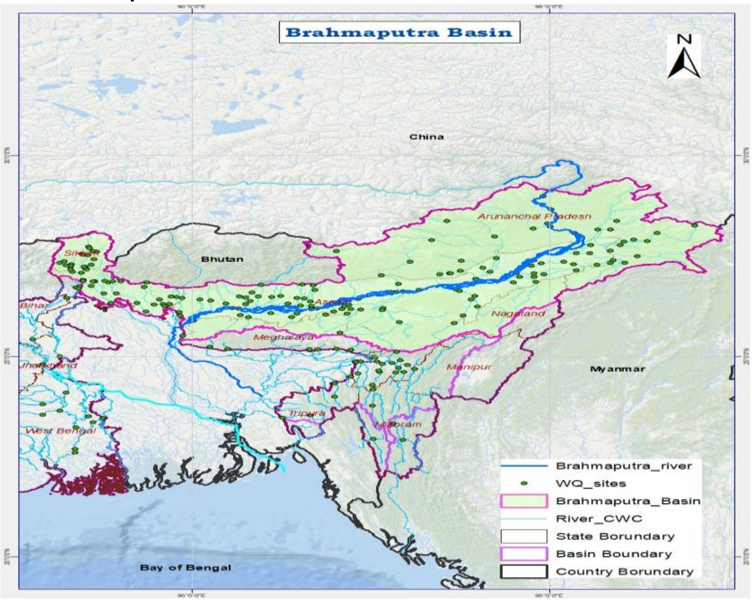

Figure 8: Brahmaputra Basin

Brahmaputra catchment is the heaviest rainfall region in the world. Brahmaputra basin, particularly the portions in Assam, is prone to annual floods and riverbank erosions.

Water quality samples collected from 152 water quality stations are being considered for the study.

2. ***Barak and Other Basins:***

Barak is an important river system in North East India. The Barak basin has a catchment spread over the states of Meghalaya, Manipur, Mizoram, Assam, Tripura and Nagaland as well in the neighbouring country of Myanmar. Upto Indo-Bangladesh border in Karimganj district of Assam, the catchment area of the Barak River is 26,193 sq.km. All the other rivers draining directly into the Meghna River system are small compared to the Barak River. The Barak also has numerous tributaries within Assam and Manipur. The principal right bank tributaries are Makru, Jiri, Chiri, Madhura, Jatinga, Gumra, Harang

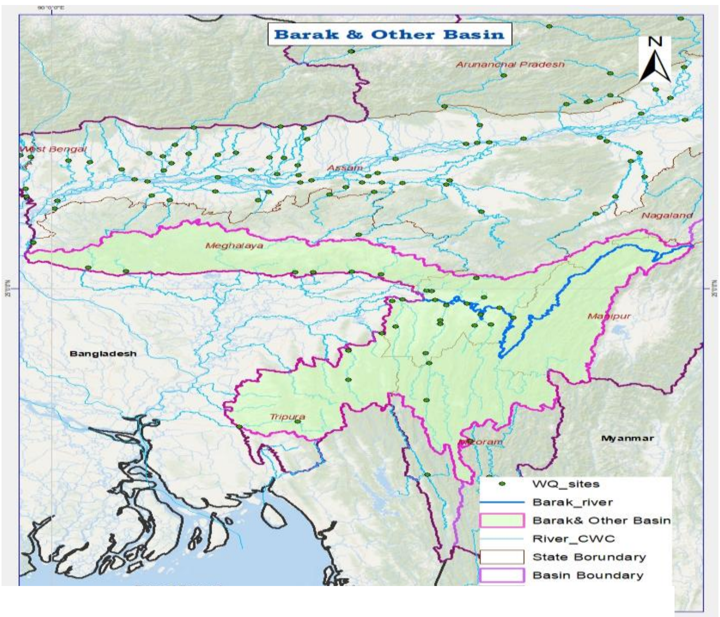

Figure 9: Barak and Other Basins

and Badri. The principal left bank tributaries are Irang, Tuivai, Sonai, Katakhal, Singla and Longai. At the international border with Bangladesh, Barak splits into two branches: Surma in the north and Kushiyara in the south. The river Surma flows in the northern part of Sylhet district of Bangladesh before joining the Meghna River system. The south flowing rivers of the Khasi and Jaintia hills of Meghalaya drain into Surma valley. The Kushiyara River flows in the southern portion of the Sylhet district before joining the Meghna River. A few west flowing rivers from Assam and Tripura join the Kushiyara after entering Bangladesh.

Water quality samples collected from 33 water quality stations are being considered for the study.

3. *Brahmani and Baitarni Basin*

The Brahmani and Baitarni basin is the 17th largest basin having total catchment area of 51907.45 Sq.km which is nearly 1.7% of the total geographical area of the country.

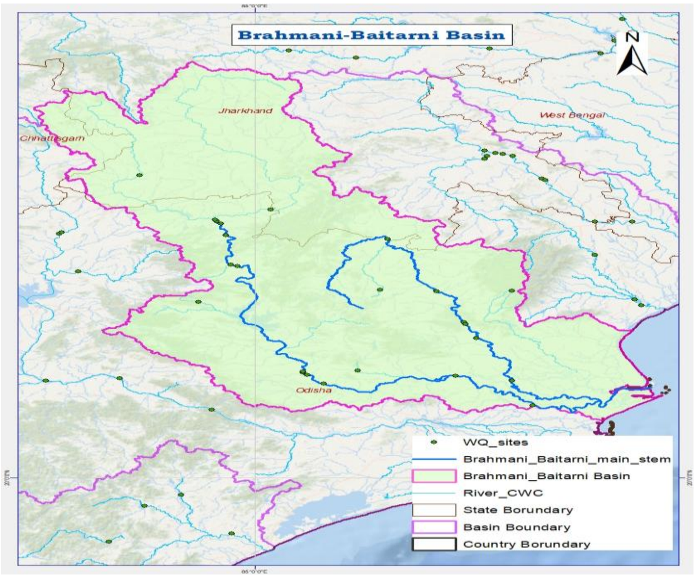

Figure 10: Brahmani and Baitarni Basin

The basin spreads from 83°55’ to 87°3’ east longitudes and 20°28’ to 23°38 north latitudes on Indian sub-continent. The basin is bounded by the Chhotanagpur Plateau on the north, by the ridge separating it from Mahanadi basin on the west and the south and by the Bay of Bengal on the east. The maximum length and width of the basin is 403 km and 193 km. The basin is further divided into two sub-basins namely Brahmani and Baitarni. The Brahmani sub basin covers 37,545 Sq.km and has a long sausage shape. The Baitarani sub basin extends over 14351 Sq.km and is roughly circular in shape. The catchment area of basin consisting of Brahmani and Baitarni Rivers extends over states of Odisha, Jharkhand and Chhattisgarh.

Water quality samples collected from 25 water quality stations are being considered for the study.

4. *Cauvery Basin*

River Cauvery is the third largest perennial river flowing in Southern India. It originates at Talakaveri on the Brahmagiri range of Hills in Kodagu District of Karnataka amidst Western Ghats at an elevation of 1,341 m above MSL and drains a total area of 81,155 Sq. Kms. It flows in south-eastern direction across the Plateau of Mysore and joins the

Bay of Bengal in Nagapattinam District of Tamilnadu. The river basin lies between 75°30' – 79°45'E longitudes and 10°05'N – 13°30'N latitudes. Cauvery Basin covers the states of Karnataka, Tamilnadu, Puducherry and some parts of Kerala. The Cauvery basin is fan shaped in Karnataka and leaf shaped in Tamilnadu. The major tributaries are Harangi, Hemavati, Kabini, Bhavani, Lakshmanthirtha, Noyyal, and Arkavati.

Water quality samples collected from 39 water quality stations are being considered for the study.

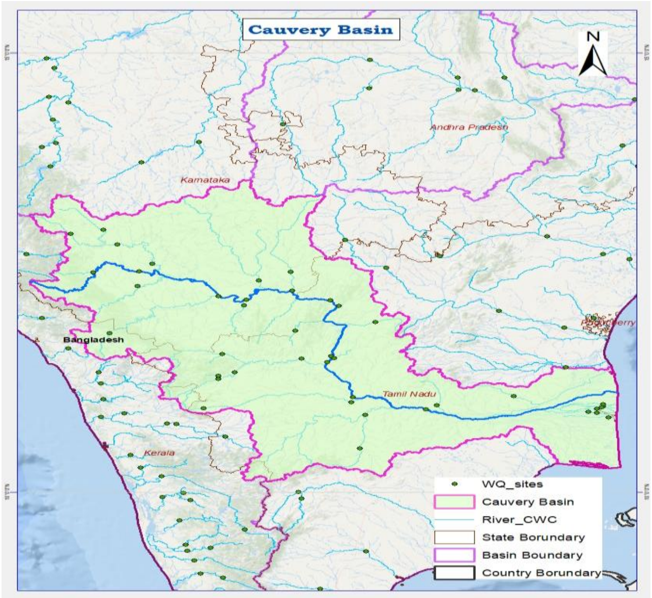

Figure 11: Cauvery Basin

5. *East Flowing Rivers between Pennar & Cauvery Basin and East Flowing Rivers South of Cauvery Basin*

The East Flowing Rivers (South of river Krishna excluding Cauvery and Pennar Basins) cover large areas in the states of Andhra Pradesh, Tamilnadu and some parts of Karnataka and Union territory of Puducherry.

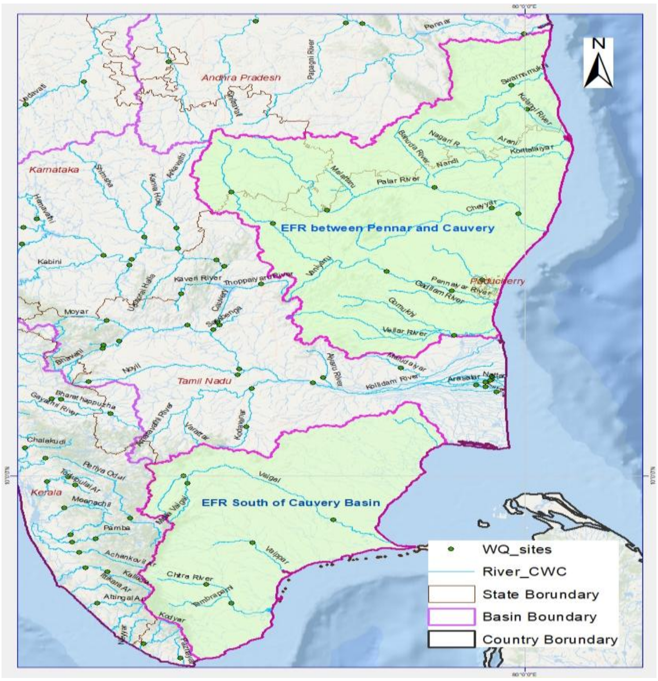

Figure 12: EFR between Pennar & Cauvery Basin and EFR South of Cauvery Basin

The basin of East flowing rivers consists of several independent river basins of peninsular India lying to the South of Krishna basin, except Cauvery basin. The East flowing rivers are draining into the Bay of Bengal. There are eleven river basins of which Palar and Ponnaiyar are more important. Other river basins are Gundlakamma, Paleru, Swarnamukhi, Kalingi, Varahanadi, Vellar, Vaigai, Vaippar and Tambraparani.

Water quality samples collected from 19 water quality stations are being considered for the study.

6. East Flowing Rivers between Mahanadi and Godavari Basin

East Flowing Rivers between Mahanadi and Pennar basin spreads over states of Andhra Pradesh and Odisha having an area of 86,643 km^2 and stretches between 78°40' to 85°1' east longitudes and 14°34' to 20°22' north latitudes. It is bounded by the Eastern

Ghats on the north and west, by Nallamala Range and Andhra plains on the south and by the Bay of Bengal on the east. This composite basin comprises of three river systems. The river systems between Mahanadi and Godavari covers an area of 49,685 km^2 and the river systems between Krishna and Pennar extends over an area of 24,669 km^2. In addition, there is also a small area between Godavari and Krishna drained mainly by the small stream of Palleru. This minor portion of the basin has an area of about 12,289 km^2.

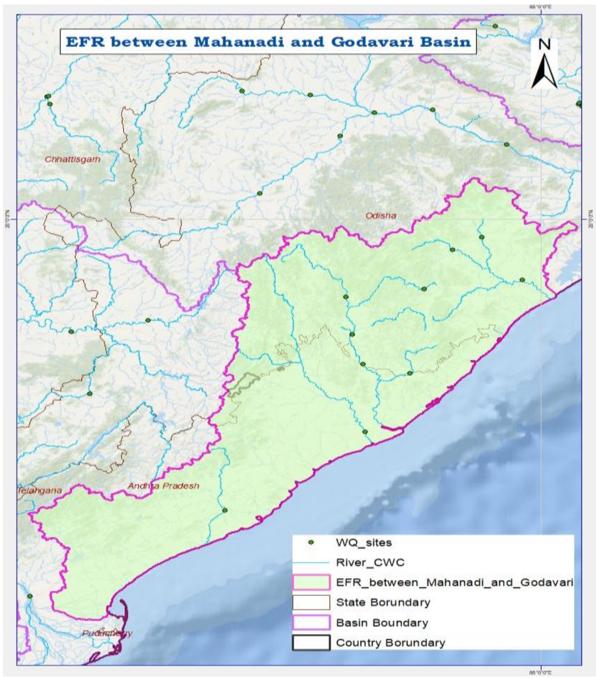

Figure 13: EFR between Mahanadi & Godavari Basin

The independent rivers (directly draining into Bay of Bengal) in the basin from north to south are the Rushikulya, the Bahuda, the Vamsadhara, the Nagavali, the Sarada, the Varaha, the Tandava, the Eluru, the Gundlakamma, the Musi, the Paleru and the Manneru.

Water quality samples collected from 7 water quality stations are being considered for the study.

7. *Ganga (including Yamuna) Basin*

The Ganga River originates from the southern great Himalayas in Uttarakhand on the Indian side of the border with Tibet. It is formed by five headstreams, namely Bhagirathi, Alaknanda, Mandkini, Dhauliganga and Pindar. Of those, the two major headstreams are the Alaknanda and the Bhagirathi, which receives both monsoon as well as glacial melt water from the Himalayan glaciers known as Gangotri. The major tributaries of Ganga are also originating from the Himalaya excluding Sone and Damodar rivers originating from the Amarkantak hills of Maikal range and Khamarpat hill on Chota Nagpur Plateau, respectively.

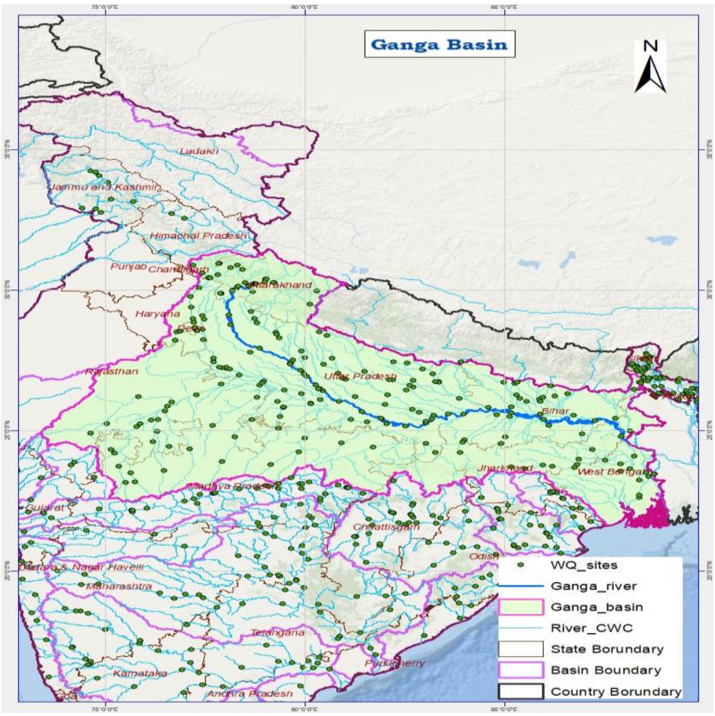

Figure 14: Ganga Basin

Alaknanda and Bhagirathi Rivers join at Devprayag in Uttarakhand to form the river Ganga which acts as a single stream. At Prayagraj river Ganga receives its biggest tributary, the river Yamuna from right. The delta of the river Ganga can be said to start from Farakka in West Bengal. From the origin after traversing about 2500 km it empties into the Bay of Bengal at Ganga Sagar Island The mainstream of river Ganga falls in the States of Uttrakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. Rishikesh, Haridwar and Varanasi are important cities in the banks of the river Ganga. The main tributaries are Yamuna, Gomti, Ghaghra, Son, Gandak, Ramganga, Kosi etc.

Water quality samples collected from 223 water quality stations are being considered for the study.

8. *Narmada River Basin*

The Narmada is the largest west-flowing river in India, draining a substantial area in Madhya Pradesh, as well as some regions in the states of Maharashtra and Gujarat. It courses through the Deccan trap situated between the Vindhyachal and the Satpura Range of hills before culminating in the Gulf of Khambh at in the Arabian Sea. The total drainage area of the basin is 98,796 km2, with nearly 87% located in Madhya Pradesh. Generally, the hilly regions are forested, and the soils vary, being red, yellow, shallow black in upper reaches, medium black in middle reaches, and medium & deep black in the lower reaches of the basin. Water samples collected from 34 water quality stations are being considered for the study.

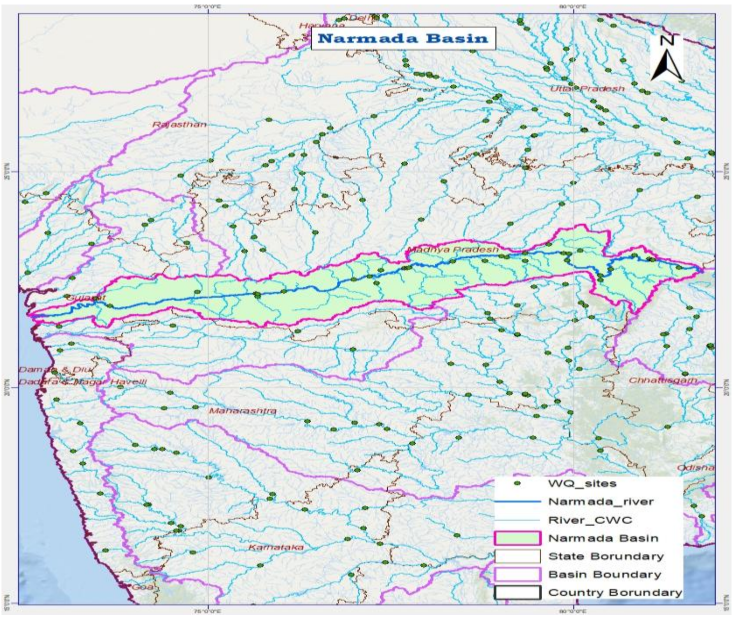

Figure 15: Narmada Basin

9. Indus(upto) Border Basin

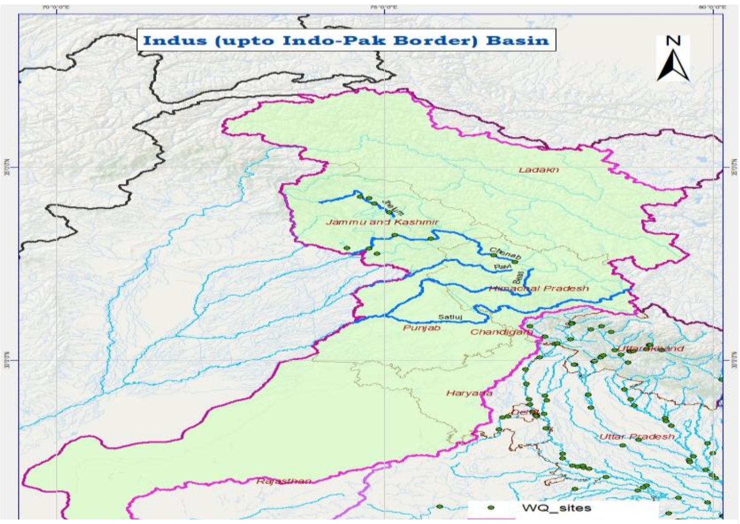

Figure 16: Indus Basin

The Indian part of Indus basin spreads over the states of Jammu & Kashmir, Ladakh, Himachal Pradesh, Punjab and a part of Rajasthan, Haryana, and Union Territory of Chandigarh. Upper part of the basin consists of mountain ranges and narrow valleys lying in Jammu and Kashmir, Ladakh and Himachal Pradesh. In Punjab, Haryana and Rajasthan the basin consists of vast plains, which are the fertile granary of the country. It was the cradle of the great Indus Valley civilization of ancient world. The Indian part of the basin consists of five major tributaries: Satluj, Ravi, Beas, Chenab, and Jhelum which are ultimately merging with river Indus in Pakistan. Water quality samples collected from 11 water quality stations are being considered for the study.

10. Pennar Basin

The Pennar River is one of the major East flowing rivers in Southern India. It rises in the Chennakesava hill of the Nandidurg range in Karnataka.

The Pennar drains an area of 55,213 Sqs.Kms in the states of Karnataka and Andhra Pradesh. The total length of Pennar River is 597 Km of which 61 Km runs in Karnataka and the rest in Andhra Pradesh. This river has six major tributaries viz., the Jayamangali, the Kunderu and the Sagileru joining from the left, the Chitravathi, the Papagni and the Cheyyeru joining on the right.
Water quality samples collected from 8 water quality stations are being considered for the study.

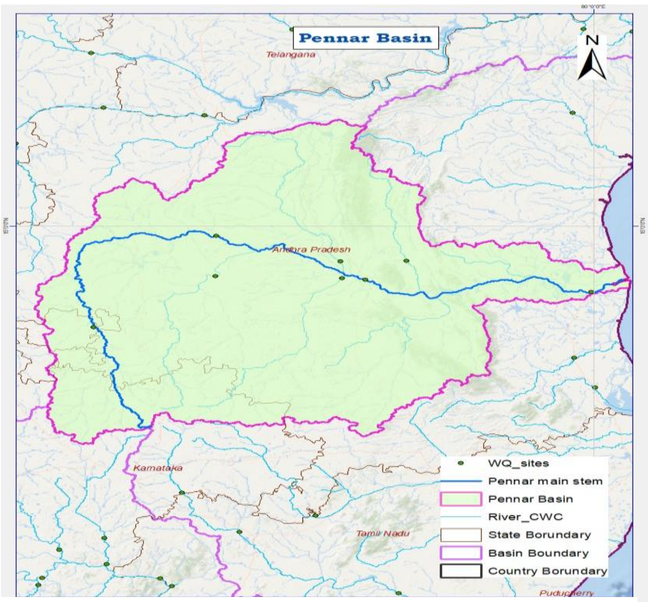

Figure 17: Pennar Basin

11. West Flowing rivers south of Tapi Basin

The West Flowing Rivers Basin consists of all the small independent river basins of peninsular India lying to the South of Krishna Basin (except Cauvery Basin) draining into the Arabian Sea. The basin is located in the South West corner of the peninsular India and covers the areas in the States of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala. There are as many as 31 Nos of medium and minor river basins in this region viz., Ulhas, Bhogeshwari, Amba, Kal, Kajavi, Gad, Mandovi/Madei, Aghanashini, Haladi, Sita, Swarna, Gurupur, Netravathi, Payaswani, Valatapatnam, Kuttyadi, Chaliyar, Kadalundi, Bharathapuzha, Chalakudi, Periyar, Muvattupuzha, Meenachil, Pamba, Achankovil, Manimala, Kallada, Vamanapuram, Tambraparani and Pazhayar.

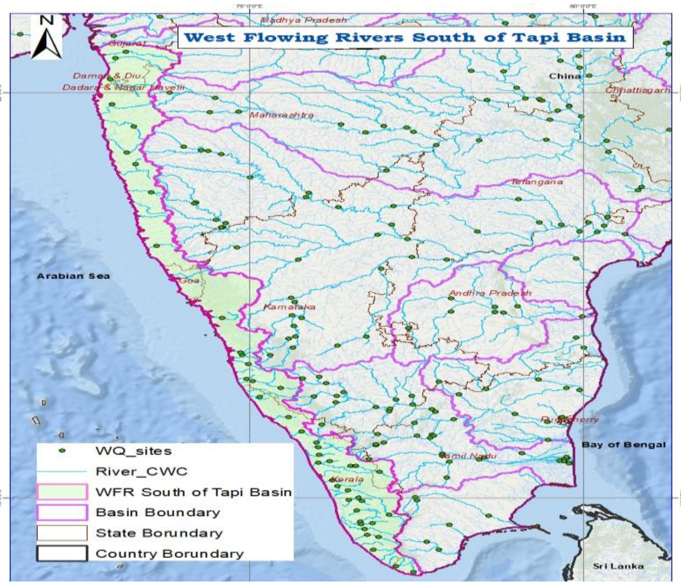

Figure 18: WFR south of Tapi Basin

Maps showing these basins are presented as Plates - I to III. All the rivers originate from the high mountains of the Western Ghats and exhibit similar characteristics. They have steep high banks which rarely overflow or cause floods.

Water quality samples collected from 43 water quality stations are being considered for the study.

12. Krishna Basin

The river Krishna is the second largest eastward draining interstate river in Peninsular India. The basin of Krishna is situated between East longitudes 730 21’ to 810 09’ and North latitudes 13 07’ to 19 25’ in the Deccan Plateau covering large areas in the States of Maharashtra, Karnataka, Telangana and Andhra Pradesh. The river Krishna rises in the Western Ghats at an altitude of 1337m just North of Mahabaleswar, about 64 km from the Arabian Sea and flows from West to East through the States of Maharashtra, Karnataka, Telangana and Andhra Pradesh before it joins the Bay of Bengal at downstream of Vijayawada.

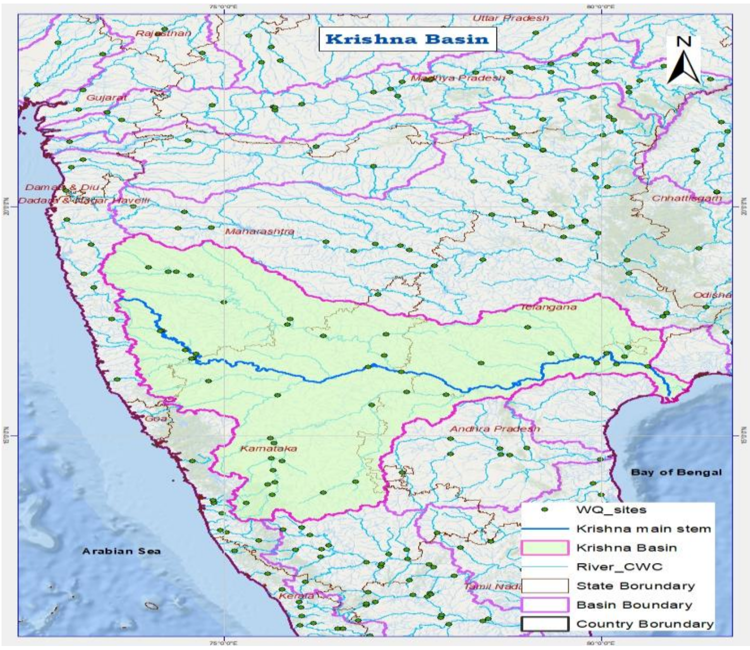

Figure 19: Krishna Basin

There are about 13 major tributaries which join the river Krishna along its 1400 km course, out of which, six tributaries are on right bank and remaining seven are on left bank. Among the major tributaries, the Ghataprabha, Malaprabha and Tunga- Bhadra are the principal right bank tributaries which together contribute 35.45% of the total catchment area, whereas the Bhima, Musi and Munneru are the principal left bank tributaries which together contribute 35.62% of the total catchment area.

The Krishna Basin is bounded on the North by the ridge, separating it from the Godavari basin and on the South and East by the Eastern Ghats and on the West by the Western Ghats. The basin is more or less triangular in shape with its base along the Western Ghats, the apex at Vijayawada and the river Krishna itself forming the median. All the major tributaries are originating in the Western Ghats and joining river Krishna at the base of the triangle in the upper two-thirds of its length.

Water quality samples collected from 45 water quality stations are being considered for the study.

13. Godavari Basin

The Godavari basin extends over states of Maharashtra, Andhra Pradesh, Chhattisgarh and Odisha in addition to smaller parts in Madhya Pradesh, Karnataka and Union territory of Puducherry having a total area of 3,12,812 Sq.km with a maximum length and width of about 995 km and 583 km.

It lies between 73°24’ to 83°4’ east longitudes and 16°19’ to 22°34’ north latitudes and accounts for nearly 9.5% of the total geographical area of the country. The basin is bounded by Satmala hills, the Ajanta range and the Mahadeo hills on the north, by the Eastern Ghats on the south and the east and by the Western Ghats on the west.

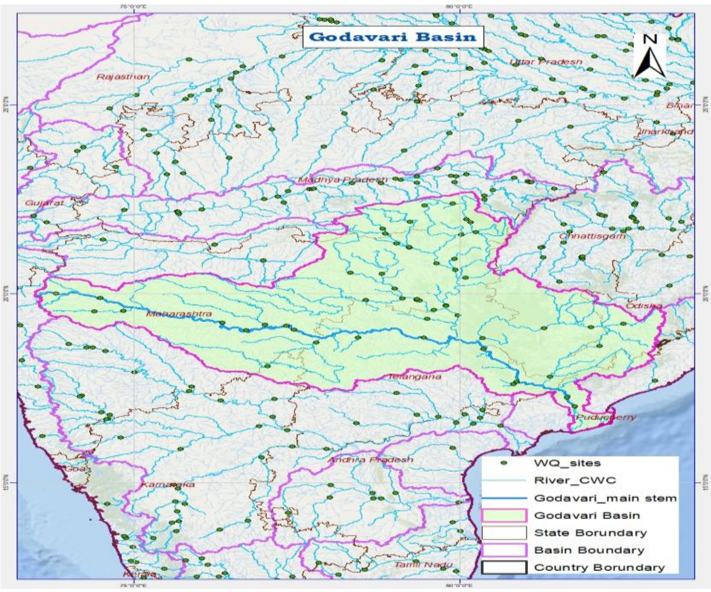

Figure 20: Godavari Basin

The Godavari River rises from Trimbakeshwar in the Nashik district of Maharashtra about 80 km from the Arabian Sea at an elevation of 1,067 m. The total length of Godavari from its origin to outfall into the Bay of Bengal is 1,465 km. Its principal tributaries joining from right are the Pravara and the Manjra whereas the Purna, the Penganga, the Wardha, the Wainganga, the Indravati and the Kolab joins from left.

Water quality samples collected from 55 water quality stations are being considered for the study.

14. Mahanadi Basin

The River Mahanadi is one of the major inter-state east flowing Rivers in peninsular India. In the course of its traverse, it drains fairly large areas of Madhya Pradesh & Odisha and comparatively small areas in the States of Bihar & Maharashtra.

The basin is physically bounded in the north by the Central India hills, in the south and east by the Eastern Ghats and in the West by Maikala Hill Range. The total catchment area of the basin is 1,41,589 km2. The River Mahanadi originates at an elevation

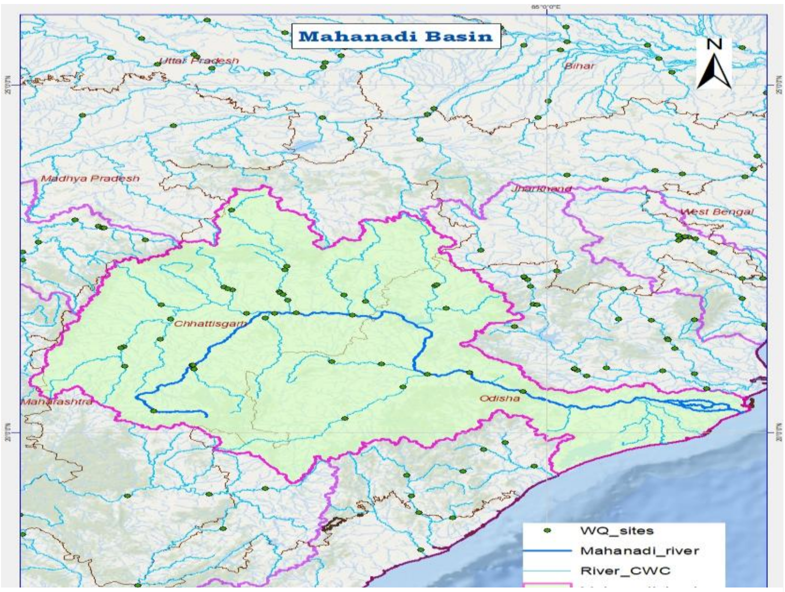

Figure 21: Mahanadi Basin

of about 442 m above MSL near Pharsiya village in Raipur district of Madhya Pradesh. The total length of the river from its origin to its out fall into the Bay of Bengal is about 851 kms, of which, 357 kms is in Madhya Pradesh and the remaining 494 kms is in Odisha. During its traverse, a number of tributaries join the river on both the banks. The important tributaries are the Seonath, the Hasdeo, the Mand, the Ib, the Bhadar, the Jonk, the Ong and the Tel.

Water samples collected from 42 water quality stations are being considered for the study.

15. Subernarekha Basin

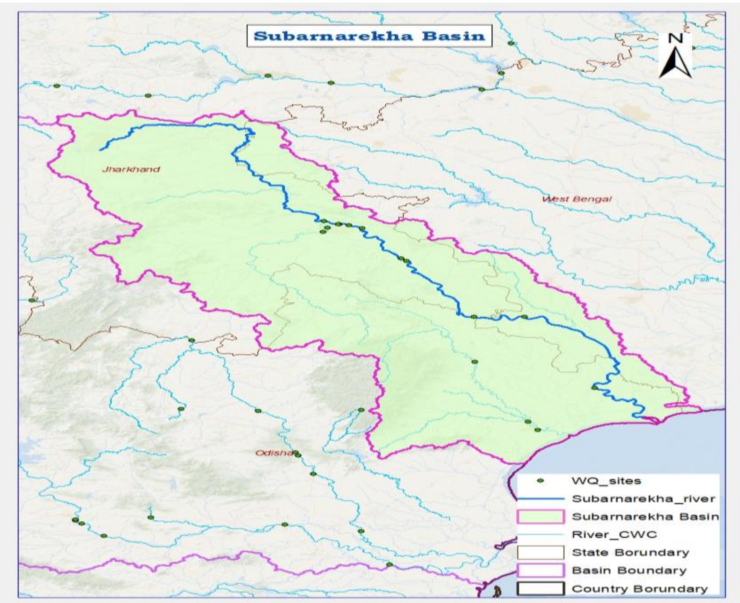

Figure 22: Subernarekha Basin

The Subernarekha basin extends over States of Jharkhand, Odisha and comparatively smaller part in West Bengal having a total area of 29,196 Sq.km with a maximum length and width of about 297 km and 119 km. It lies between 85°8′ to 87°32′ east longitudes and 21°15′ to 23°34′ north latitudes. Situated in the north-east corner of the Peninsular India, the basin is bounded by the Chhotanagpur plateau on the north and the west, by the ridges separating it from Baitarani basin on the south, by the Bay of Bengal on the south-east and by the Kasai Valley of Kangsabati River on the east.

The Subernarekha River originates near Nagri village in Ranchi district of Bihar at an elevation of 600 m. The total length of the river is about 395 kms. The principal tributaries of the river are the Kanchi, the Kharkai and the Karkari. The Burhabalang is a flashy River which originates at an elevation of 800 m and after traversing a distance of 125 kms drops into the Bay of Bengal. The river drains parts of areas in Mayurbhanj and Balasore districts of Odisha.

Water quality samples collected from 15 water quality stations are being considered for the study.

16. Tapi Basin

The Tapi is the second-largest west-flowing river, originating from Multai (Betul district) in Madhya Pradesh and coursing through the states of Madhya Pradesh, Maharashtra, and Gujarat before joining the Arabian Sea approximately 15 km west of Surat. The Tapi River spans a length of about 724 km, and its basin covers an area of 65,145 km2, situated in the Deccan plateau between East longitude 72°-38' to 78°-17' and North latitude 20°-05' to 22°-03'. The Tapi basin is bordered on the north by the Satpura Range, on the east by the Mahadeo Hills, on the south by the Ajanta Range and the Satmala Hills, and on the west by the Arabian Sea. The Gawilgarh Hills serve as the dividing line between the upper Tapi and the Purna sub-basins.

Water quality samples collected from 4 water quality stations are being considered for the study.

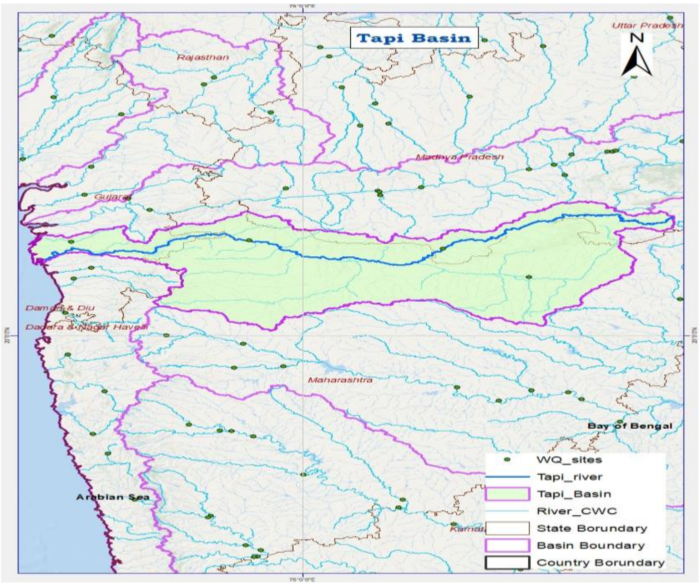

Figure 23: Tapi Basin

17. Mahi Basin

The Mahi River is one of the major interstate rivers of India, draining into the Gulf of Khambhat. The basin is bounded on the north and northwest by the Aravalli Hills, on the east by the ridge separating it from the Chambal basin, on the south by the Vindhyas, and on the west by the Gulf of Khambhat. The basin has a maximum width of about 250 km. The Mahi River originates on the northern slope of the Vindhyas at latitude 22°-35' N and longitude 74°-58' E near the village of Sardarpur in the Dhar district of Madhya Pradesh at an elevation of 500 m above MSL. It stretches for a length of 583 km and traverses through the states of Madhya Pradesh, Rajasthan, and Gujarat. The Mahi River drains an area of 34,842 km2. Its length is 583 kms and traverses through the states of Madhya Pradesh, Rajasthan and Gujarat. The Mahi River drains an area of 34,842 km^2.

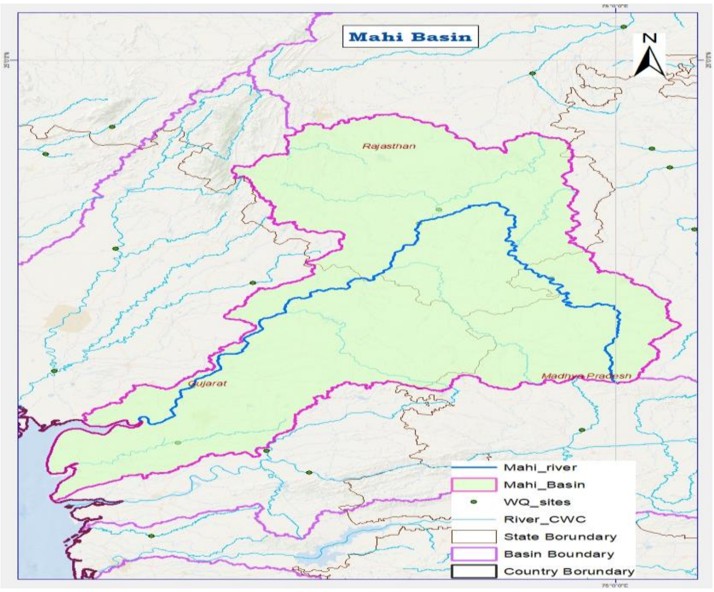

Figure 24: Mahi Basin

Water quality samples collected from 5 water quality stations are being considered for the study.

18. Sabarmati Basin

Sabarmati River is one of the major west flowing rivers of India. The Sabarmati basin extends over the states of Rajasthan and Gujarat having an area of 21,674 Sq. km with maximum length and width of 300 km and 150 km respectively. It lies between 70°58′ to 73°51′ east and 22°15′ to 24°47′ north. The basin is bounded by Aravalli hills in the north and north-east, Rann of Kutch in the west and Gulf of Khambhat in the south. The Sabarmati basin extends over parts of Udaipur, Sirohi, Pali and Dungarpur districts of Rajasthan, Sabarkantha, Kheda, Ahmedabad, Mahesana, Gandhinagar and Banaskantha districts of Gujarat.

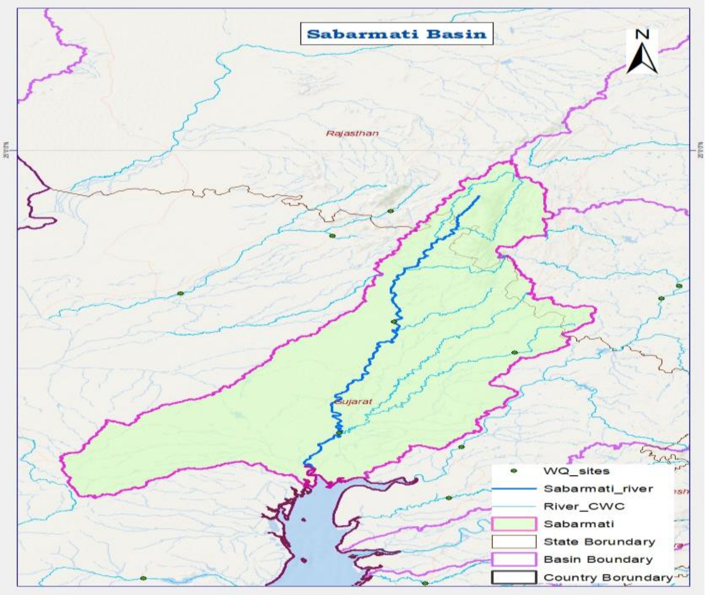

Figure 25: Sabarmati Basin

Water quality samples collected from 3 water quality stations are being considered for the study.

19. West Flowing Rivers of Kutch and Saurashtra including Luni basin

West flowing rivers of Kutch and Saurashtra including Luni basin is bounded by Aravalli range and Gujarat plains in the east, Thar Desert in the north, Arabian Sea in the south and the west. The basin is spread over in the states of Rajasthan (13 Districts), Gujarat (13 Districts), and Daman and Diu (1 District). The total number of villages lying in this basin is 13,787.

Water quality samples collected from 4 water quality stations are being considered for the study.

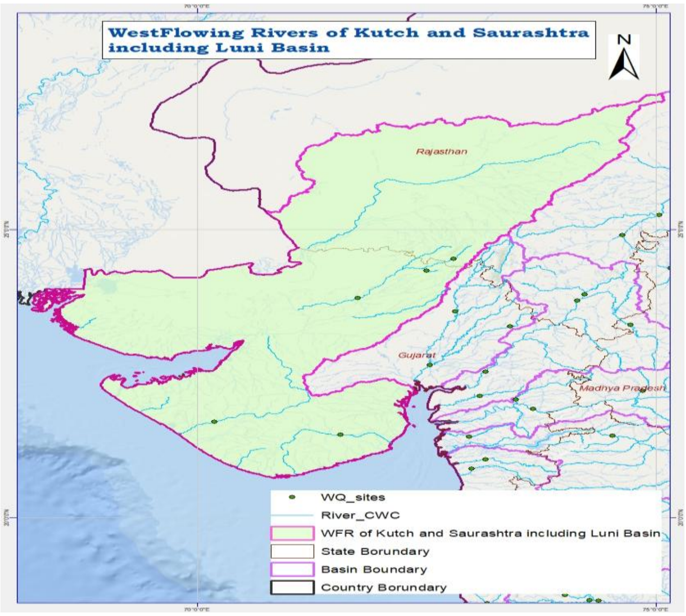

Figure 26: WFR of Kutch & Saurashtra including Luni Basin

6. METHODOLOGY

Living organisms require trace amounts of certain metals, including cobalt, copper, iron, manganese, molybdenum, vanadium, strontium, and zinc, for their proper functioning. However, excessive levels of these essential metals can be harmful to organisms. On the other hand, non-essential metals like cadmium, chromium, mercury, lead, arsenic, and antimony pose more significant concerns for surface water systems, as these metals can have adverse effects on human and animal life. Once these non-essential metals enter a system, they tend to persist for longer periods. Inorganic metals, once absorbed, have the potential to interact with various binding stations within the human body and possess a strong affinity for biological tissues. While natural water contains trace amounts of toxic metals, the issue of metal pollution has been exacerbated by industrial waste containing these metals. Major contributors to metal pollution in surface water include industries such as electroplating, metallurgy, galvanizing plants, tanneries, and thermal power stations. Metals can exist in various forms in surface water, including colloidal, particulate, and dissolved forms, with dissolved concentrations typically being low. The soluble forms are generally in the form of ions, unionized compounds, organo-metallic chelates, or complexes. The solubility of trace metals in surface water is primarily influenced by factors such as pH, the type and concentration of ligands to which the metal can bind, and the oxidation state of mineral components.

6.1 Metal Detection Techniques

Various analytical methods are commonly used to estimate heavy metals in water and wastewater. These methods include:

- **Inductively Coupled Plasma Analyser (ICP):** ICP techniques are widely used and applicable over a broad linear range. They are especially sensitive when analyzing refractory elements. However, the detection limits for ICP methods are generally higher than those for Atomic Absorption Spectrophotometry (AAS).
- **Atomic Absorption Spectrophotometry (AAS):** AAS is another widely used technique for detecting heavy metals. It is known for its sensitivity and is particularly useful for measuring specific elements.
- **Colorimetric Methods:** Colorimetric methods are applied when potential interferences are known to be within the limits of the particular method. These methods rely on color changes to indicate the presence and concentration of specific heavy metals.
- **Polarographic Estimation:** Polarography is an electroanalytical method that can be used to detect heavy metals in solution based on their electrochemical behavior.
- **Ion-Selective Electrodes (ISE):** Ion-selective electrodes are used to measure the concentration of specific ions, including heavy metal ions, in a solution. These electrodes are selective for particular ions and can provide precise measurements.

6.2 Chemicals and Reagents

Chemicals and reagents used during the chemical analyses were of analytical reagent grade. Standard solutions are prepared using certified reference materials. De-ionized water was consistently utilized in the study. To ensure the accuracy of the experiments, all glassware and containers were meticulously cleaned. This cleaning process involved soaking them in detergent, followed by immersion in 10% nitric acid for 48 hours. Subsequently, the glassware was thoroughly rinsed with de-ionized water multiple times before use.

6.3 Method

In the current study, water samples were collected and stored in polyethylene containers. These water samples were then meticulously prepared for the quantification of various heavy metals: arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc. At most of the stations, samples were collected once in a month. A total of 6691 samples were collected during January, 2025 to December, 2025 from 20 river basins of India. Nine (09) trace & toxic metals namely: arsenic, cadmium, copper, chromium, iron, lead, mercury, nickel, and zinc were analysed during this period. The collected samples were transported to Level-II/III laboratories of CWC for sample preparation and sent to five Level-III laboratories of CWC after sample preparation/preservation. These samples were analyzed at five Level-III laboratories of CWC: NRWQL, New Delhi, LCWQL, Coimbatore, KGRWQL, Hyderabad, BRWQL, Guwahati and UMGWQL, Varanasi using ICP-MS and APHA method.

Figure 27: ICP-MS

7. RESULTS AND DISCUSSION

CWC is involved in the analysis of 9 trace & toxic metals namely: arsenic, cadmium, copper, chromium, iron, lead, mercury, nickel, and zinc. The analysis results are compared with the prescribed limits of BIS: 10500-2012. The analysis results of 767 water quality (WQ) monitoring stations spread across various river basins were considered for the study. All metals were found to be within the acceptable limits at 494 out of 767 monitored stations, while at 273 stations studied, at least one metal was found to be beyond the permissible limit.

The overall summary of the results is as under:

Table 11: Overall summary

Sl. No.	Trace & Toxic Metal	Acceptable limit as per BIS:10500, 2012 (in µg/L)	Total No. of samples analysed	No. of samples where metal found within acceptable limit	No. of samples where metal found above acceptable limit	% of samples where metal found above acceptable limit
1	Arsenic (As)	10	6660	6595	65	0.98
2	Cadmium (Cd)	3	6667	6660	7	0.10
3	Chromium (Cr)	50	6660	6653	7	0.11
4	Copper (Cu)	50	6667	6655	12	0.18
5	Iron (Fe)	1000	6459	6050	409	6.33
6	Lead (Pb)	10	6549	6508	41	0.63
7	Mercury (Hg)	1	5120	5107	13	0.25
8	Nickel (Ni)	20	6648	6582	66	0.99
9	Zinc (Zn)	5000	6691	6691	0	0.00

The details and overall status of stations under study is given at Annexure-I.
The parameter-wise discussion of the analysis results is given in the ensuing paragraphs.

7.1 Arsenic (As)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 10 µg/L of arsenic in drinking water. Out of 6660 river water samples, 65 samples from 42 water quality stations were found to have arsenic concentrations beyond the acceptable limit. The arsenic concentration varies from 0.000 to 34.73 µg/L. Maximum arsenic concentration (34.73 µg/L) was observed at Chapra water quality monitoring station on Jalangi River on 02.07.2025.

The details of stations where arsenic concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below. Figure 28 represents GIS map of WQ stations where Arsenic found above acceptable limit.

Table 12: River-wise list of WQ stations with Arsenic values above limit (9th Edition) January-December, 2025

Sl. No	River / Tributary	Site	Date of Sampling	As (µg/L)	State/UT	District
1	Adhwara Group	Ekmighat	03.06.2025	15.59	Bihar	Darbhanga
			01.07.2025	11.60	Bihar	Darbhanga
2	Alaknanda	Kirtinagar D/S	01.08.2025	11.44	Uttrakhand	Tehri Garhwal
		Kirtinagar U/S	01.08.2025	12.91	Uttrakhand	Tehri Garhwal
		Srinagar	01.08.2025	12.44	Uttrakhand	Pauri Garhwal
3	Bagmati	Hayaghat	01.07.2025	10.07	Bihar	Darbhanga
4	Baya	Bachhwara	01.04.2025	11.08	Bihar	Begusarai
		Bachhwara	01.05.2025	10.94	Bihar	Begusarai
		Bachhwara	03.06.2025	12.11	Bihar	Begusarai
5	Burhi Gandak	Kanti	03.03.2025	10.04	Bihar	Muzaffarpur
		Sikandarpur	01.04.2025	10.03	Bihar	Muzaffarpur
		Kanti	03.06.2025	11.73	Bihar	Muzaffarpur
		Sakra	03.06.2025	13.52	Bihar	Muzaffarpur
		Sikandarpur	03.06.2025	10.30	Bihar	Muzaffarpur
6	Churni	Hanskhali	05.02.2025	20.30	West Bengal	Nadia
		Hanskhali	02.01.2025	14.03	West Bengal	Nadia

Sl. No	River / Tributary	Site	Date of Sampling	As (µg/L)	State/UT	District
		Hanskhali	02.07.2025	20.19	West Bengal	Nadia
		Hanskhali	04.06.2025	29.00	West Bengal	Nadia
		Hanskhali	05.03.2025	15.39	West Bengal	Nadia
7	Dikhow	Sivasagar	30.07.2025	12.13	Assam	Sivasagar
8	Ganga	Buxar	04.06.2025	10.85	Bihar	Buxar
		Gandhighat	01.08.2025	11.28	Bihar	Patna
		Bithoor	01.05.2025	10.53	Uttar Pradesh	Kanpur
		Kanpur	01.05.2025	10.31	Uttar Pradesh	Kanpur
		Parmarthghat	01.05.2025	10.74	Uttar Pradesh	Kanpur
		Bithoor	01.06.2025	11.30	Uttar Pradesh	Kanpur
		Hathikhana	01.06.2025	10.66	Uttar Pradesh	Fatehgarh
		Jajmau	01.06.2025	11.64	Uttar Pradesh	Kanpur
		Kanpur	01.06.2025	11.71	Uttar Pradesh	Kanpur
		Parmarthghat	01.06.2025	12.21	Uttar Pradesh	Kanpur
9	Godavari	Yelli	03.03.2025	10.69	Maharashtra	Nanded
		Bhadrachalam	01.04.2025	11.69	Telangana	Bhadradri Kothagudem
10	Gomti	Gomtinagar	01.04.2025	12.14	Uttar Pradesh	Lucknow
11	Hindon	Baleni	02.08.2025	10.71	Uttar Pradesh	Baghpat
12	Jalangi	Chapra	05.02.2025	16.92	West Bengal	Nadia
		Chapra	02.01.2025	12.15	West Bengal	Nadia
		Chapra	02.07.2025	34.73	West Bengal	Nadia
		Chapra	04.06.2025	31.84	West Bengal	Nadia
		Chapra	05.03.2025	25.90	West Bengal	Nadia
13	Jivach	Kakarghatti	03.06.2025	10.20	Bihar	Darbhanga
14	Kichha(Gaula)	Dhaneta	01.04.2025	13.14	Uttar Pradesh	Bareilly
15	Krishna/Musi	Dameracherla	03.03.2025	14.08	Telangana	Nalgonda
16	Mathabhanga	Banpur	03.12.2025	10.09	West Bengal	Nadia

Sl. No	River / Tributary	Site	Date of Sampling	As (µg/L)	State/UT	District
		Banpur	05.02.2025	17.96	West Bengal	Nadia
		Banpur	02.01.2025	15.09	West Bengal	Nadia
		Banpur	02.07.2025	14.13	West Bengal	Nadia
		Banpur	04.06.2025	23.29	West Bengal	Nadia
		Banpur	05.03.2025	30.13	West Bengal	Nadia
17	Ramganga	Dabri	01.05.2025	12.00	Uttar Pradesh	Shahjahanpur
		Dabri	01.06.2025	16.76	Uttar Pradesh	Shahjahanpur
18	Sahibi	Dadri	02.09.2025	16.86	Haryana	Jhajjar
19	Sarayan	Sitapur	01.05.2025	10.76	Uttar Pradesh	Sitapur
20	Som	Rangeli	02.06.2025	10.98	Rajasthan	Dungarpur
21	Subansiri	Chouldhowaghat	20.02.2025	28.48	Assam	Lakhimpur
22	Sukheta	Todarpur	01.04.2025	11.73	Uttar Pradesh	Hardoi
		Todarpur	01.07.2025	10.10	Uttar Pradesh	Hardoi
23	Tiyar	Lakhoura	03.06.2025	10.43	Bihar	East Champaran
24	Tungabhadra	Mantralayam	02.06.2025	12.18	Andhra Pradesh	Kurnool
		Bawapuram	02.06.2025	10.59	Andhra Pradesh	Kurnool
25	Yamuna	Baghpat	02.06.2025	10.16	Uttar Pradesh	Baghpat
		Karnal	02.08.2025	13.34	Haryana	karnal
		Kuthnaur	02.09.2025	13.73	Uttrakhand	Uttarakashi
		Naugaon	02.09.2025	13.31	Uttrakhand	Uttarakashi
		Palla	02.06.2025	12.00	Delhi	North West Delhi
		Vrindavan- Yamuna Expressway Link Road Bridge U/S ofMathura	02.07.2025	11.28	Uttar Pradesh	Mathura

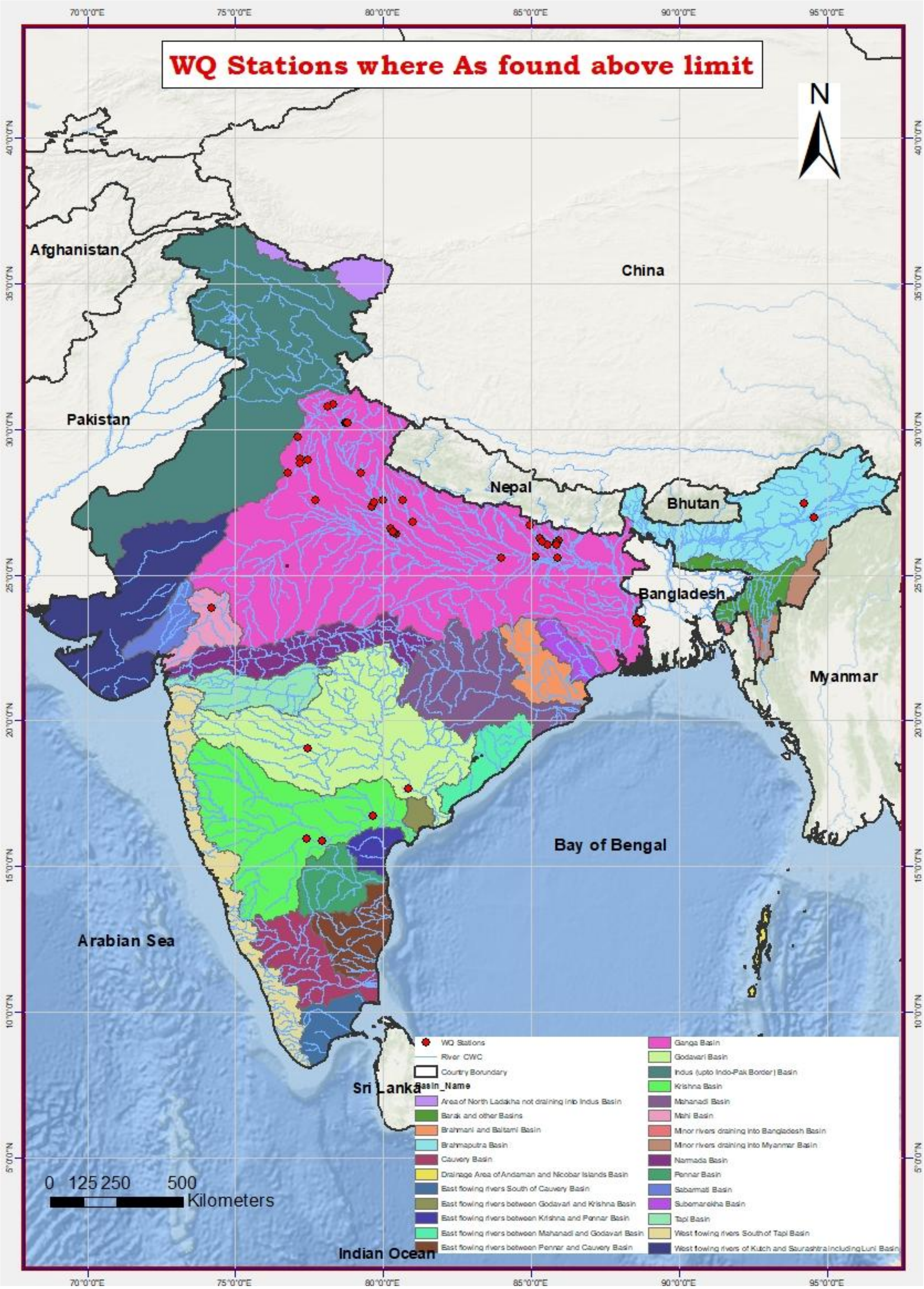

Figure 28: WQ stations where Arsenic found above acceptable limit

Comparative Assessment of Arsenic Concentration in River Water (2023–2025)

A comparative evaluation of arsenic concentrations in river water was carried out for three consecutive monitoring periods corresponding to the 7th edition (January–December 2023), 8th edition (January–December 2024), and the latest monitoring dataset (2025). The assessment focuses on exceedance of the BIS acceptable limit of 10 µg/L for arsenic in drinking water.

During 2023, a total of 5,911 river water samples were collected and analyzed. Out of these, 10 samples (0.17%) exceeded the BIS acceptable limit of 10 µg/L. These exceedances were confined to 3 monitoring stations located on three rivers, namely Rind, Sengar, and Yamuna. The maximum arsenic concentration recorded during this period was 17.59 µg/L, observed at Lalpur station on the Sengar River on 21 June 2023. In 2024, a total of 5,456 samples were analyzed. Among these, 41 samples (0.75%) exceeded the acceptable limit, indicating a more than fourfold increase in exceedances compared to 2023. The contamination was more widespread, with exceedances reported from 13 monitoring stations across five rivers, namely Hindon, Lalbekia, Rind, Sengar, and Yamuna. The highest arsenic concentration recorded in 2024 was 22.63 µg/L, measured at Palla station on the Yamuna River (Delhi) on 21 June 2024.

In the latest monitoring cycle January-December 2025, a total of 6660 river water samples were analyzed. Of these, 65 samples (0.98%) exceeded the BIS acceptable limit, showing a continued increasing trend in arsenic exceedance. These exceedances were reported from 42 monitoring stations distributed across 25 rivers, including major river systems such as Ganga, Godavari, Gomti, Hindon, Ramganga, Yamuna, and others (Adhwara Group, Alaknanda, Bagmati, Baya, Burhi Gandak, Churni, Dikhow, Jalangi, Jivach, Kichha (Gaula), Krishna/Musi, Mathabhanga, Sahibi, Sarayan, Som, Subansiri, Sukheta, Tiyar, Tungabhadra). The arsenic concentration ranged from non-detectable levels to 34.73 µg/L, with the maximum value (34.73 µg/L) recorded at Chapra monitoring station on the Jalangi River on 02 July 2025.

Trend Analysis and Interpretation

The comparative analysis clearly demonstrates a progressive increase in arsenic exceedance in river water over the three-year period from 2023 to 2025. The number of samples exceeding the BIS acceptable limit of 10 µg/L has risen substantially, from 10 cases in 2023 to 41 in 2024 and further to 65 in 2025, indicating a consistent escalation in exceedances. Simultaneously, the spatial distribution of exceedance has expanded markedly, with affected rivers increasing from 3 in 2023 to 5 in 2024 and reaching 25 rivers in 2025, reflecting a widening geographical spread. In addition, the maximum recorded arsenic concentration has shown a steady upward trend, increasing from 17.59 µg/L in 2023 to 22.63 µg/L in 2024 and further to 34.73 µg/L in 2025. Collectively, these observations indicate both an intensification in the severity of arsenic exceedance and a significant expansion in its geographical occurrence across river systems.

However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

A GIS map depicting the stations where arsenic values were found above the acceptable limit during both study periods is shown as Figure 29.

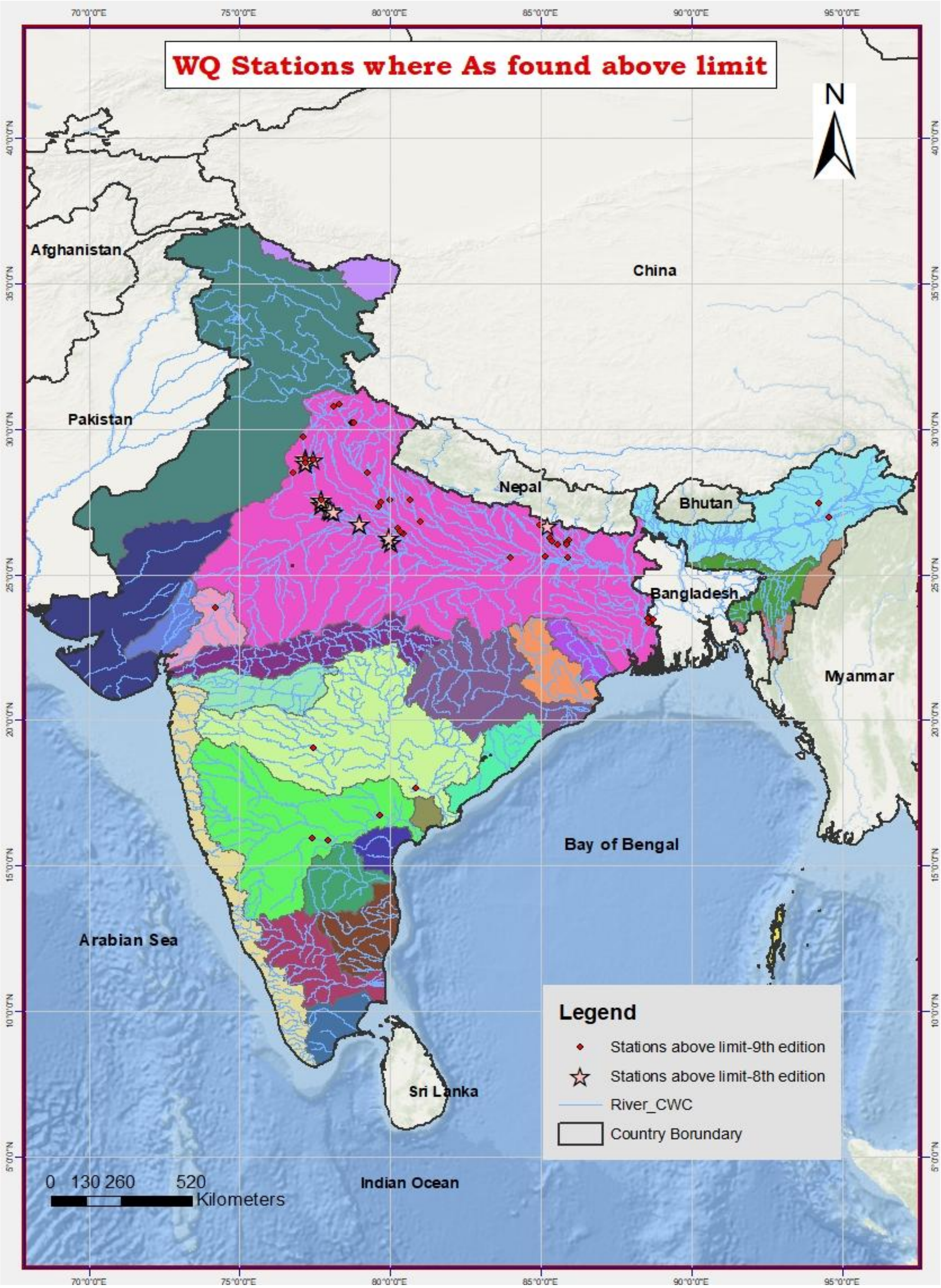

Figure 29: WQ stations where Arsenic found above acceptable limit (both study periods)

7.2 Cadmium (Cd)

Bureau of Indian Standards (BIS) has recommended an acceptable limit of 3 µg/L of cadmium in drinking water. Out of total 6667 river water samples analysed, 07 samples from 04 water quality stations were found to have cadmium concentrations beyond the acceptable limit. The cadmium concentration varies from 0.000 to 10.02 µg/L. Maximum cadmium concentration (10.02 µg/L) was observed at Musiri water quality monitoring station on Cauvery River on 11.06.2025.

The details of stations where cadmium concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below.

Table 13: River-wise list of WQ stations with Cd values above limit

S.No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Cd (µg/L)	State/UT	District
1	Adhwara Group	Ekmighat	03.06.2025	3.54	Bihar	Darbhanga
2	Cauvery	Biligundulu	11.06.2025	3.69	Tamil Nadu	Krishnagiri
		Musiri	11.06.2025	10.02	Tamil Nadu	Tiruchirapalli
3	Narmada	Manot	01.05.2025	3.72	Madhya Pradesh	Mandla
		Dindori	02.06.2025	3.22	Madhya Pradesh	Dindori
4	Ponnaiyar	Singasadanapalli	01.022025	3.35	Tamil Nadu	Krishnagiri
		Gummanur	11.06.2025	4.63	Tamil Nadu	Krishnagiri

Figure 30 represents GIS map of WQ stations where Cadmium found above acceptable limit.

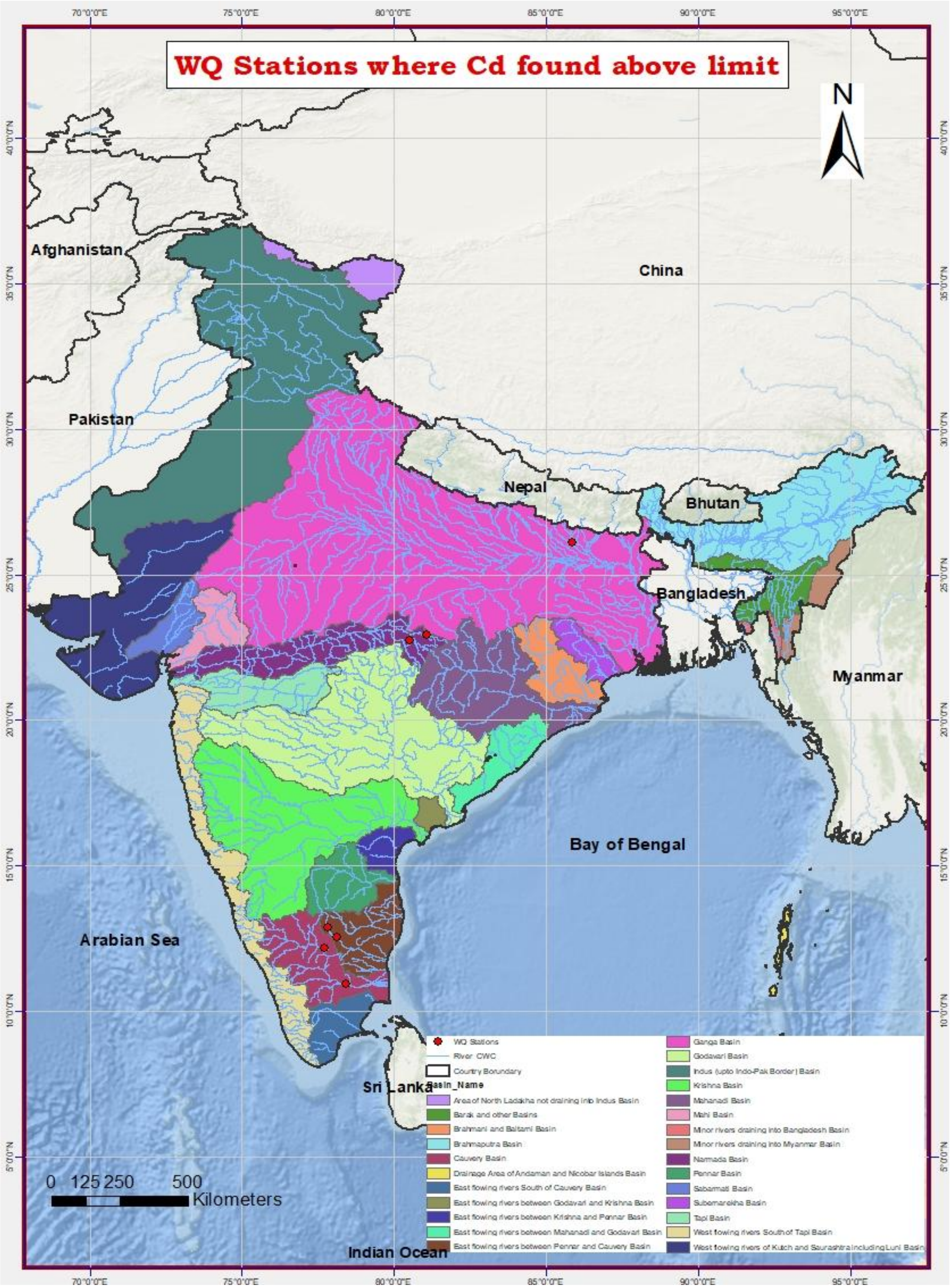

Figure 30: WQ stations where Cadmium found above acceptable limit

Comparative Assessment of Cadmium Concentration in River Water (2023–2025)

The data on cadmium concentrations exceeding the acceptable limit have been comparatively analyzed for three consecutive monitoring periods, including the 7th edition (January–December 2023), the subsequent dataset for 2024, and the latest monitoring data for 2025. The assessment is based on exceedance of the prescribed acceptable limit for cadmium in water.

During the year 2023, out of a total of 5,940 river water samples analyzed, only one sample (0.017%) from a single monitoring station showed cadmium concentration above the acceptable limit, indicating minimal exceedance during this period. The cadmium concentration ranged from non-detectable levels to 10.59 µg/L, with the maximum concentration of 10.59 µg/L recorded at the Thevur monitoring station on the Sarabenga River on 01 February 2023.

In comparison, the year 2024 exhibited a notable increase in cadmium exceedances, both in terms of frequency and spatial distribution. Out of 5,459 samples analyzed, 7 samples (0.13%) from 3 monitoring stations across 3 rivers (Baghmati, Kabini, and Ponnaiyar) were found to exceed the acceptable limit. Although the maximum concentration (6.54 µg/L) recorded at Singasadanapalli station on the Ponnaiyar River on 01 October 2024 was lower than that observed in 2023, the increase in the number of exceedances and affected locations indicates a wider spatial spread of contamination.

The latest monitoring data for 2025 further indicate a persistent presence of cadmium exceedance, though with slight variation in magnitude and distribution. Out of 6667 river water samples analyzed, 7 samples (0.11%) from 4 monitoring stations located on four rivers (Adhwara Group, Cauvery, Narmada, and Ponnaiyar) exceeded the acceptable limit. The cadmium concentration ranged from 0.000 to 10.02 µg/L, with the maximum concentration of 10.02 µg/L observed at the Musiri monitoring station on the Cauvery River on 11 June 2025.

Overall, the comparative analysis indicates that while cadmium exceedance remains relatively low in terms of percentage exceedance, there is a clear increase in the number of affected stations and rivers from 2023 to 2024, followed by a continued but spatially shifting presence in 2025. The fluctuations in maximum concentration values, coupled with the expanding geographical occurrence, suggest localized but recurring inputs of cadmium, possibly influenced by anthropogenic activities such as industrial discharge, agricultural runoff, and urban effluents, along with site-specific geochemical conditions.

However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

A GIS map depicting the stations where cadmium values were found above the acceptable limit during both study periods is shown as Figure 31.

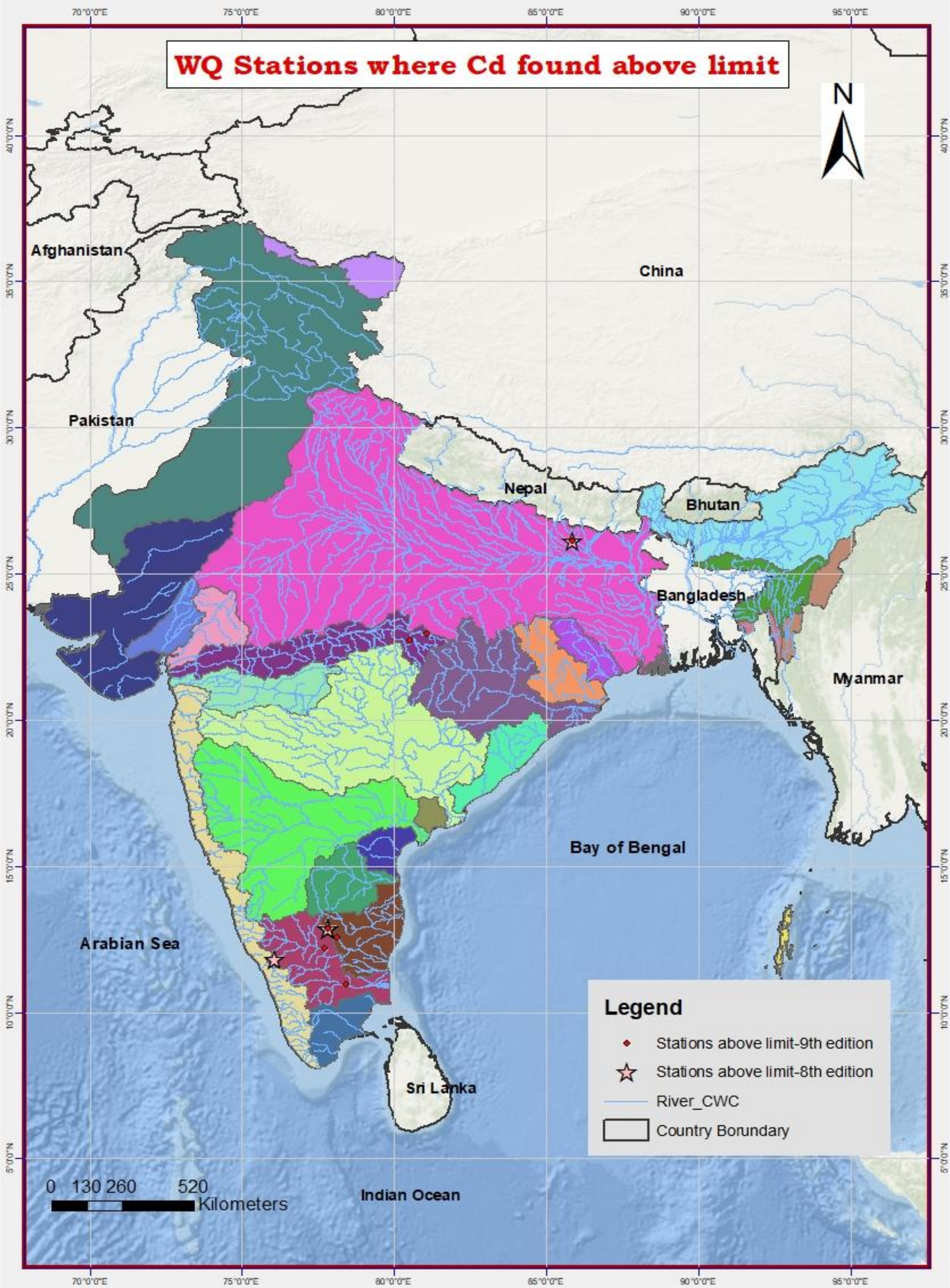

Figure 31: WQ stations where Cadmium found above acceptable limit (both study periods)

7.3 Chromium (Cr)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 50 µg/L of chromium in drinking water. Out of total 6660 river water samples analysed, 7 samples from 06 water quality stations were found to have chromium concentrations beyond the acceptable limit. The chromium concentration varies from 0.000 to 118.83 µg/L. Maximum chromium concentration (118.83 µg/L) was observed at Baleni water quality monitoring station on Hindon River on 02.04.2025. Chromium (Cr) is a heavy metal that can have detrimental effects on aquatic ecosystems and human health when present in elevated concentrations.

The details of stations where chromium concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below.

Table 14: River-wise list of WQ stations with Cr values above limit

S. No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Cr (µg/L)	State/UT	District
1	Hindon	Baleni	02.04.2025	118.83	Uttar Pradesh	Baghpat
		Chilla Gaon	02.04.2025	73.83	Delhi	East Delhi
		Galeta	02.04.2025	84.39	Uttar Pradesh	Baghpat
2	Malaprabha	Cholachagudda	23.07.2025	65.66	Karnataka	Bagalkot
		Cholachagudda	23.09.2025	85.99	Karnataka	Bagalkot
3	Namchik	Jairampur	20.03.2025	60.92	Arunachal Pradesh	Changlang
4	Siang	Pasighat	20.02.2025	60.87	Arunachal Pradesh	East Siang

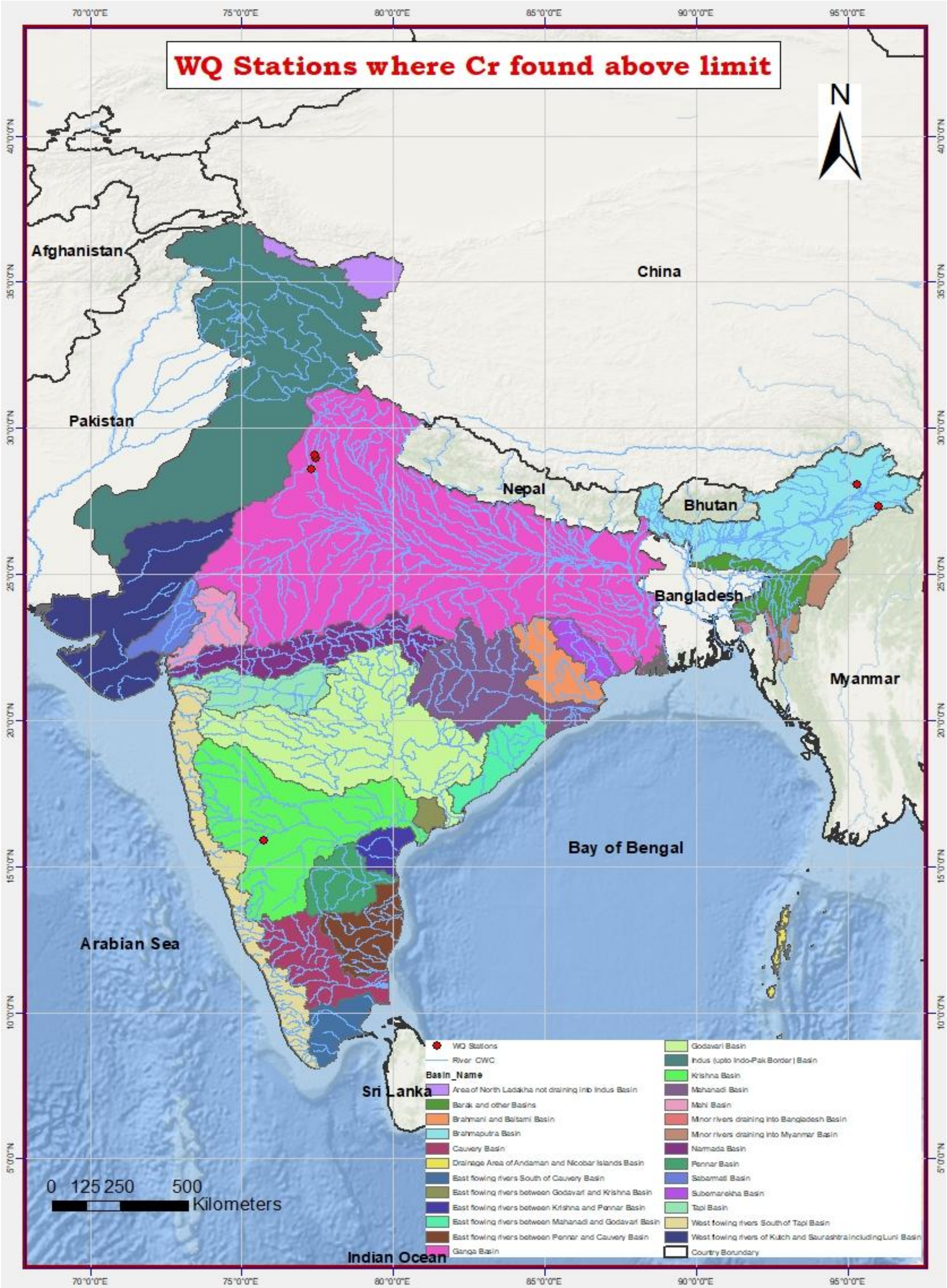

Figure 32: WQ stations where Chromium found above acceptable limit

Comparative Assessment of Chromium Concentration in River Water (2023–2025)

A comparative evaluation of chromium concentrations in river water was carried out for the monitoring periods 2023, 2024, and 2025, with emphasis on samples exceeding the prescribed acceptable limit. The analysis reveals significant temporal variation in both the magnitude and spatial distribution of chromium exceedance.

During 2023, chromium exceedances were comparatively widespread and pronounced. Out of 5,730 river water samples analyzed, 87 samples (1.52%) exceeded the acceptable limit, representing the highest frequency of exceedances among the three years. The chromium concentration ranged from 0.00 to 84.61 µg/L, with the maximum concentration of 84.61 µg/L recorded at the Biligundulu monitoring station on the Cauvery River on 12 June 2023. The exceedance was geographically extensive, affecting 21 rivers, including Aliyar, Bhadra, Bhavani, Bhavani/Moyar, Cauvery, Chittar, Gandhayar, Gataprabha, Kallar, Kodaganar, Marudaiyar, Noyyal, Palar, Ponnaiyar, Sarabenga, Suruliyar, Tambraparani, Thoppaiyar, Tungabhadra, Vaigai, and Yamuna, indicating a broad regional spread of chromium pollution. In contrast, 2024 showed a substantial reduction in the number of exceedances and affected rivers, suggesting an improvement in overall conditions or localized containment. Out of 5,039 samples analyzed, only 14 samples (0.28%) from 9 monitoring stations exceeded the acceptable limit. However, despite the reduction in frequency, the maximum concentration increased sharply to 248.90 µg/L, indicating the occurrence of highly elevated, localized exceedance events. Chromium exceedances were reported in 6 rivers, namely Arkavathi, Chinnar, Cauvery, Gataprabha, Yagachi, and Yamuna, reflecting a contraction in spatial distribution but persistence in certain river systems.

The 2025 monitoring data further indicate a continued decline in the number of exceedances, with 7 samples (0.11%) out of 6660 analyzed samples exceeding the acceptable limit. These exceedances were observed at 6 monitoring stations across four rivers—Hindon, Malaprabha, Namchik, and Siang. The chromium concentration ranged from 0.000 to 118.834 µg/L, with the maximum concentration of 118.83 µg/L recorded at the Baleni monitoring station on the Hindon River on 02 April 2025. While the frequency and spatial extent of exceedances decreased further, the persistence of elevated concentrations indicates sporadic but significant exceedance events.

Overall, the comparative analysis demonstrates a declining trend in the frequency and spatial distribution of chromium exceedances from 2023 to 2025, accompanied by intermittent spikes in maximum concentration levels, particularly in 2024 and 2025. This pattern suggests that while widespread exceedance may be reducing, localized high-intensity pollution sources—likely linked to industrial discharge, urban runoff, and site-specific anthropogenic activities—continue to impact certain river stretches.

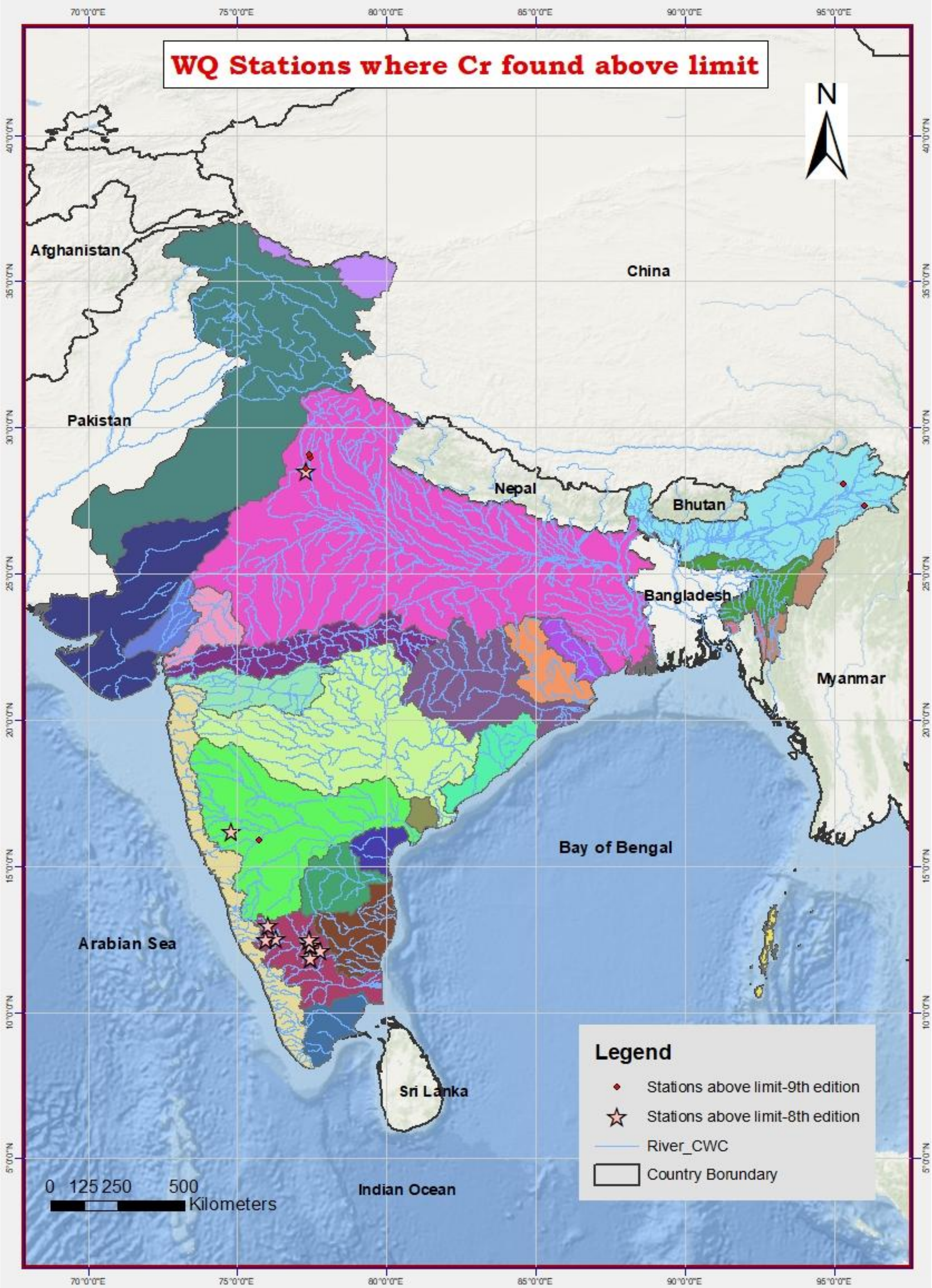

Figure 33: WQ stations where Chromium found above acceptable limit (both study periods)

7.4 Copper (Cu)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 50 µg/L of copper in drinking water. Out of total 6667 river water samples analysed, 12 samples from 11 water quality stations were found to have copper concentrations beyond the acceptable limit. The copper concentration varies from 0.000 to 294.25 µg/L. Maximum copper concentration (294.25 µg/L) was observed at Paramakudi water quality monitoring station on Vaigai River on 15-01-2025.

The details of stations where copper concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below.

Table 15: River-wise list of WQ stations with Cu values above limit

S. No.	River/ Reser-voir	Water Quality Stations	Date of Sampling	Cu (µg/L)	State/UT	District
1	Arkavathi	T Bekuppe	21.11.2025	83.89	Karnataka	Ramanagara
2	Bhavani	Savandapur	01.01.2025	63.59	Tamil Nadu	Erode
3	Brahmaputra	Neamatighat	01.09.2025	124.32	Assam	Jorhat
4	Cauvery	Kodumudi	01.02.2025	60.85	Tamil Nadu	Erode
5	Krishna	Wadenaplly	01.04.2025	258.14	Telangana	Suryapet
6	Mahi	Khanpur	01.12.2025	53.50	Gujarat	Anand
7	Ponnaiyar	Singasadanapalli	01.01.2025	62.26	Tamil Nadu	Krishnagiri
		Singasadanapalli	01.02.2025	72.43	Tamil Nadu	Krishnagiri
8	Ranganadi	Yazali	21.07.2025	59.96	Arunachal Pradesh	Lower Subansiri
9	Sabarmati	Vautha	01.04.2025	92.34	Gujarat	Kheda
		Derol Bridge	01.12.2025	53.27	Gujarat	Sabarkantha
10	Vaigai	Paramakudi	15.01.2025	294.25	Tamil Nadu	Ramanathapuram

Figure 34 represents a GIS map of WQ stations where Copper is found above acceptable limit.

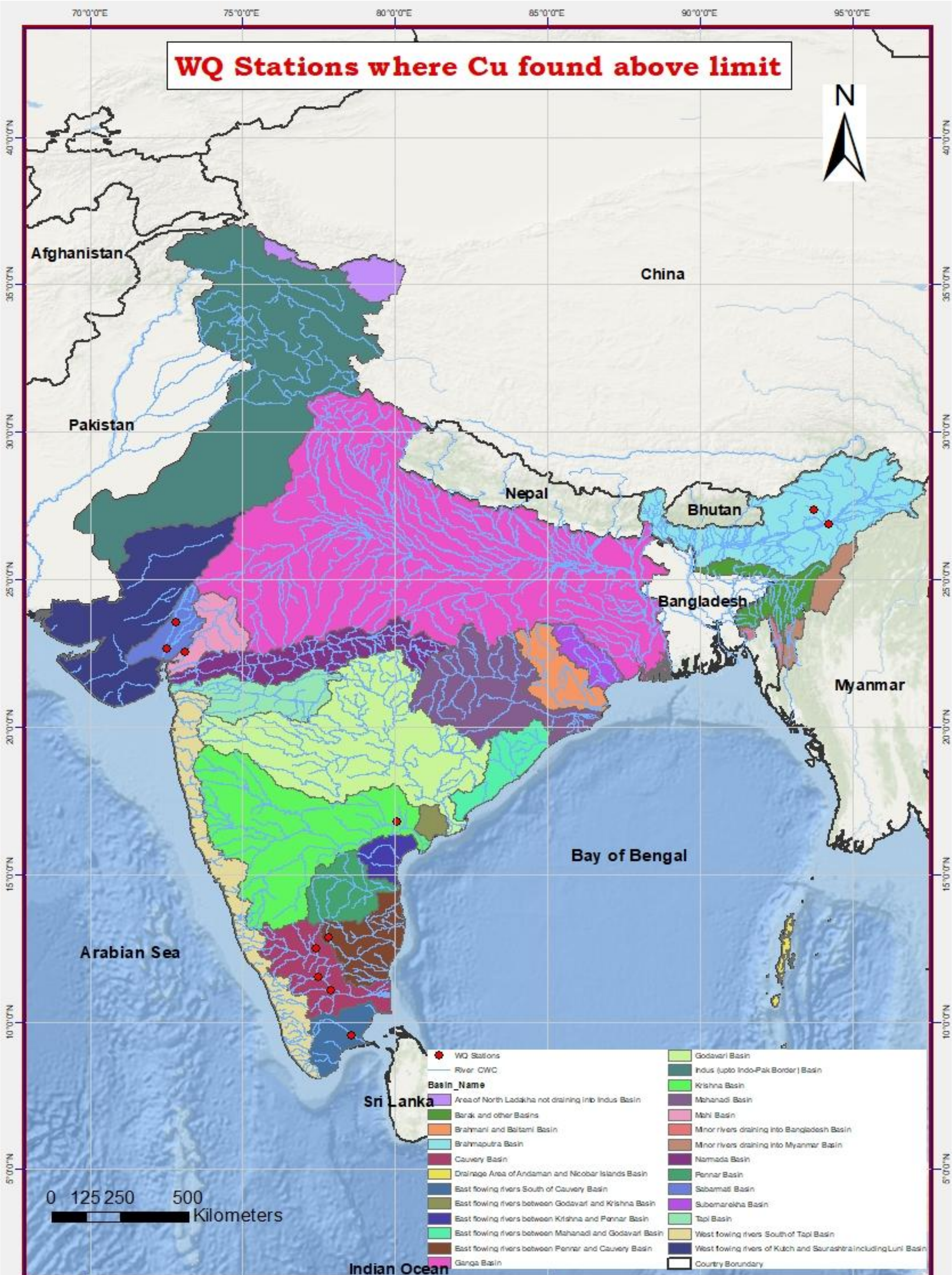

Figure 34: WQ stations where Copper found above acceptable limit

Comparative Assessment of Copper Concentration in River Water (2023–2025)

A comparative analysis of copper concentrations in river water was carried out for the monitoring periods 2023, 2024, and 2025, with reference to exceedance of the prescribed acceptable limit. During January–December 2023, a total of 5,940 river water samples were analyzed, of which only three samples (0.05%) from three monitoring stations exceeded the acceptable limit. These exceedances were reported from rivers Aliyar, Bhavani, and Hindon, indicating a limited and localized occurrence of copper exceedance. However, despite the low frequency, the maximum copper concentration reached 107.01 µg/L, recorded at Nellithurai station on the Bhavani River, suggesting the presence of high-intensity localized pollution sources.

In 2024, a moderate increase in exceedances was observed. Out of 5,457 samples analyzed, seven samples (0.13%) from three monitoring stations exceeded the permissible limit. These were reported from the Chinnar and Ponnaiyar rivers, indicating a shift in the spatial distribution of exceedance. The copper concentration ranged from 0.000 to 160.41 µg/L, with the highest concentration of 160.41 µg/L recorded at the Singasadanapalli station on the Ponnaiyar River on 02 September 2024. The increase in both exceedances and maximum concentration reflects a growing intensity of localized exceedance events.

The 2025 monitoring data further indicate a notable escalation in both the frequency and spatial spread of copper exceedance. Out of 6667 river water samples analyzed, 12 samples (0.18%) from 11 monitoring stations exceeded the acceptable limit. These exceedances were distributed across multiple river systems, including Arkavathi, Bhavani, Brahmaputra, Cauvery, Krishna, Mahi, Ponnaiyar, Ranganadi, Sabarmati, and Vaigai, demonstrating a significant expansion in geographical coverage. The copper concentration ranged from 0.000 to 294.25 µg/L, with the maximum concentration of 294.25 µg/L recorded at the Paramakudi monitoring station on the Vaigai River on 15 January 2025, representing the highest value observed across the three years.

Overall, the comparative assessment indicates a progressive increase in copper exceedance from 2023 to 2025, characterized by a rise in the number of exceedances, expansion in the number of affected rivers, and a substantial increase in maximum concentration levels. While the percentage of exceedance remains relatively low, the increasing magnitude and spatial distribution of exceedance suggest intensifying anthropogenic influences, such as industrial discharge, urban runoff, and agricultural inputs. However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

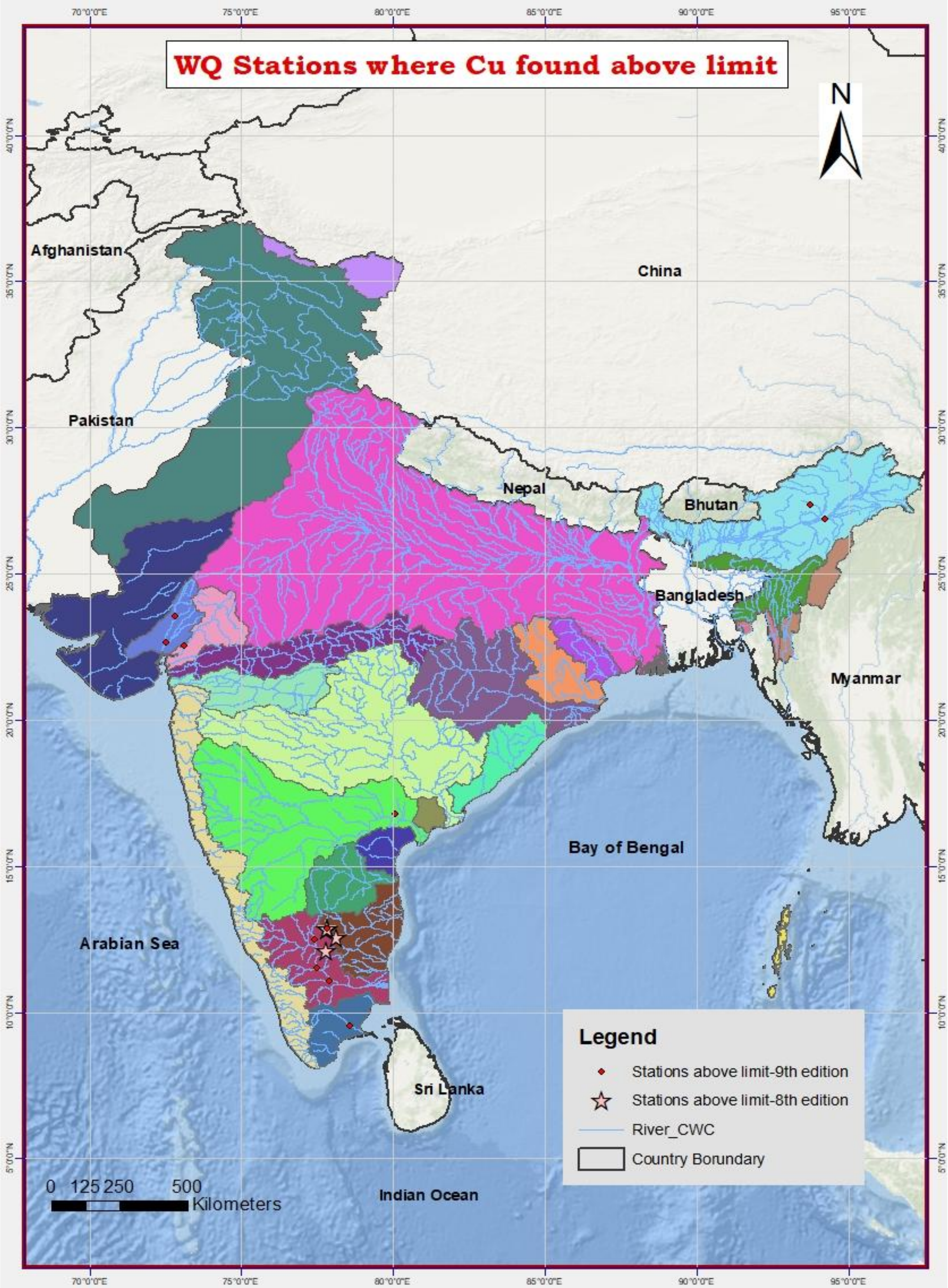

Figure 35: WQ stations where Copper found above acceptable limit (both study periods)

7.5 Iron (Fe)

Bureau of Indian Standards (BIS) 10500:2012 has recommended the acceptable limit of 1.0 mg/L (1000 µg/L) for Iron. Out of total 6459 river water samples analysed, 409 samples from 209 water quality stations were found to have iron concentrations beyond the acceptable limit. The iron concentration varies from 0.000 to 43692.32 mg/L. Maximum iron concentration (43692.32 mg/L) was observed at Kuthnaur water quality monitoring station on Yamuna River on 02.09.2025.

The details of stations where iron concentrations (in mg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below.

Table 16: River-wise list of WQ stations with Fe values above limit

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
1	Amba	Nagothane	02.09.2025	1175.00	Maha-rashtra	Raigad
2	Baitarani	Anandapur	11.07.2025	1256.81	Odisha	Keonjhar
	Baitarani	Swampatana	21.06.2025	1036.35	Odisha	Keonjhar
	Baitarani	Swampatana	11.08.2025	1089.28	Odisha	Keonjhar
3	Barak	A.P.Ghat	11.11.2025	1905.25	Assam	Cachar
	Barak	A.P.Ghat	13.10.2025	3710.86	Assam	Cachar
	Barak	B.P.Ghat	11.12.2025	1044.96	Assam	Karimganj
	Barak	B.P.Ghat	11.11.2025	1903.62	Assam	Karimganj
	Barak	B.P.Ghat	13.10.2025	4371.13	Assam	Karimganj
	Barak	Chotabekra	11.12.2025	1955.38	Manipur	Jiribam
	Barak	Chotabekra	11.11.2025	3340.19	Manipur	Jiribam
	Barak	Chotabekra	13.10.2025	4112.72	Manipur	Jiribam
	Barak	Fuletral	11.11.2025	2344.11	Assam	Cachar
	Barak	Fuletral	13.10.2025	3776.98	Assam	Cachar
4	Barak/Rukni	Dholai	11.12.2025	1453.38	Assam	Cachar
	Barak/Rukni	Dholai	11.11.2025	1914.98	Assam	Cachar
	Barak/Rukni	Dholai	13.10.2025	2329.56	Assam	Cachar
5	Brahamani	Bolani	21.06.2025	1460.11	Odisha	Sundargarh
	Brahamani	Bolani	11.07.2025	1004.72	Odisha	Sundargarh
	Brahamani	Bonaigarh	11.07.2025	1275.11	Odisha	Sundergarh
	Brahamani	Bonaigarh	11.08.2025	1008.32	Odisha	Sundergarh
	Brahamani	Gomlai	21.06.2025	1058.58	Odisha	Sundergarh
	Brahamani	Gomlai	11.07.2025	1267.64	Odisha	Sundergarh
	Brahamani	Gomlai	11.08.2025	1071.72	Odisha	Sundergarh
	Brahamani	Jenapur	11.07.2025	1117.33	Odisha	Jajpur
	Brahamani	Jenapur	11.08.2025	1033.81	Odisha	Jajpur
	Brahamani	Kamalanga	11.07.2025	1050.56	Odisha	Angual
	Brahamani	Nandira	11.07.2025	1163.36	Odisha	Angual
	Brahamani	Nandira	11.08.2025	1156.14	Odisha	Angual
	Brahamani	Panposh	21.06.2025	1303.56	Odisha	Sundergarh
	Brahamani	Panposh	11.07.2025	1060.71	Odisha	Sundergarh
	Brahamani	Panposh	11.08.2025	1105.04	Odisha	Sundergarh

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Brahamani	Purunagarh	21.06.2025	1091.01	Odisha	Deogarh
	Brahamani	Purunagarh	11.07.2025	1062.26	Odisha	Deogarh
	Brahamani	R.S.P	21.06.2025	1211.60	Odisha	Sundergarh
	Brahamani	R.S.P-I	21.06.2025	1255.92	Odisha	Sundergarh
	Brahamani	R.S.P-II	21.06.2025	1013.51	Odisha	Sundergarh
	Brahamani	R.S.P-II	11.07.2025	1235.93	Odisha	Sundergarh
	Brahamani	Talcher	21.06.2025	1030.25	Odisha	Angual
	Brahamani	Talcher	11.07.2025	1020.44	Odisha	Angual
6	Brahmaputra	Neamatighat	20.01.2025	4338.08	Assam	Jorhat
	Brahmaputra	Pancharatna	03.10.2025	1001.53	Assam	Goalpara
7	Brahmaputra/Jaldhaka	Nagrakata	01.09.2025	1705.71	West Bengal	Jalpaiguri
8	Brahmaputra/Jaldhaka/Di-ana	Diana	11.11.2025	1107.33	West Bengal	Jalpaiguri
9	Brahmaputra/Sankosh	Golokganj	01.08.2025	1146.66	ASSAM	Dhubri
	Brahmaputra/Sankosh	Sankosh LRP	02.06.2025	1475.16	West Bengal	Alipurduar
10	Brahmaputra/Teesta/Chel	Chel	01.08.2025	1107.91	West Bengal	Jalpaiguri
	Brahmaputra/Teesta/Chel	Chel	03.10.2025	1062.00	West Bengal	Jalpaiguri
11	Brahmaputra/Teesta	Domohani	01.08.2025	1399.10	West Bengal	Jalpaiguri
	Brahmaputra/Teesta	Khanitar	01.08.2025	1651.49	Sikkim	Pakyong
	Brahmaputra/Teesta	Mekhliganj	01.07.2025	1132.07	West Bengal	COOCHBE-HAR
	Brahmaputra/Teesta	Sevoke	11.11.2025	1567.16	West Bengal	Darjeeling
12	Brahmapu-tra/Teesta/Rangit	Majitar	21.03.2025	1093.97	Sikkim	Namchi
13	Brahmaputra/Torsa	Hasimara	01.08.2025	1362.01	West Bengal	Alipurduar
	Brahmaputra/Torsa	Hasimara	11.11.2025	1085.37	West Bengal	Alipurduar
14	Brahmapu-tra/Torsa/Kaljani	Ambari	03.10.2025	1231.73	West Bengal	Coochbe-har
15	Burhabalanga	Balighat(Burhabalanga)	11.07.2025	1238.28	Odisha	Balasore
	Burhabalanga	Baripada	11.07.2025	1251.15	Odisha	Mayur-bhanj
	Burhabalanga	Govindpur(NH-5)	11.07.2025	1209.26	Odisha	Balasore
16	Buridehing	Jagunghat	20.03.2025	1249.94	Assam	Tinsukia
	Buridehing	Naharkatia	20.06.2025	1480.68	Assam	Dibrugarh
17	Cauvery	Chunchunkatte	23.06.2025	1017.01	Karna-taka	Mysore
	Cauvery	Chunchunkatte	23.07.2025	1681.77	Karna-taka	Mysore
	Cauvery	Chunchunkatte	21.08.2025	1497.89	Karna-taka	Mysore
	Cauvery	Kudige	23.06.2025	2607.83	Karna-taka	Kodagu

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
18	Cauvery/Bhavani	Savandapur	01.01.2025	1910.53	Tamil Nadu	Erode
19	Cauvery/Bhavani/ Moyar	Thengumarahada	01.02.2025	1002.05	Tamil Nadu	Nilgiris
	Cauvery/Bhavani/ Moyar	Thengumarahada	02/08/2025	1511.31	Tamil Nadu	Nilgiris
	Cauvery/Bhavani/ Moyar	Thengumarahada	01.09.2025	1299.53	Tamil Nadu	Nilgiris
	Cauvery/Bhavani/ Moyar	Thengumarahada	01/11/2025	1659.14	Tamil Nadu	Nilgiris
20	Cauvery/Chinnar	Hogenakkal	13.10.2025	1043.94	Tamil Nadu	Dhar-mapuri
21	Cauvery/Hemavathi	Akkihebbal	23.10.2025	1249.69	Karna-taka	Mandya
	Cauvery/Hemavathi	M H halli	23.10.2025	1806.61	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	23.01.2025	1496.19	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	23.04.2025	1130.20	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	22.05.2025	3735.90	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	23.06.2025	4921.08	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	23.07.2025	3574.90	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	21.08.2025	1986.26	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	23.09.2025	1035.56	Karna-taka	Hassan
	Cauvery/Hemavathi	Sakaleshpura	22.12.2025	1374.48	Karna-taka	Hassan
22	Cauvery/Hemavathi /Yagachi	Thimmanahalli	21.03.2025	1004.50	Karna-taka	Hassan
23	Cauvery/Kabini	Muthankera	23.04.2025	1034.50	Kerala	Wayanad
	Cauvery/Kabini	Muthankera	22.05.2025	1152.70	Kerala	Wayanad
	Cauvery/Kabini	Muthankera	23.07.2025	3300.55	Kerala	Wayanad
	Cauvery/Kabini	Muthankera	21.08.2025	1134.19	Kerala	Wayanad
	Cauvery/Kabini	Muthankera	23.09.2025	1192.65	Kerala	Wayanad
	Cauvery/Kabini	Muthankera	21.11.2025	1173.31	Kerala	Wayanad
	Cauvery/Kabini	Muthankera	22.12.2025	1223.14	Kerala	Wayanad
	Cauvery/Kabini	T. Narasipur	23.09.2025	1088.62	Karna-taka	Mysore
	Cauvery/Kabini	T. Narasipur	23.10.2025	1952.33	Karna-taka	Mysore
24	Cauvery/Lakshmanthirtha	K.M. Vadi	23.07.2025	3583.87	Karna-taka	Mysore
	Cauvery/Lakshmanthirtha	K.M. Vadi	21.08.2025	2642.50	Karna-taka	Mysore
	Cauvery/Lakshmanthirtha	K.M. Vadi	23.09.2025	1776.61	Karna-taka	Mysore

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Cauvery/Lakshmanthirtha	K.M. Vadi	23.10.2025	4588.56	Karna-taka	Mysore
25	Cauvery/Marudai yar	Varanavasi	01.01.2025	1328.15	Tamil Nadu	Ariyalur
	Cauvery/Marudai yar	Varanavasi	25.11.2025	12332.72	Tamil Nadu	Ariyalur
26	Cauvery/Noyyal	Alandurai	02/08/2025	2421.53	Tamil Nadu	Coimba-tore
	Cauvery/Noyyal	Alandurai	11.09.2025	1912.11	Tamil Nadu	Coimba-tore
	Cauvery/Noyyal	Alandurai	01/11/2025	1043.90	Tamil Nadu	Coimba-tore
	Cauvery/Noyyal	Elunuthi Mangalam	01.03.2025	1290.17	Tamil Nadu	Erode
27	Cauvery/Shimsha	T K Halli	23.10.2025	1638.46	Karna-taka	Mandya
28	Cauvery/Suvarnavathi	Bendrahalli	23.07.2025	2212.55	Karna-taka	Chamaraja Nagar
	Cauvery/Suvarnavathi	Bendrahalli	21.08.2025	2007.45	Karna-taka	Chamaraja Nagar
	Cauvery/Suvarnavathi	Bendrahalli	23.09.2025	1585.33	Karna-taka	Chamaraja Nagar
	Cauvery/Suvarnavathi	Bendrahalli	23.10.2025	2560.40	Karna-taka	Chamaraja Nagar
	Cauvery/Suvarnavathi	Bendrahalli	21.11.2025	1417.04	Karna-taka	Chamaraja Nagar
	Cauvery/Suvarnavathi	Bendrahalli	22.12.2025	1077.15	Karna-taka	Chamaraja Nagar
29	Desang	Desangpani	01.09.2025	3528.85	Assam	Charaideo
	Desang	Nanglamoraghat	01.09.2025	3999.70	Assam	Sivasagar
30	Dhaleswari	Gharmura	11.11.2025	2270.18	Assam	Hailakandi
	Dhaleswari	Gharmura	13.10.2025	2294.04	Assam	Hailakandi
31	Dhansiri	Bokajan	02.08.2025	1234.55	Assam	Karbi An-glong
32	Dhansiri(S)	Numaligarh	19.06.2025	1079.48	Assam	Golghat
33	Dikhow	Bihubar	20.02.2025	1369.66	Assam	Sivasagar
	Dikhow	Bihubar	20.06.2025	1334.62	Assam	Sivasagar
34	Doyang	Gelabil	01.08.2025	1018.70	Assam	Golaghat
35	Gad	Belne bridge	23.06.2025	1620.42	Maha-rashtra	Sindudurg
	Gad	Belne Bridge	23.07.2025	4165.03	Maha-rashtra	Sindudurg
	Gad	Belne Bridge	21.08.2025	4374.69	Maha-rashtra	Sindudurg
	Gad	Belne Bridge	23.09.2025	3898.57	Maha-rashtra	Sindudurg
36	Ganga	Ankinghat	01.08.2025	1153.59	Uttar Pradesh	Kanpur Na-gar
	Ganga	Devprayag (G)	01.07.2025	1315.54	Ut-trakhand	Pauri Garhwal

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Ganga	Devprayag (G)	01.08.2025	1403.83	Uttrakhand	Pauri Garhwal
	Ganga	Hathikhana	01.05.2025	1010.65	Uttar Pradesh	Fatehgarh
	Ganga	Hathikhana	01.08.2025	1195.37	Uttar Pradesh	Fatehgarh
	Ganga	Hathikhana	03.10.2025	1478.63	Uttar Pradesh	Fatehgarh
	Ganga	Hathikhana	01.06.2025	1006.76	Uttar Pradesh	Fatehgarh
	Ganga	Jajmau	01.08.2025	1267.11	Uttar Pradesh	Kanpur
	Ganga	Jajmau	01.09.2025	1046.87	Uttar Pradesh	Kanpur
	Ganga	Jajmau	03.10.2025	2001.50	Uttar Pradesh	Kanpur
	Ganga	Kanpur	01.08.2025	1283.84	Uttar Pradesh	Kanpur
	Ganga	Kanpur	01.09.2025	1037.72	Uttar Pradesh	Kanpur
	Ganga	Kanpur	03.10.2025	1510.88	Uttar Pradesh	Kanpur
	Ganga	Parmarthghat	01.08.2025	1038.78	Uttar Pradesh	Kanpur
	Ganga	Parmarthghat	01.11.2025	1058.10	Uttar Pradesh	Kanpur
	Ganga	Rishikesh D/S	01.07.2025	1012.70	Uttrakhand	Rishikesh
37	Ganga/Alaknanda	Karnaprayag Confluence U/S	01.07.2025	1297.84	Uttrakhand	Chamoli
	Ganga/Alaknanda	Kirtinagar D/S	01.08.2025	1178.27	Uttrakhand	Tehri Garhwal
	Ganga/Alaknanda	Kirtinagar U/S	01.08.2025	1892.78	Uttrakhand	Tehri Garhwal
	Ganga/Alaknanda	Rudraprayag (A)	01.07.2025	1398.60	Uttrakhand	Rudraprayag
	Ganga/Alaknanda	Rudraprayag (A)	01.08.2025	1564.29	Uttrakhand	Rudraprayag
	Ganga/Alaknanda	Srinagar	01.07.2025	1658.79	Uttrakhand	Pauri Garhwal
	Ganga/Alaknanda	Srinagar	01.08.2025	1681.94	Uttrakhand	Pauri Garhwal
38	Ganga/Alaknanda/Mandakini	Augustmuni D/S	01.08.2025	3152.15	Uttrakhand	Rudraprayag
	Ganga/Alaknanda/Mandakini	Augustmuni U/S	01.08.2025	3314.29	Uttrakhand	Rudraprayag
39	Ganga/Alaknanda/Pinder	Karnaprayag (P)	01.08.2025	1110.94	Uttrakhand	Chamoli
40	Ganga/Bhagirathi	Koteshwar	01.08.2025	1088.04	Uttrakhand	Tehri Garhwal

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Ganga/Bhagirathi	Uttarkashi	01.03.2025	2068.98	Ut-trakhand	Uttarkashi
	Ganga/Bhagirathi	Uttarkashi	01.07.2025	2128.81	Ut-trakhand	Uttarkashi
	Ganga/Bhagirathi	Uttarkashi	01.08.2025	1853.49	Ut-trakhand	Uttarkashi
41	Ganga/Kiul	Lakhisarai	02.07.2025	1025.57	Bihar	Lakhisarai
42	Ganga/Mahanand a/Bal-ason	Matigara	01.07.2025	1182.36	West Bengal	Darjeeling
43	Ganga/Mahananda	Sonapur(Mahananda)	01.09.2025	1193.42	West Bengal	North Di-najpur
44	Ganga/Phalgu	Gaya	02.07.2025	1271.65	Bihar	Gaya
45	Ganga/Sone	Japla	01.07.2025	1308.20	Jhar-khand	Palamu
	Ganga/Sone	Koelwar	02.07.2025	1171.67	Bihar	Bhojpur
46	Ganga/Yamuna	Agra Canal, Kalindikunj	02.09.2025	2780.20	Delhi	South Delhi
	Ganga/Yamuna	Agra Canal, Kalindikunj	02.08.2025	1082.24	Delhi	South Delhi
	Ganga/Yamuna	Baghpat	02.08.2025	3963.28	Uttar Pradesh	Baghpat
	Ganga/Yamuna	Baghpat	02.09.2025	5630.96	Uttar Pradesh	Baghpat
	Ganga/Yamuna	Delhi Railway Bridge	02.08.2025	1589.77	Delhi	North Delhi
	Ganga/Yamuna	Delhi Railway Bridge	02.09.2025	1217.78	Delhi	North Delhi
	Ganga/Yamuna	Gokulbarrage (Ma-thura)	02.09.2025	14433.58	Uttar Pradesh	Mathura
	Ganga/Yamuna	Kalanaur	02.08.2025	9067.42	Uttar Pradesh	Saharanpur
	Ganga/Yamuna	Kalanaur	01.05.2025	1103.72	Uttar Pradesh	Saharanpur
	Ganga/Yamuna	Karnal	02.08.2025	13409.46	Haryana	karnal
	Ganga/Yamuna	Kuthnaur	02.09.2025	43692.32	Ut-trakhand	Uttarakashi
	Ganga/Yamuna	Mawi	02.08.2025	1875.15	Uttar Pradesh	Shamli
	Ganga/Yamuna	Mawi	01.05.2025	1121.86	Uttar Pradesh	Shamli
	Ganga/Yamuna	Mawi	02.09.2025	2086.40	Uttar Pradesh	Shamli
	Ganga/Yamuna	Mohna	02.09.2025	3143.46	Haryana	Faridabad
	Ganga/Yamuna	Naugaon	02.07.2025	2184.56	Ut-trakhand	Uttarakashi
	Ganga/Yamuna	Naugaon	02.09.2025	38105.03	Ut-trakhand	Uttarakashi
	Ganga/Yamuna	Okhla Barrage D/s of Delhi	02.09.2025	3243.89	Delhi	South Delhi
	Ganga/Yamuna	Palla	03.10.2025	5211.77	Delhi	North West Delhi
	Ganga/Yamuna	Palla	02.09.2025	4469.40	Delhi	North West Delhi
	Ganga/Yamuna	Palla	02.08.2025	1766.10	Delhi	North West Delhi

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Ganga/Yamuna	Vrindavan- Yamuna Expressway Link Road Bridge U/S of Mathura	02.09.2025	11913.35	Uttar Pradesh	Mathura
47	Ganga/Yamuna/C hambal	Dhareri	02.09.2025	9650.65	Madhya Pradesh	Ujjain
	Ganga/Yamuna/C hambal	Tal	02.09.2025	7547.05	Madhya Pradesh	Ratlam
48	Ganga/Yamuna/C hambal/Banas	Baranwada	02.09.2025	1072.49	Rajasthan	Sawaimadhopu r
	Ganga/Yamuna/C hambal/Banas	Tonk	02.09.2025	3047.34	Rajasthan	Tonk
49	Ganga/Yamuna/C hambal/Parwati	Bhadana VillageD/ Sof Kota City	02.09.2025	1812.97	Rajasthan	Kota
50	Ganga/Yamuna/C hambal/Shipra	Mahidpur	02.09.2025	2465.10	Madhya Pradesh	Ujjain
	Ganga/Yamuna/C hambal/Shipra	Ujjain	02.09.2025	1722.15	Madhya Pradesh	Ujjain
51	Ganga/Yamuna/Giri	Yashwant Nagar	02.07.2025	4223.16	Himachal Pradesh	Sirmaur
52	Ganga/Yamuna/Hindon	Baleni	02.08.2025	2869.67	Uttar Pradesh	Baghpat
	Ganga/Yamuna/Hindon	Chilla Gaon	02.09.2025	2163.21	Delhi	East Delhi
	Ganga/Yamuna/Hindon	Galeta	02.08.2025	1002.22	Uttar Pradesh	Baghpat
	Ganga/Yamuna/Hindon	Noida	02.08.2025	2273.20	Uttar Pradesh	Gautam Bhud Nagar
	Ganga/Yamuna/Hindon	Noida	01.05.2025	1155.39	Uttar Pradesh	Gautam Bhud Nagar
53	Ganga/Yamuna/Sahibi	Dadri	02.09.2025	26730.82	Haryana	Jhajjar
	Ganga/Yamuna/Sahibi	Dhansa	02.08.2025	2885.48	Delhi	South Delhi
54	Ganga/Yamuna/Tons	Tuini (Tons)	02.07.2025	3157.84	Uttrakhand	Dehradun
55	Ganga/Yamuna/Tons(South)	Haripur	02.09.2025	8418.92	Uttrakhand	Dehradun
56	Ganga/Yamuna/Tons/Pabar	Tuini (Pabar)	02.07.2025	1314.72	Uttrakhand	Dehradun
57	Gaur	Bhalwara	01.07.2025	1091.36	Madhya Pradesh	Jabalpur
58	Godavari	Yelli	01.01.2025	1299.60	Maharashtra	Nanded
59	Godavari/Indravati	Chindnar	02.07.2025	1384.11	Chhattisgarh	Dantewada
	Godavari/Indravati	Jagdalpur	02.06.2025	5846.03	Chhattisgarh	Bastar
	Godavari/Indravati	Jagdalpur	02.07.2025	5170.98	Chhattisgarh	Bastar
	Godavari/Indravati	Nowrangpur	02.06.2025	7170.92	Odisha	Nabarangpu r
	Godavari/Indravati	Nowrangpur	02.07.2025	7627.03	Odisha	Nabarangpu r

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Godavari/Indravati	Nowrangpur	03.10.2025	1500.10	Odisha	Naba-rangpu r
	Godavari/Indravati	Pathagudem	02.07.2025	1371.70	Chhattis-garh	Bijapur
	Godavari/Indravati	Pathagudem	01.09.2025	1847.89	Chhattis-garh	Bijapur
60	Godavari/Sabari	Konta	02.06.2025	1283.22	Chhattis-garh	Sukma
	Godavari/Sabari	Konta	02.07.2025	2109.20	Chhattis-garh	Sukma
	Godavari/Sabari	Konta	01.09.2025	1175.04	Chhattis-garh	Sukma
	Godavari/Sabari	Saradaput	03.10.2025	1038.24	Odisha	Malkangiri
61	Gumra	Gumra Bazar	11.11.2025	1095.03	Assam	Cachar
62	Hiran	D/S Patan	01.07.2025	1423.07	Madhya Pradesh	Jabalpur
	Hiran	Patan	01.07.2025	1062.73	Madhya Pradesh	Jabalpur
63	Jatinga	Harangajao	13.10.2025	4335.09	Assam	Dima Hasao
64	Kakrakhal	Kalain	11.08.2025	2251.10	Assam	Cachar
	Kakrakhal	Kalain	01.11.2025	1568.18	Assam	Cachar
65	Kanijhari	Kenduapada	21.06.2025	1076.03	Odisha	Keonjhar
	Kanijhari	Kenduapada	11.08.2025	1080.77	Odisha	Keonjhar
66	Katakhal	Katigora	01.11.2025	1514.97	Assam	Cachar
	Katakhal	Katigora	13.10.2025	2139.08	Assam	Cachar
	Katakhal	Katigora	01.09.2025	3997.55	Assam	Cachar
	Katakhal	Lala	11.08.2025	2008.34	Assam	Hailakandi
	Katakhal	Lala	01.11.2025	1827.20	Assam	Hailakandi
	Katakhal	Lala	13.10.2025	2176.29	Assam	Hailakandi
	Katakhal	Lala	01.09.2025	2629.35	Assam	Hailakandi
	Katakhal	Matijuri	11.12.2025	1371.05	Assam	Hailakandi
	Katakhal	Matijuri	11.11.2025	2109.36	Assam	Hailakandi
	Katakhal	Matijuri	13.10.2025	3406.91	Assam	Hailakandi
67	Kharkai	Kulpatanga	21.06.2025	1196.06	Jhar-khand	Purba Singhbhum
	Kharkai	Kulpatanga	11.07.2025	1091.50	Jhar-khand	Purba Singhbhum
68	Koel	Jaraikela	21.06.2025	1360.12	Odisha	Sundergarh
	Koel	Jaraikela	11.07.2025	1153.51	Odisha	Sundergarh
	Koel	Jaraikela	11.08.2025	1009.97	Odisha	Sundergarh
	Koel	Panposh-II	21.06.2025	1276.12	Odisha	Sundergarh
	Koel	Panposh-II	11.07.2025	1264.95	Odisha	Sundergarh
	Koel	Panposh-II	11.08.2025	1028.10	Odisha	Sundergarh
69	Kopili	Dharamtul	02.07.2025	1507.34	Assam	Morigaon
	Kopili	Dharamtul	01.08.2025	1573.71	Assam	Morigaon
	Kopili	Jagibhakatgaon	02.07.2025	1106.01	Assam	Morigaon
	Kopili	Kampur	01.08.2025	1861.91	Assam	Nagaon
	Kopili	Kampur	01.09.2025	1275.01	Assam	Nagaon
	Kopili	Kheronighat	01.08.2025	1261.09	Assam	Karbi An-glong

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
70	Krishna	Arjunwad (seasonal)	04.02.2025	1549.88	Maha-rashtra	Kolhapur
	Krishna	Vijayawada	01.01.2025	1360.68	Andhra Pradesh	NTR
71	Krishna/Ghataprabha	Gokak	23.06.2025	4384.90	Karna-taka	Belgaum
	Krishna/Ghataprabha	Gokak	23.09.2025	1033.49	Karna-taka	Belgaum
	Krishna/Ghataprabha	Gokak	23.10.2025	1208.18	Karna-taka	Belgaum
	Krishna/Ghataprabha	Gokak	21.11.2025	1357.59	Karna-taka	Belgaum
	Krishna/Ghataprabha	Gokak	22.12.2025	1000.12	Karna-taka	Belgaum
72	Krishna/Malaprabha	Cholachagudda	22.12.2025	2481.76	Karna-taka	Bagalkot
	Krishna/Malaprabha	Cholachagudda	21.02.2025	1179.50	Karna-taka	Bagalkot
	Krishna/Malaprabha	Cholachagudda	23.10.2025	1289.83	Karna-taka	Bagalkot
73	Krishna/Tungabhadr a/Bhadra	Lakkavalli	23.06.2025	1737.30	Karna-taka	Chikmaga-lur
74	Krishna/Tungabhadr a/Haridra	Byaladahalli	23.06.2025	1293.35	Karna-taka	Davanag-ere
	Krishna/Tungabhadr a/Haridra	Byaladahalli	21.08.2025	3932.54	Karna-taka	Davanag-ere
	Krishna/Tungabhadr a/Haridra	Byaladahalli	23.10.2025	2156.28	Karna-taka	Davanag-ere
75	Krishna/Tungabhadr a/Ku-mudavathi	Kuppelur	23.07.2025	2073.48	Karna-taka	Haveri
	Krishna/Tungabhadr a/Ku-mudavathi	Kuppelur	21.08.2025	3950.96	Karna-taka	Haveri
	Krishna/Tungabhadr a/Ku-mudavathi	Kuppelur	23.10.2025	1050.17	Karna-taka	Haveri
76	Krishna/Tungabhadr a/Su-varnamukhi	Hoovinahole	21.08.2025	1293.27	Karna-taka	Chitradurga
	Krishna/Tungabhadr a/Su-varnamukhi	Hoovinahole	23.10.2025	1785.84	Karna-taka	Chitradurga
77	Krishna/Tungabhadr a/Ve-davathi	Kellodu	21.08.2025	3903.46	Karna-taka	Chitradurga
78	Krishna/Tungabhadra	Haralahalli	23.06.2025	1816.57	Karna-taka	Haveri
	Krishna/Tungabhadra	Haralahalli	21.08.2025	2584.21	Karna-taka	Haveri
	Krishna/Tungabhadra	Honnali	23.06.2025	1565.88	Karna-taka	Davanag-ere
	Krishna/Tungabhadra	Honnali	23.07.2025	1504.36	Karna-taka	Davanag-ere
	Krishna/Tungabhadra	Honnali	21.08.2025	1618.54	Karna-taka	Davanag-ere

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Krishna/Tungabhadra	Honnali	23.10.2025	2917.46	Karna-taka	Davanag-ere
79	Krishna/Tunga-bhadra/Bhadra	Holehonnur	21.02.2025	1634.40	Karna-taka	Shimoga
	Krishna/Tunga-bhadra/Bhadra	Holehonnur	21.03.2025	1513.70	Karna-taka	Shimoga
	Krishna/Tunga-bhadra/Bhadra	Holehonnur	23.06.2025	1734.63	Karna-taka	Shimoga
	Krishna/Tunga-bhadra/Bhadra	Holehonnur	23.09.2025	2667.60	Karna-taka	Shimoga
80	Krishna/Tunga-bhadra/Tunga	Hariharapura	23.06.2025	2047.74	Karna-taka	Chikamaga-luru
	Krishna/Tunga-bhadra/Tunga	Hariharapura	23.07.2025	1609.19	Karna-taka	Chikamaga-luru
	Krishna/Tunga-bhadra/Tunga	Hariharapura	23.09.2025	1881.24	Karna-taka	Chikamaga-luru
	Krishna/Tunga-bhadra/Tunga	Shimoga	23.06.2025	2003.11	Karna-taka	Shimoga
	Krishna/Tunga-bhadra/Tunga	Shimoga	21.08.2025	1308.00	Karna-taka	Shimoga
	Krishna/Tunga-bhadra/Tunga	Shimoga	23.10.2025	1715.20	Karna-taka	Shimoga
81	Krishna/Tunga-bhadra/Varadha	Marol	23.07.2025	3570.50	Karna-taka	Haveri
	Krishna/Tunga-bhadra/Varadha	Marol	23.09.2025	1713.85	Karna-taka	Haveri
	Krishna/Tunga-bhadra/Varadha	Marol	23.10.2025	2205.29	Karna-taka	Haveri
82	Kushal/Kusei	Kusei	21.06.2025	1031.83	Odisha	Keonjhar
	Kushal/Kusei	Kusei	11.07.2025	1089.53	Odisha	Keonjhar
83	Kushiyara	Karimganj	11.11.2025	1654.65	Assam	Karimganj
	Kushiyara	Karimganj	13.10.2025	1943.45	Assam	Karimganj
84	LachenChu	Rangma Range	01.07.2025	1376.76	Sikkim	Mangan
	LachenChu	Rangma Range	01.09.2025	1763.92	Sikkim	Mangan
85	Lohit	Dholla	20.01.2025	1454.79	Assam	Tinsukia
86	Longai	Fakira Bazar	11.12.2025	1882.48	Assam	Karimganj
	Longai	Fakira Bazar	11.11.2025	1300.07	Assam	Karimganj
	Longai	Fakira Bazar	13.10.2025	1968.67	Assam	Karimganj
	Longai	Patharkandi	11.08.2025	2224.61	Assam	Karimganj
	Longai	Patharkandi	01.12.2025	1060.54	Assam	Karimganj
	Longai	Patharkandi	01.01.2025	1303.41	Assam	Karimganj
	Longai	Patharkandi	01.11.2025	2398.33	Assam	Karimganj
	Longai	Patharkandi	13.10.2025	2946.03	Assam	Karimganj
	Longai	Patharkandi	01.09.2025	1369.72	Assam	Karimganj
87	Madhura	Udharbond	11.08.2025	1406.25	Assam	Cachar
	Madhura	Udharbond	01.12.2025	1669.64	Assam	Cachar
	Madhura	Udharbond	01.11.2025	2632.20	Assam	Cachar
	Madhura	Udharbond	13.10.2025	1957.93	Assam	Cachar
	Madhura	Udharbond	01.09.2025	2189.80	Assam	Cachar
88	Mahanadi	Tikarpada	11.07.2025	1045.53	Odisha	Angul
	Mahanadi	Tikarpada	11.08.2025	1066.41	Odisha	Angul

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
89	Mahananda	Noukaghat	01.09.2025	1017.04	West Bengal	Jalpaiguri
90	Manu	Kailashahar	11.08.2025	2143.43	Tripura	Unakoti
	Manu	Kailashahar	01.11.2025	1547.63	Tripura	Unakoti
	Manu	Kailashahar	13.10.2025	1807.55	Tripura	Unakoti
	Manu	Kailashahar	01.09.2025	7779.65	Tripura	Unakoti
	Manu	Manughat	11.08.2025	1912.70	Tripura	Dhalai
	Manu	Manughat	01.11.2025	4536.10	Tripura	Dhalai
	Manu	Manughat	13.10.2025	6526.73	Tripura	Dhalai
	Manu	Manughat	01.09.2025	1575.36	Tripura	Dhalai
91	Meghna/Gumti	Amarpur	11.08.2025	3543.91	Tripura	Gomati
	Meghna/Gumti	Amarpur	01.12.2025	1489.35	Tripura	Gomati
	Meghna/Gumti	Amarpur	01.11.2025	1811.05	Tripura	Gomati
	Meghna/Gumti	Amarpur	13.10.2025	2924.62	Tripura	Gomati
	Meghna/Gumti	Sonamura	11.08.2025	2437.74	Tripura	Sepahijala
	Meghna/Gumti	Sonamura	01.12.2025	1099.92	Tripura	Sepahijala
	Meghna/Gumti	Sonamura	01.11.2025	2450.15	Tripura	Sepahijala
	Meghna/Gumti	Sonamura	13.10.2025	2405.24	Tripura	Sepahijala
	Meghna/Gumti	Sonamura	01.09.2025	2033.20	Tripura	Sepahijala
92	Mushal/Mudala	Mushal	11.07.2025	1116.20	Odisha	Keonjhar
	Mushal/Mudala	Mushal	11.08.2025	1000.18	Odisha	Keonjhar
93	Ponnaiyar	Singasadanapalli	01.01.2025	4942.84	Tamil Nadu	Krishnagiri
	Ponnaiyar	Singasadanapalli	01.02.2025	5419.30	Tamil Nadu	Krishnagiri
	Ponnaiyar	Singasadanapalli	01.09.2025	1722.93	Tamil Nadu	Krishnagiri
	Ponnaiyar	Singasadanapalli	03/10/2025	3603.26	Tamil Nadu	Krishnagiri
	Ponnaiyar	Singasadanapalli	01/11/2025	3839.55	Tamil Nadu	Krishnagiri
94	Ramial	Altuma	21.06.2025	1098.42	Odisha	Dhenkanal
	Ramial	Altuma	11.07.2025	1084.72	Odisha	Dhenkanal
	Ramial	Altuma	11.08.2025	1124.38	Odisha	Dhenkanal
95	Ranganadi	Ranganadi NT Road Crossing	20.01.2025	2337.71	Assam	Lakhimpur
	Ranganadi	Ranganadi NT Road Crossing	01.08.2025	1048.89	Assam	Lakhimpur
	Ranganadi	Ranganadi NT Road Crossing	20.02.2025	1708.91	Assam	Lakhimpur
	Ranganadi	Yazali	21.07.2025	2007.28	Arunachal Pradesh	Lower Subansiri
96	Sankh	Panposh-I	21.06.2025	1066.54	Odisha	Sundergarh
	Sankh	Panposh-I	11.07.2025	1338.73	Odisha	Sundergarh
	Sankh	Panposh-I	11.08.2025	1092.16	Odisha	Sundergarh
	Sankh	Tilga	11.07.2025	1031.74	Jharkhand	Simdega
	Sankh	Tilga	11.08.2025	1012.15	Jharkhand	Simdega

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
97	Shakkar	Gadarwara	01.07.2025	1072.16	Madhya Pradesh	Narsingpur
98	Sher	D/S Belkhedi	01.07.2025	1098.44	Madhya Pradesh	Narmada-puram
99	Sonai	Amraghat	11.12.2025	1246.62	Assam	Cachar
	Sonai	Amraghat	03.02.2025	2054.08	Assam	Cachar
	Sonai	Amraghat	11.11.2025	1449.55	Assam	Cachar
	Sonai	Amraghat	13.10.2025	3457.99	Assam	Cachar
	Sonai	Tulargram	11.08.2025	1722.73	Assam	Cachar
	Sonai	Tulargram	01.12.2025	1319.65	Assam	Cachar
	Sonai	Tulargram	01.11.2025	1500.44	Assam	Cachar
	Sonai	Tulargram	13.10.2025	1463.25	Assam	Cachar
	Sonai	Tulargram	01.09.2025	2277.91	Assam	Cachar
100	Subansiri	Daporizo	01.08.2025	1822.39	Aruna-chal Pra-desh	Upper Su-bansiri
	Subansiri	Lemeking	01.08.2025	1410.63	Aruna-chal Pra-desh	Upper Su-bansiri
101	Subarnarekha	Baridhi	21.06.2025	1051.57	Jhar-khand	Paschim Singhbhum
	Subarnarekha	Baridhi	11.07.2025	1025.79	Jhar-khand	Paschim Singhbhum
	Subarnarekha	Baridhi	11.08.2025	1049.45	Jhar-khand	Paschim Singhbhum
	Subarnarekha	Domuhani	21.06.2025	1062.66	Jhar-khand	Purba Singhbhum
	Subarnarekha	GH.Rd.Bridge	11.07.2025	1147.51	Jhar-khand	Purba Singhbhum
	Subarnarekha	Ghatshila	21.06.2025	1110.87	Jhar-khand	Purba Singhbhum
	Subarnarekha	Ghatshila	11.07.2025	1025.97	Jhar-khand	Purba Singhbhum
	Subarnarekha	Gopiballavpur	21.06.2025	1035.60	West Bengal	Paschim Midnapur
	Subarnarekha	Gopiballavpur	11.07.2025	1092.80	West Bengal	Paschim Midnapur
	Subarnarekha	Jamshedpur	21.06.2025	1106.74	Jhar-khand	Purba Singhbhum
	Subarnarekha	Jamshedpur	11.07.2025	1122.67	Jhar-khand	Purba Singhbhum
	Subarnarekha	Jamsolaghat	21.06.2025	1035.86	Odisha	Mayur-bhanj
	Subarnarekha	Jamsolaghat	11.07.2025	1153.76	Odisha	Mayur-bhanj
	Subarnarekha	Lupungdhi	11.07.2025	1082.75	Jhar-khand	Saraikela kharsawan
	Subarnarekha	Lupungdhi	11.08.2025	1208.05	Jhar-khand	Saraikela kharsawan
	Subarnarekha	Rajghat(Subarnarekha)	21.06.2025	1148.00	Odisha	Mayur-bhanj

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Subarnarekha	Rajghat(Subarnarekha)	11.07.2025	1143.69	Odisha	Mayur-bhanj
	Subarnarekha	Rajghat(Subarnarekha)	11.08.2025	1003.05	Odisha	Mayur-bhanj
102	Talgang	Kadamtala	11.08.2025	2848.81	Tripura	North Trip-ura
	Talgang	Kadamtala	01.12.2025	1636.78	Tripura	North Trip-ura
	Talgang	Kadamtala	01.11.2025	2206.32	Tripura	North Trip-ura
	Talgang	Kadamtala	13.10.2025	1208.06	Tripura	North Trip-ura
	Talgang	Kadamtala	01.09.2025	2142.97	Tripura	North Trip-ura
103	Teesta	Adarsh Gaon	01.07.2025	1419.31	Sikkim	Mangan
	Teesta	Sankalang	01.08.2025	1042.89	Sikkim	Mangan
104	Teesta/DikChu/Bakcha Chu	Bakchachu	01.08.2025	1083.63	Sikkim	Mangan
	Teesta/DikChu/Bakcha Chu	Bakchachu	02.06.2025	1131.48	Sikkim	Mangan
	Teesta/DikChu/Bakcha Chu	Bakchachu	11.11.2025	1412.99	Sikkim	Mangan
105	Teesta/Rangit	Rothak	01.08.2025	1263.48	Sikkim	Namchi
	Teesta/Rangit	Rothak	02.06.2025	1360.29	Sikkim	Namchi
106	Teesta/Rangit/Rathang Chu	Yuksum	01.09.2025	1009.31	Sikkim	Gyalsingh
107	Teesta/Rangit/Rathang Chu/Rimbi Khola	Upper Rimbi	01.08.2025	1087.07	Sikkim	Gyalsingh
	Teesta/Rangit/Rathang Chu/Rimbi Khola	Upper Rimbi	01.09.2025	1284.21	Sikkim	Gyalsingh
108	Teesta/RangpoCh u	Rangpo Check Post	01.09.2025	1259.58	Sikkim	Pakyong
109	Teesta/RaniKhola	Ranipool	01.08.2025	1130.69	Sikkim	Gangtok
	Teesta/RaniKhola	Ranipool	02.06.2025	1532.48	Sikkim	Gangtok
	Teesta/RaniKhola	Singtam	02.06.2025	1037.52	Sikkim	Pakyong
110	Tlawng	Bairabi	11.11.2025	1042.58	Mizoram	Kolasib
	Tlawng	Bairabi	13.10.2025	2549.98	Mizoram	Kolasib
111	Umkhen/Brahmaputra	Umkhen-II	01.09.2025	3385.40	Megha-laya	East Khasi hills
112	Vaigai	Ambasamudram	23.10.2025	3269.67	Tamil Nadu	Theni
113	Vaigai/Suruliar	Theni	01.01.2025	2262.81	Tamil Nadu	Theni
	Vaigai/Suruliar	Theni	11.06.2025	1088.17	Tamil Nadu	Theni
	Vaigai/Suruliar	Theni	01.07.2025	2651.21	Tamil Nadu	Theni
	Vaigai/Suruliar	Theni	02/08/2025	1607.06	Tamil Nadu	Theni
	Vaigai/Suruliar	Theni	01/11/2025	2144.42	Tamil Nadu	Theni
114	Vamsadhara	Gunupur	21.06.2025	1091.80	Odisha	Rayagada

Sl. No	River / Tributary	Site	Date of Sampling	Fe (µg/L)	State/UT	District
	Vamsadhara	Gunupur	11.07.2025	1003.06	Odisha	Rayagada
	Vamsadhara	Gunupur	11.08.2025	1007.10	Odisha	Rayagada
	Vamsadhara	Kashinagar	21.06.2025	1034.63	Odisha	Gajapati
	Vamsadhara	Kashinagar	11.08.2025	1187.89	Odisha	Gajapati
115	Varna	Samdoli	04.02.2025	1217.84	Maha-rashtra	Sangli
	Varna	Samdoli	25.11.2025	1064.98	Maha-rashtra	Sangli
116	Yedduvagu	Munugodu	01.01.2025	2210.64	Andhra Pradesh	Palnadu

Iron is the element analysed which is found to exceed the limit at maximum number of stations and samples despite of the comparatively higher acceptable limit of 1 mg/L. This shows the abundance of the metals across various rivers. Figure 36 depicts the GIS map of WQ stations where Iron is found to be above limit.

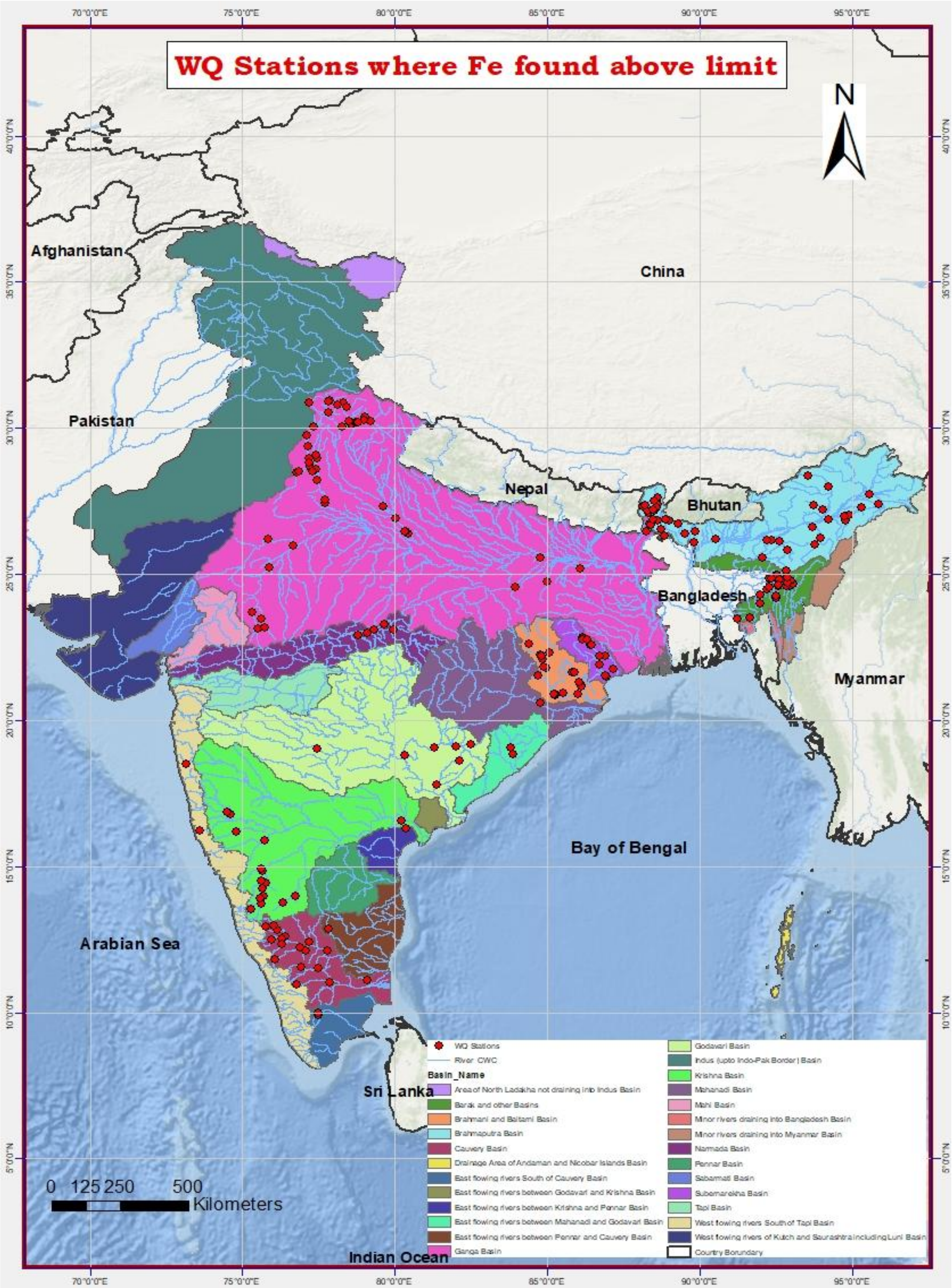

Figure 36: WQ stations where Iron found above acceptable limit

Comparative Assessment of Iron Concentration in River Water (2023–2025)

A comparative evaluation of iron concentrations in river water was carried out for the monitoring periods 2023, 2024, and 2025, with particular emphasis on exceedance of the prescribed acceptable limit. The analysis reveals a consistent and significant upward trend in the frequency, magnitude, and spatial distribution of iron exceedance over the three years.

During 2023 (7th edition), a total of 5,768 river water samples were analyzed across India. Of these, 292 samples (5.06%) from 63 monitoring stations exceeded the acceptable limit, indicating a moderate level of non-compliance. These exceedances were distributed across 49 rivers, reflecting a relatively widespread occurrence. The iron concentration ranged from 0.000 mg/L to 5.99 mg/L, with the maximum concentration of 5.99 mg/L recorded at the Murappanadu monitoring station on the Tambraparani River on 02 November 2023.

In 2024, although the total number of samples analyzed slightly decreased to 5,417, the extent of exceedance increased. A total of 325 samples (6.00%) from 78 monitoring stations exceeded the acceptable limit, indicating a notable rise in both frequency and spatial spread. The iron concentration ranged from 0.000 mg/L to 21.216 mg/L, with the highest concentration of 21.216 mg/L observed at the Kudlur monitoring station on the Cauvery River on 23 October 2024. Compared to 2023, this represents a significant increase in maximum concentration (over threefold), along with an expansion in the number of affected stations.

The 2025 monitoring data demonstrates a further and pronounced escalation in iron exceedance. Out of 6459 river water samples analyzed, 409 samples (6.33%) from 209 monitoring stations exceeded the acceptable limit, indicating the highest level of non-compliance among the three years. These exceedances were reported across 116 rivers, showing a substantial increase in geographical coverage. The iron concentration ranged from 0.000 mg/L to 43692.32 mg/L, with the maximum concentration of 43692.32 mg/L recorded at the Kuthnaur monitoring station on the Yamuna River on 02 September 2025. This exceptionally high value suggests the presence of extreme localized exceedance, likely influenced by significant anthropogenic inputs or site-specific conditions.

Overall, the comparative analysis clearly indicates a progressive deterioration in iron water quality from 2023 to 2025, characterized by increasing exceedances, expanding spatial distribution, and a dramatic rise in maximum concentration levels. The trend suggests intensifying contamination pressures, potentially linked to industrial discharge, mining activities, urban runoff, and geogenic contributions. However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

A graphical representation of the above-limit values at the common stations is given as Figure 37.

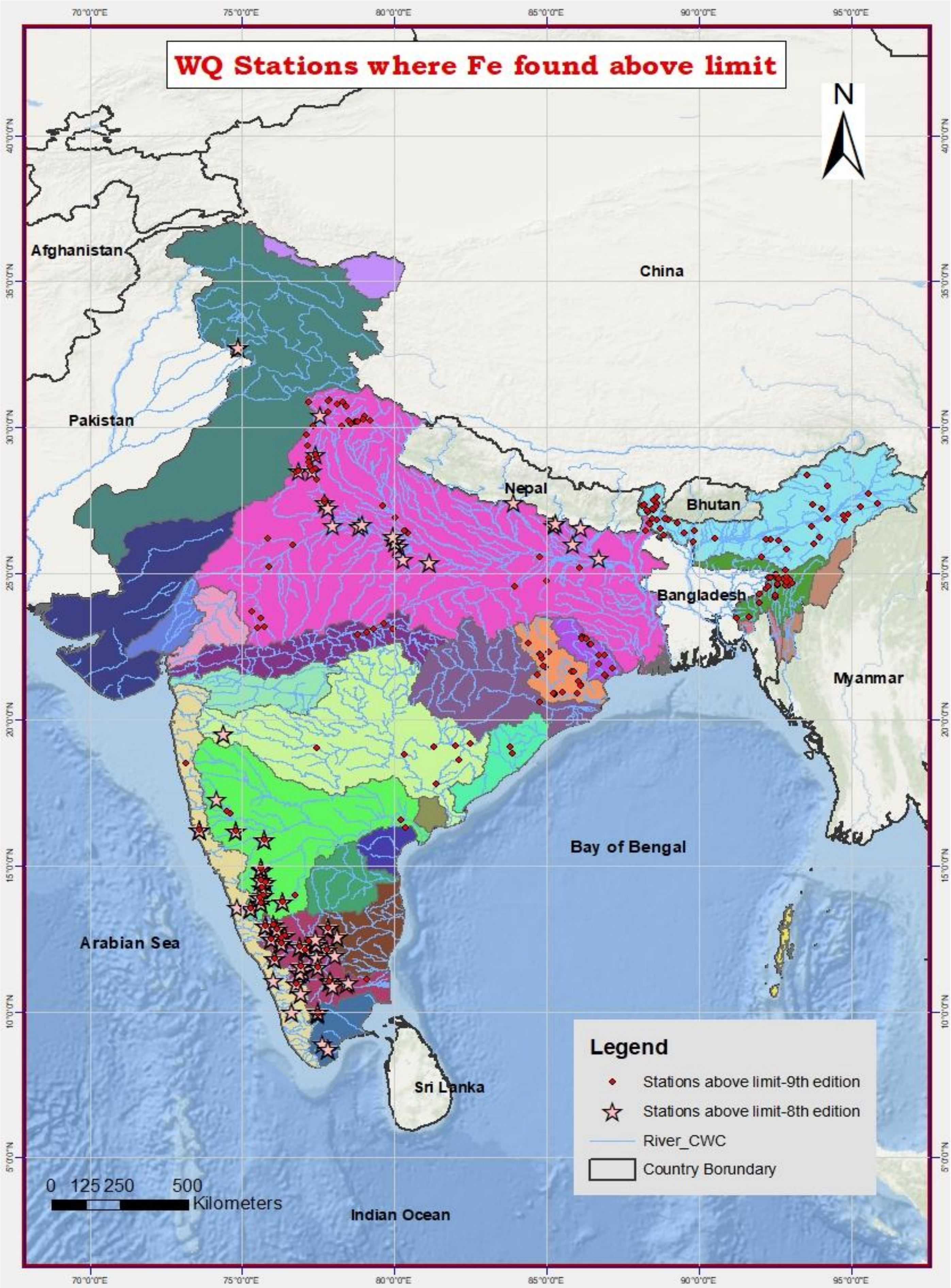

Figure 37: WQ stations where Iron found above acceptable limit (both study periods)

7.6 Lead (Pb)

Bureau of Indian Standards (BIS) 10500:2012 has recommended that the acceptable limit for lead is 0.01 mg/L or 10 µg/L in drinking water. Out of total 6549 river water samples analysed, 41 samples from 38 water quality stations were found to have lead concentrations beyond the acceptable limit. The lead concentration varies from 0.000 to 46.13 µg/L. Maximum lead concentration (46.13 µg/L) was observed at T Bekuppe water quality monitoring station on Arkavathi River on 21-11-2025.

The details of stations where lead concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates are depicted in the table given below.

Table 17: River-wise list of WQ stations with Pb values above limit

S.No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Pb (µg/L)	State/UT	District
1	Arkavathi	T Bekuppe	21.11.2025	46.13	Karnataka	Ramanagara
2	Bata	Ganguwala	01.12.2025	11.41	Himachal Pradesh	Sirmaur
3	Brahmaputra	Neamatighat	20.01.2025	14.44	Assam	Jorhat
		Neamatighat	01.09.2025	16.29	Assam	Jorhat
4	BurhiGandak	Sakra	01.07.2025	14.73	Bihar	Muzaffarpur
		Sikandarpur	01.07.2025	16.53	Bihar	Muzaffarpur
5	Burhner	Mohgaon	01.05.2025	10.80	Madhya Pradesh	Mandla
6	Dikhow	Sivasagar	20.01.2025	13.01	Assam	Sivasagar
7	Gandak	Triveni	01.07.2025	13.12	Bihar	West Cham-paran
8	Ganga	Hathidah	04.02.2025	12.71	Bihar	Patna
9	Gaur	Bhalwara	03.03.2025	13.16	Madhya Pradesh	Jabalpur
10	Hemavathi	Sakaleshpura	23.10.2025	11.85	Karnataka	Hassan
11	Hiran	D/S Patan	03.03.2025	13.76	Madhya Pradesh	Jabalpur
12	Kabini	Muthankera	23.06.2025	10.20	Kerala	Wayanad
13	Kosi	Baltara	01.07.2025	12.60	Bihar	Khagaria
14	Lalbekia	Bairgania	01.07.2025	10.30	Bihar	Sitamarhi
15	Mahi	Mataji	01.04.2025	13.13	Madhya Pradesh	Ratlam
16	Malaprabha	Cholachagudda	23.07.2025	11.98	Karnataka	Bagalkot
		Cholachagudda	23.09.2025	22.22	Karnataka	Bagalkot
17	Narmada	D/S Dindori	01.05.2025	10.01	Madhya Pradesh	Jabalpur
		Narmadapuram (Hoshangabad)	01.09.2025	10.75	Madhya Pradesh	Hoshangabad
18	Ponnaiyar	Singasadanapalli	01.01.2025	10.45	Tamil Nadu	Krishnagiri
		Singasadanapalli	01.02.2025	11.06	Tamil Nadu	Krishnagiri
19	Ranganadi	Ranganadi NT Road Crossing	20.01.2025	11.52	Assam	Lakhimpur

S.No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Pb (µg/L)	State/UT	District
20	Sahibi	Dadri	02.09.2025	24.21	Haryana	Jhajjar
		Dhansa	03.10.2025	10.60	Delhi	South Delhi
21	Sripalpur	Sripalpur	04.02.2025	11.21	Bihar	Patna
22	Subansiri	Chouldhowaghat	20.01.2025	10.60	Assam	Lakhimpur
23	Tiljuga	Nirmali	01.07.2025	10.86	Bihar	Supaul
24	Tiyar	Lakhoura	01.07.2025	11.72	Bihar	East Cham-paran
25	Tunga	Hariharapura	23.10.2025	10.69	Karnataka	Chikamagaluru
26	Tungabhadra	Honnali	22.12.2025	11.79	Karnataka	Davanagere
27	Varadha	Marol	23.06.2025	10.28	Karnataka	Haveri
28	Vedavathi	Kellodu	23.10.2025	10.57	Karnataka	Chitradurga
29	Yamuna	Gokulbarrage (Mathura)	02.09.2025	13.78	Uttar Pradesh	Mathura
		Kalanaur	02.08.2025	10.86	Uttar Pradesh	Saharanpur
		Karnal	02.08.2025	10.54	Haryana	karnal
		Kuthnaur	02.09.2025	18.78	Uttrakhand	Uttarakashi
		Naugaon	02.09.2025	16.92	Uttrakhand	Uttarakashi
		Palla	03.10.2025	15.83	Delhi	North West Delhi
		Vrindavan- Ya-muna Express-way Link Road Bridge U/S of Mathura	02.09.2025	10.99	Uttar Pradesh	Mathura

A GIS map of WQ stations where lead is found above acceptable limit is depicted in Figure 38.

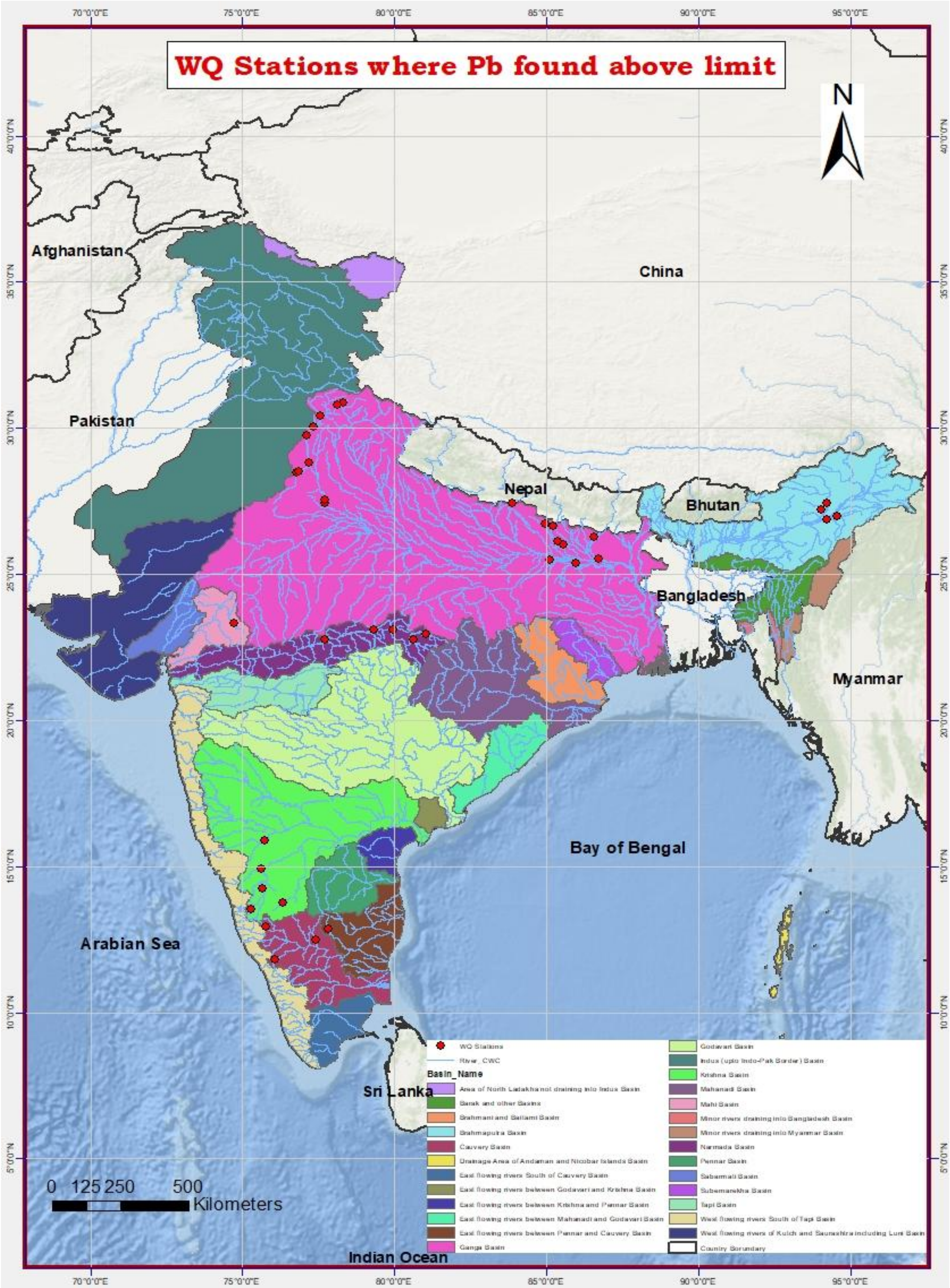

Figure 38: WQ stations where Lead found above acceptable limit

Comparative Assessment of Lead Concentration in River Water (2023–2025)

A comparative assessment of lead concentrations in river water was conducted for the monitoring periods 2023, 2024, and 2025, with emphasis on exceedance of the prescribed acceptable limit. The analysis reflects notable temporal variations in the frequency, magnitude, and spatial distribution of lead exceedance.

During January–December 2023 (7th edition), a total of 5,890 river water samples were analyzed, of which 76 samples (1.29%) from 23 monitoring stations exceeded the acceptable limit. The lead concentration ranged from 0.000 to 75.51 µg/L, with the maximum concentration of 75.51 µg/L recorded at the Kudige monitoring station on the Cauvery River on 14 November 2023. The exceedances were relatively limited in spatial extent, indicating moderate and localized exceedance.

In 2024, out of 5,265 samples analyzed, 80 samples (1.52%) from 45 monitoring stations were found to exceed the acceptable limit, indicating a slight increase in frequency and a substantial expansion in the number of affected stations compared to 2023. The lead concentration ranged from 0.000 to 117.90 µg/L, with the highest concentration of 117.90 µg/L observed at the Hogenakkal monitoring station on the Chinnar River on 24 October 2024. This increase in both maximum concentration and spatial spread suggests intensification of exceedance and wider distribution across river systems.

The 2025 monitoring data indicate a reduction in the number of exceedances but continued widespread spatial occurrence. Out of 6549 river water samples analyzed, 41 samples (0.63%) from 38 monitoring stations exceeded the acceptable limit, covering 29 rivers, including major systems such as Arkavathi, Brahmaputra, Ganga, Narmada, Ponnaiyar, Subansiri, Tungabhadra, and Yamuna, among others. The lead concentration ranged from 0.000 to 46.13 µg/L, with the maximum observed concentration of 46.13 µg/L recorded at the T. Bekuppe monitoring station on the Arkavathi River on 21 November 2025. Although the frequency of exceedance decreased compared to 2024, the persistence of exceedance across a large number of rivers indicates continued diffuse and geographically widespread inputs.

Overall, the comparative analysis indicates that lead exceedance exhibited an initial increase in both magnitude and spatial distribution from 2023 to 2024, followed by a decline in exceedance frequency in 2025, albeit with continued widespread occurrence across river systems. The observed pattern suggests that while some improvement may have occurred in reducing peak exceedance levels, lead pollution remains a persistent environmental concern, likely influenced by industrial discharge, urban runoff, and other anthropogenic sources. However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

A graphical representation of the above-limit values at the common stations is given as Figure 39.

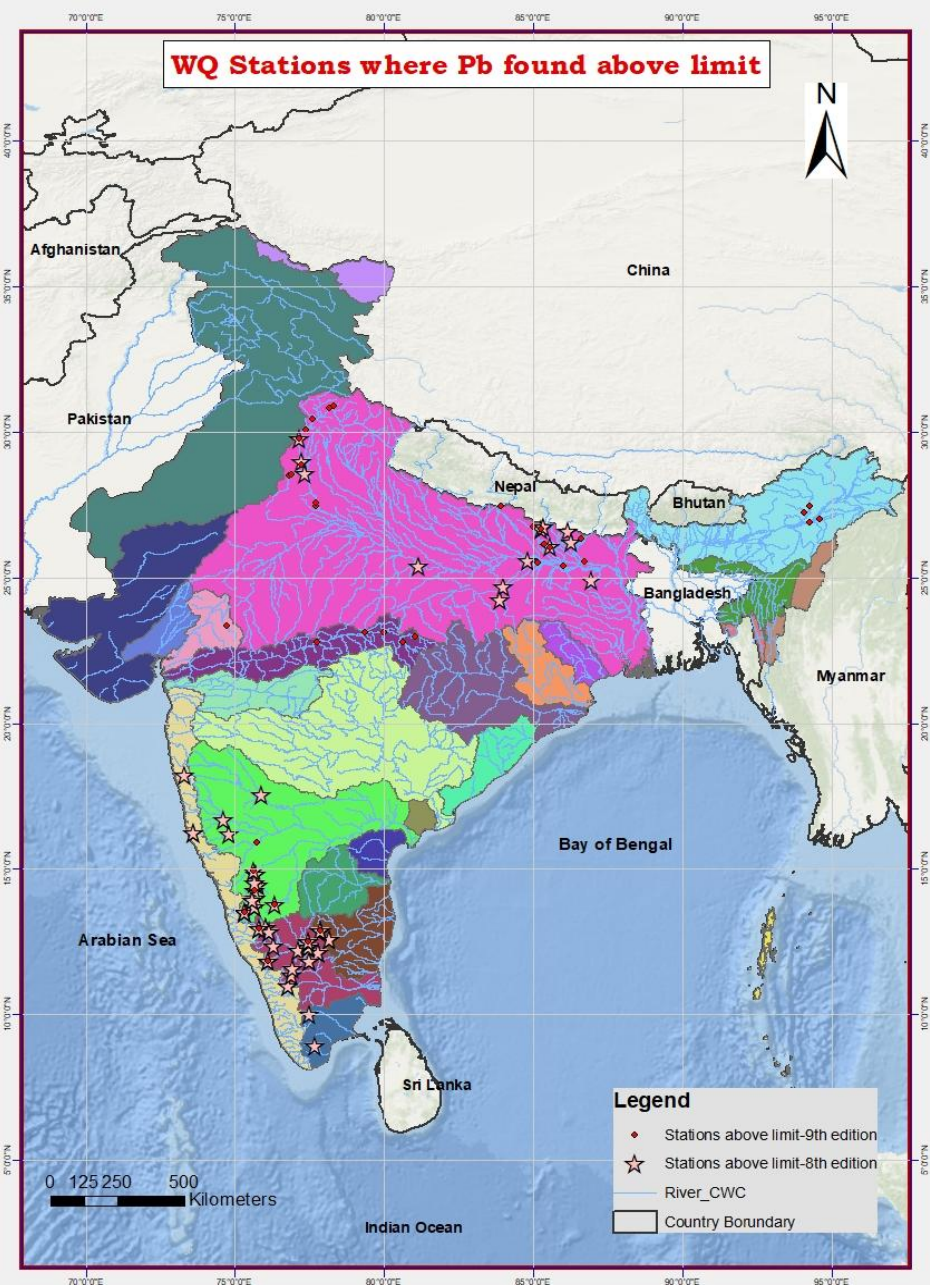

Figure 39: WQ stations where Lead found above acceptable limit (both study periods)

7.7 Mercury (Hg)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 1 µg/L of mercury in drinking water. Out of total 5120 river water samples analysed, 13 samples from 8 water quality stations were found to have mercury concentrations beyond the acceptable limit. The mercury concentration varies from 0.000 to 2.39 µg/L. Maximum mercury concentration (2.39 µg/L) was observed at Galeta water quality monitoring station on Hindon River on 03.11.2025.

The details of stations where mercury concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below.

Table 18: River-wise list of WQ stations with Hg values above limit

S. No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Hg (µg/L)	State/UT	District
1	Baya	Bachhwara	03.06.2025	1.29	Bihar	Begusarai
2	Dhadar	Pingalwada	01.01.2025	1.47	Gujarat	Vadodara
		Pingalwada	01.03.2025	1.25	Gujarat	Vadodara
		Pingalwada	01.07.2025	1.39	Gujarat	Vadodara
3	Hagari	T. Ramapuram	02.06.2025	1.03	Karnataka	Bellary
4	Hindon	Galeta	03.11.2025	2.39	Uttar Pradesh	Baghpat
5	Kim	Motinaroli	01.01.2025	2.26	Gujarat	Surat
		Motinaroli	01.02.2025	2.05	Gujarat	Surat
		Motinaroli	01.03.2025	1.01	Gujarat	Surat
6	Krishna	Deosugur	03.03.2025	1.02	Karnataka	Raichur
7	Tungabhadra	Bawapuram	02.06.2025	1.60	Andhra Pradesh	Kurnool
		Bawapuram	02.07.2025	1.52	Andhra Pradesh	Kurnool
8	Varna	Samdoli	04.02.2025	1.26	Maharashtra	Sangli

Figure 40 represents GIS map of WQ stations where mercury is found above acceptable limit.

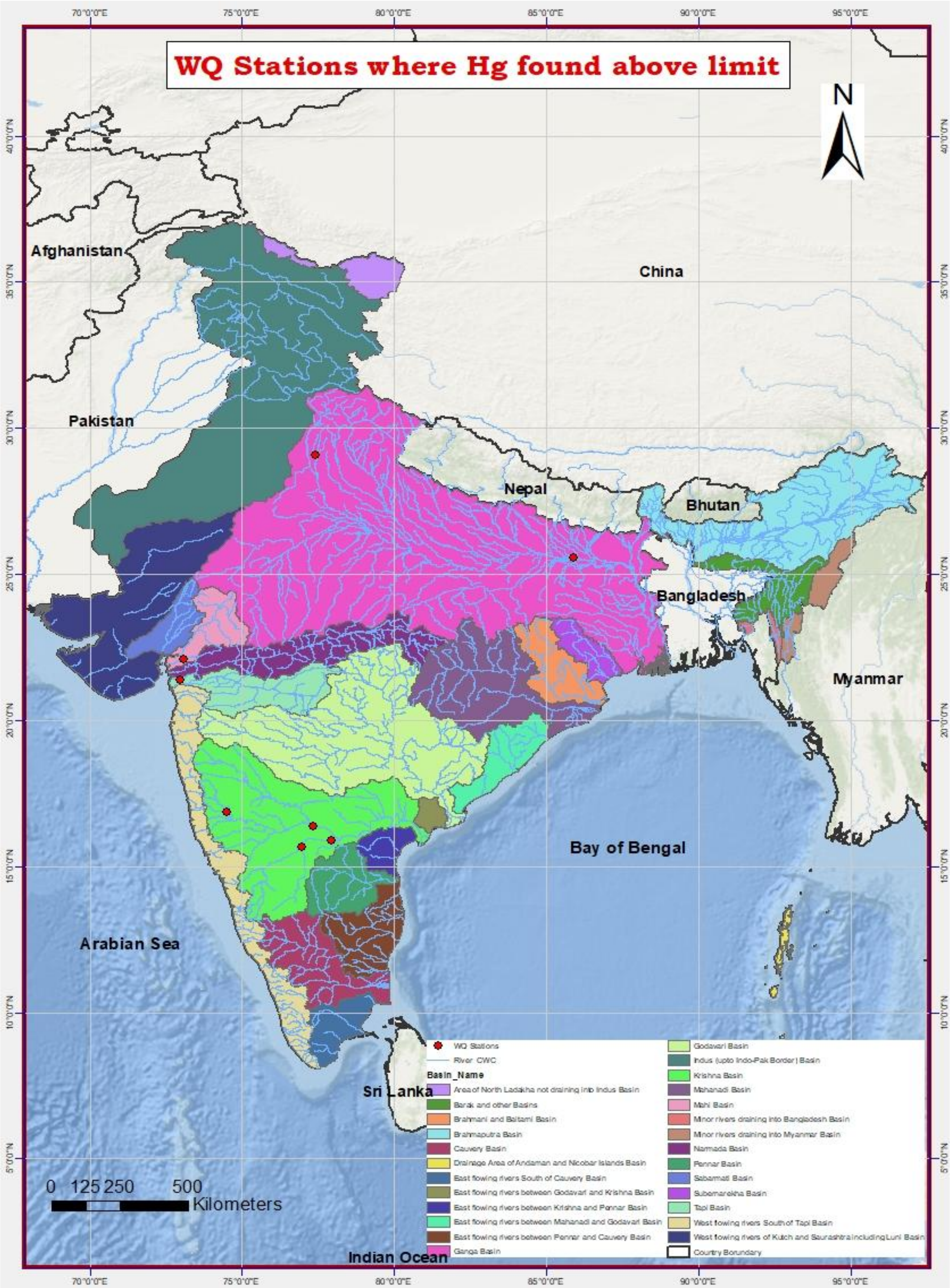

Figure 40: WQ stations where Mercury found above acceptable limit

Comparative Assessment of Mercury Concentration in River Water (2023–2025)

A comparative evaluation of mercury concentrations in river water was conducted for the monitoring periods 2023, 2024, and 2025, with emphasis on exceedance of the prescribed acceptable limit. The analysis highlights variations in the frequency, magnitude, and spatial distribution of mercury exceedance over the three years.

During 2023 (7th edition), out of 5,897 river water samples analyzed, 28 samples (0.47%) from 14 monitoring stations exceeded the acceptable limit. The mercury concentration ranged from 0.000 to 4.79 µg/L, with the maximum concentration of 4.79 µg/L recorded at the Rajahmundry monitoring station on the Godavari River on 20 October 2023. This indicates a moderate level of contamination with relatively higher peak concentration.

In 2024, out of 5,361 samples analyzed, 35 samples (0.65%) from 16 monitoring stations exceeded the acceptable limit, reflecting an increase in both the number of exceedances and affected stations compared to 2023. The mercury concentration ranged from 0.000 to 3.834 µg/L, with the maximum concentration of 3.834 µg/L observed at the Koggedoddi monitoring station on the Arkavathi River on 02 September 2024. Although the frequency of exceedances increased, the maximum concentration decreased, suggesting a wider but relatively less intense exceedance pattern.

The 2025 monitoring data indicate a declining trend in both frequency and magnitude of mercury exceedance. Out of 5120 river water samples analyzed, 13 samples (0.25%) from 8 monitoring stations exceeded the acceptable limit, covering rivers such as Baya, Dhadar, Hagari, Hindon, Kim, Krishna, Tungabhadra, and Varna. The mercury concentration ranged from 0.000 to 2.39 µg/L, with the maximum concentration of 2.39 µg/L recorded at the Galeta monitoring station on the Hindon River on 03 November 2025. This represents the lowest maximum concentration and least number of exceedances among the three years.

Overall, the comparative analysis indicates that mercury exceedance increased in spatial occurrence from 2023 to 2024, followed by a notable decline in both extent and intensity in 2025. While 2024 showed the highest number of exceedances and affected stations, the peak concentration remained highest in 2023. The overall trend suggests initial dispersion of contamination followed by partial improvement, although the continued presence of exceedances indicates persistent low-level inputs, likely associated with industrial discharge, urban runoff, and other anthropogenic activities, warranting sustained monitoring and control measures. However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

A graphical representation of the above-limit values at the common stations is given as Figure 41.

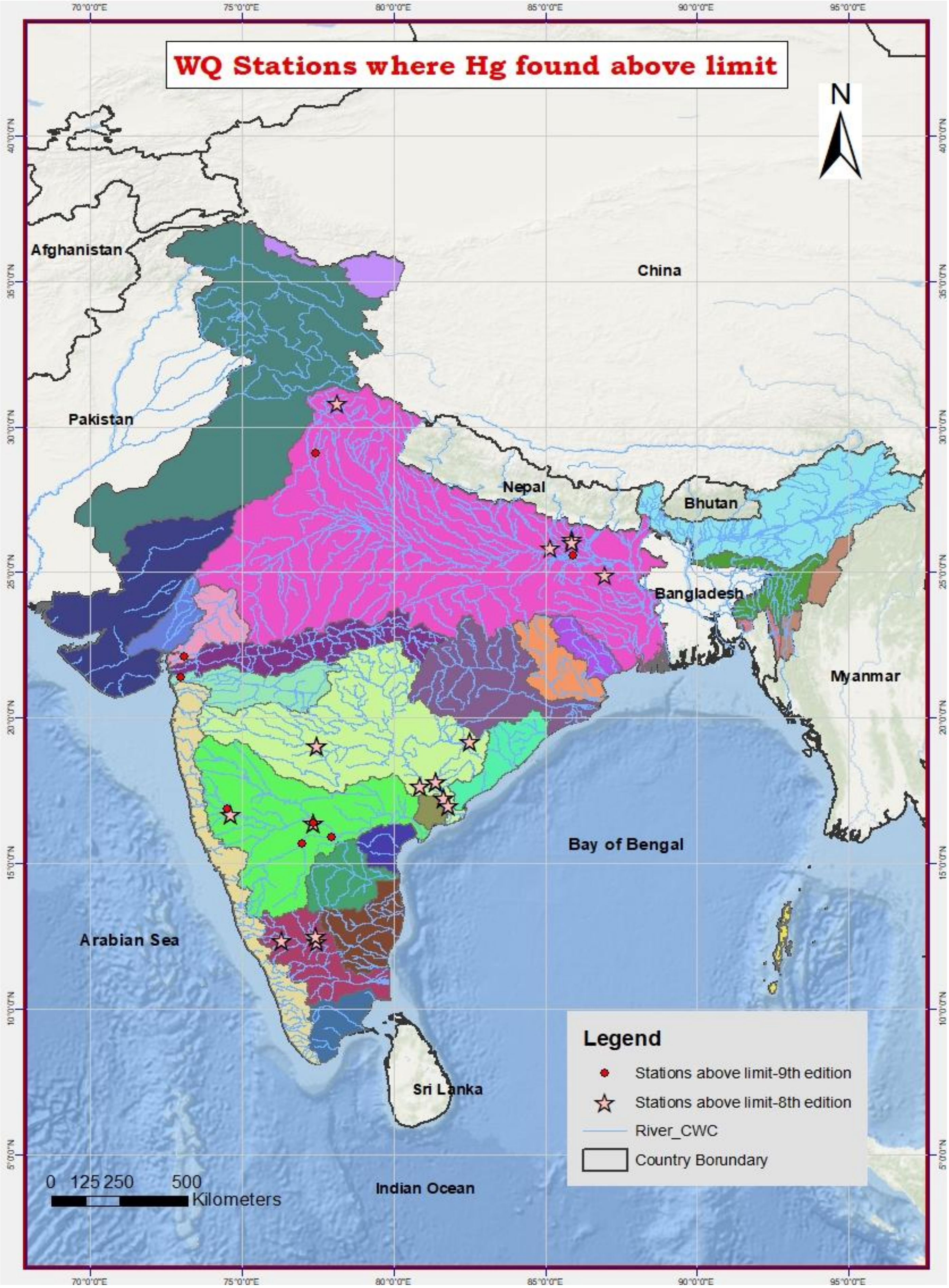

Figure 41: WQ stations where Mercury found above acceptable limit (both study periods)

7.8 Nickel (Ni)

Bureau of Indian Standards (BIS) 10500:2012 has recommended an acceptable limit of 20 µg/L of nickel in drinking water. Out of total 6648 river water samples analysed, 66 samples from 50 water quality stations were found to have nickel concentrations beyond the acceptable limit. The nickel concentration varies from 0.000 to 83.60 µg/L. Maximum nickel concentration (83.60 µg/L) was observed at Kuthnaur water quality monitoring station on Yamuna River on 02.09.2025.

The details of stations where nickel concentrations (in µg/L) were found to be beyond acceptable limit, categorized by their respective rivers and dates is depicted in the table given below.

Table 19: River-wise list of WQ stations with Ni values above limit

S.No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Ni (µg/L)	State/UT	District
1	Banas	Tonk	02.09.2025	29.83	Rajasthan	Tonk
2	Bhadra	Holehonnur	23.10.2025	23.48	Karnataka	Shimoga
3	Bhavani	Savandapur	01.01.2025	21.42	Tamil Nadu	Erode
4	Brahmaputra	Neamatighat	20.01.2025	48.24	Assam	Jorhat
5	Cauvery	Musiri	01.01.2025	26.49	Tamil Nadu	Tiruchirapalli
		Chunchunkatte	23.10.2025	26.60	Karnataka	Mysore
6	Chambal	Dhareri	02.09.2025	36.44	Madhya Pradesh	Ujjain
		Manderial	02.09.2025	20.87	Rajasthan	Karauli
		Tal	02.09.2025	35.69	Madhya Pradesh	Ratlam
7	Desang	Dillighat	30.07.2025	37.63	Assam	Dibrugarh
		Desangpani	01.09.2025	26.48	Assam	Charaideo
		Nanglamoraghat	01.09.2025	24.00	Assam	Sivasagar
8	Dikhow	Sivasagar	20.01.2025	36.87	Assam	Sivasagar
9	Godavari	Nasik	03.03.2025	23.61	Maharashtra	Nasik
		Dhalegaon	03.03.2025	34.28	Maharashtra	Parbhani
10	Hindon	Baleni	03.11.2025	27.03	Uttar Pradesh	Baghpat
		Chilla Gaon	01.05.2025	20.22	Delhi	East Delhi
		Chilla Gaon	02.07.2025	29.14	Delhi	East Delhi
		Chilla Gaon	02.09.2025	22.35	Delhi	East Delhi
		Galeta	02.06.2025	20.58	Uttar Pradesh	Baghpat
		Noida	02.07.2025	21.35	Uttar Pradesh	Gautam Bhud Nagar
		Noida	02.08.2025	31.25	Uttar Pradesh	Gautam Bhud Nagar
11	Kodaganar	Lakshmananpatti	01.01.2025	41.88	Tamil Nadu	Dindugal
12	Kundi	Kogaon	03.03.2025	21.52	Madhya Pradesh	Khargone

S.No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Ni (µg/L)	State/UT	District
13	Lohit	Parshuramkund	20.03.2025	28.64	Arunachal Pradesh	Lohit
14	Malaprabha	Cholachagudda	23.07.2025	40.07	Karnataka	Bagalkot
		Cholachagudda	21.08.2025	35.52	Karnataka	Bagalkot
		Cholachagudda	23.09.2025	59.38	Karnataka	Bagalkot
		Cholachagudda	21.11.2025	21.60	Karnataka	Bagalkot
		Cholachagudda	22.12.2025	22.32	Karnataka	Bagalkot
15	Marudaiyar	Varanavasi	01.01.2025	22.97	Tamil Nadu	Ariyalur
16	Narmada	Dindori	03.03.2025	22.61	Madhya Pradesh	Dindori
17	Raidak-I	Tufanganj	03.10.2025	69.97	West Bengal	COOCHBEHAR
18	Ranganadi	Ranganadi NT Road Crossing	21.10.2025	28.64	Assam	Lakhimpur
19	RangpoChu	Rangpo Check Post	01.08.2025	26.21	Sikkim	Pakyong
20	Sahibi	Dadri	02.09.2025	69.82	Haryana	Jhajjar
		Dhansa	02.08.2025	21.79	Delhi	South Delhi
		Dhansa	02.09.2025	24.21	Delhi	South Delhi
21	Shipra	Mahidpur	02.09.2025	20.15	Madhya Pradesh	Ujjain
		Ujjain	02.09.2025	21.61	Madhya Pradesh	Ujjain
22	Siang	Pasighat	20.02.2025	27.89	Arunachal Pradesh	East Siang
23	Subansiri	Daporizo	20.02.2025	23.68	Arunachal Pradesh	Upper Subansiri
24	Tons(South)	Haripur	02.09.2025	28.25	Uttrakhand	Dehradun
25	Tunga	Hariharapura	23.10.2025	27.24	Karnataka	Chikamagaluru
26	Vaippar	Irukkankudi	01.01.2025	51.29	Tamil Nadu	Viruthunagar
27	Varadha	Marol	22.05.2025	28.10	Karnataka	Haveri
		Marol	23.06.2025	32.23	Karnataka	Haveri
28	Yamuna	Agra Canal, Kalindikunj	02.06.2025	27.38	Delhi	South Delhi
		Agra Canal, Kalindikunj	02.09.2025	23.41	Delhi	South Delhi
		Baghpat	02.08.2025	32.35	Uttar Pradesh	Baghpat
		Baghpat	02.09.2025	26.92	Uttar Pradesh	Baghpat
		Delhi Railway Bridge	01.01.2025	26.26	Delhi	North Delhi
		Delhi Railway Bridge	04.03.2025	20.18	Delhi	North Delhi
		Delhi Railway Bridge	01.05.2025	30.39	Delhi	North Delhi

S.No.	River/ Reservoir	Water Quality Stations	Date of Sampling	Ni (µg/L)	State/UT	District
		Delhi Railway Bridge	02.06.2025	34.77	Delhi	North Delhi
		Gokulbarrage (Mathura)	02.09.2025	45.97	Uttar Pradesh	Mathura
		Kalanaur	02.08.2025	31.86	Uttar Pradesh	Saharanpur
		Karnal	02.08.2025	31.05	Haryana	karnal
		Kuthnaur	02.09.2025	83.60	Uttrakhand	Uttarakashi
		Mawi	02.08.2025	32.34	Uttar Pradesh	Shamli
		Mohna	02.06.2025	26.27	Haryana	Faridabad
		Mohna	02.09.2025	22.02	Haryana	Faridabad
		Naugaon	02.09.2025	77.39	Uttrakhand	Uttarakashi
		Palla	02.09.2025	25.49	Delhi	North West Delhi
		Vrindavan- Yamuna Expressway Link Road Bridge U/S of Mathura	01.05.2025	23.30	Uttar Pradesh	Mathura
			02.09.2025	44.31	Uttar Pradesh	Mathura

Figure 42 represents the GIS map of WQ stations with nickel values above limit.

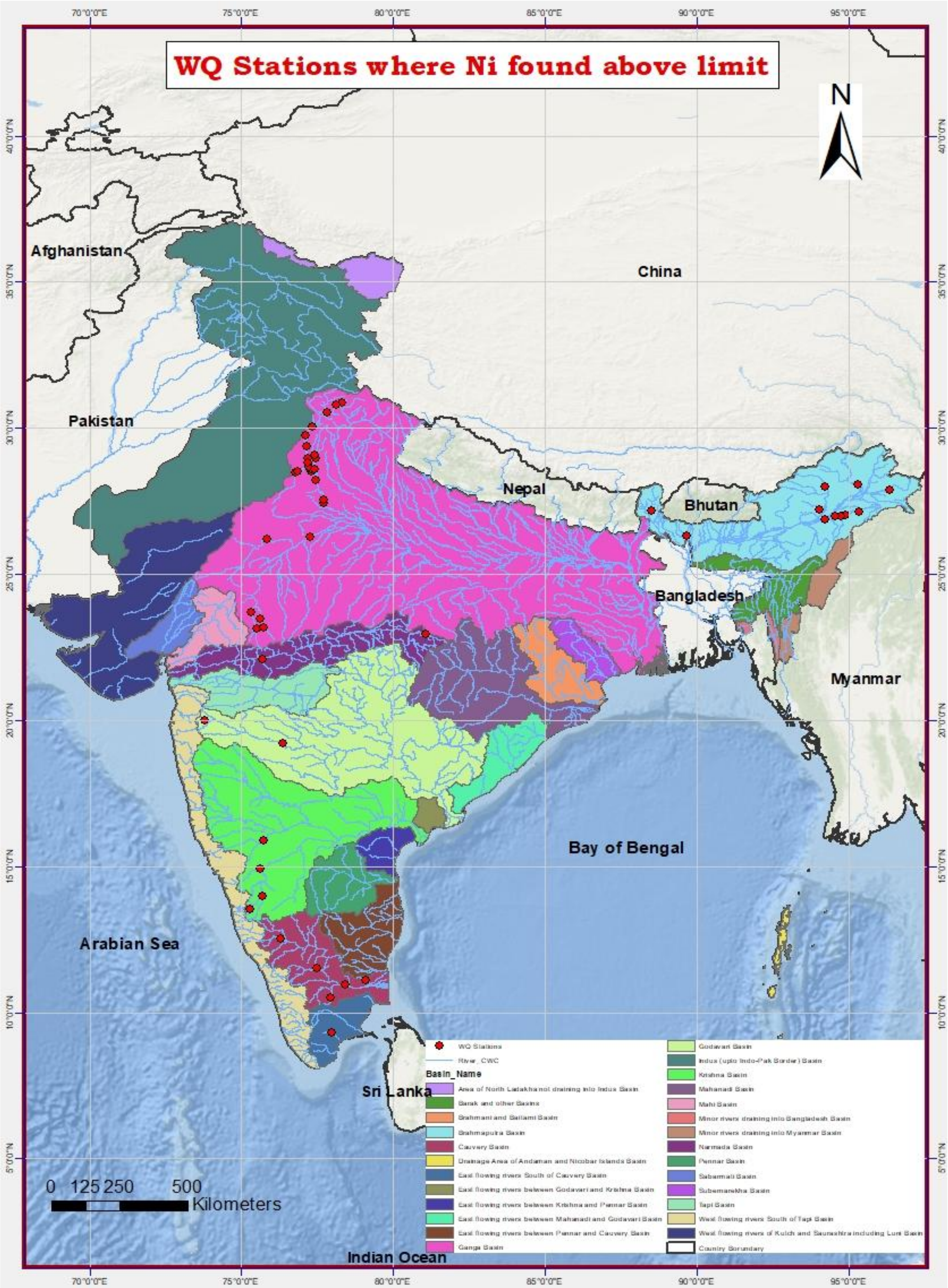

Figure 42: WQ stations where Nickel found above acceptable limit

Comparative Assessment of Nickel Concentration in River Water (2023–2025)

A comprehensive assessment of nickel concentrations in river water was carried out for the monitoring periods 2023, 2024, and 2025, with particular focus on exceedance of the prescribed acceptable limit. The comparative analysis reveals a progressive increase in both the frequency and spatial distribution of nickel exceedance over the three years.

During 2023 (7th edition), out of 5,898 river water samples analyzed, 17 samples (0.29%) exceeded the acceptable limit. These exceedances were limited to 6 monitoring stations across 4 rivers, indicating a relatively localized occurrence of nickel exceedance. The nickel concentration ranged from 0.000 to 66.64 µg/L, with the maximum concentration of 66.64 µg/L recorded at the Musiri monitoring station on the Cauvery River.

In 2024, a notable increase in both frequency and spatial spread of exceedances was observed. Out of 5,014 samples analyzed, 33 samples (0.66%) from 22 monitoring stations exceeded the acceptable limit, representing more than a twofold increase compared to 2023. The nickel concentration ranged from 0.000 to 72.11 µg/L, with the maximum concentration of 72.11 µg/L observed at the Kudlur monitoring station on the Cauvery River on 22 August 2024. This indicates both an increase in contamination intensity and expansion in affected locations.

The 2025 monitoring data further demonstrate a significant escalation in nickel exceedance. Out of 6648 river water samples analyzed, 66 samples (0.99%) from 50 monitoring stations exceeded the acceptable limit, indicating the highest level of non-compliance among the three years. These exceedances were distributed across multiple river systems, including Banas, Bhadra, Bhavani, Brahmaputra, Cauvery, Chambal, Godavari, Hindon, Narmada, Subansiri, Yamuna, and others, reflecting a substantial expansion in geographical coverage. The nickel concentration ranged from 0.000 to 83.60 µg/L, with the maximum concentration of 83.60 µg/L recorded at the Kuthnaur monitoring station on the Yamuna River on 02 September 2025.

Overall, the comparative analysis indicates a clear and consistent upward trend in nickel exceedance from 2023 to 2025, characterized by increasing exceedances, a growing number of affected monitoring stations, and rising maximum concentration levels. The observed pattern suggests intensifying anthropogenic pressures, such as industrial discharge, electroplating activities, urban runoff, and mining influences, contributing to the deterioration of river water quality. These findings indicate a increasing in the number of stations and rivers affected and a slight increase in the peak nickel concentration. However, the apparent increase in heavy metal exceedance is influenced by the substantial expansion of the monitoring network, which now covers a much larger number of stations and river basins across India.

The GIS map in Figure 43 illustrates the stations which have exceeded the Ni limit in both the current and previous reports.

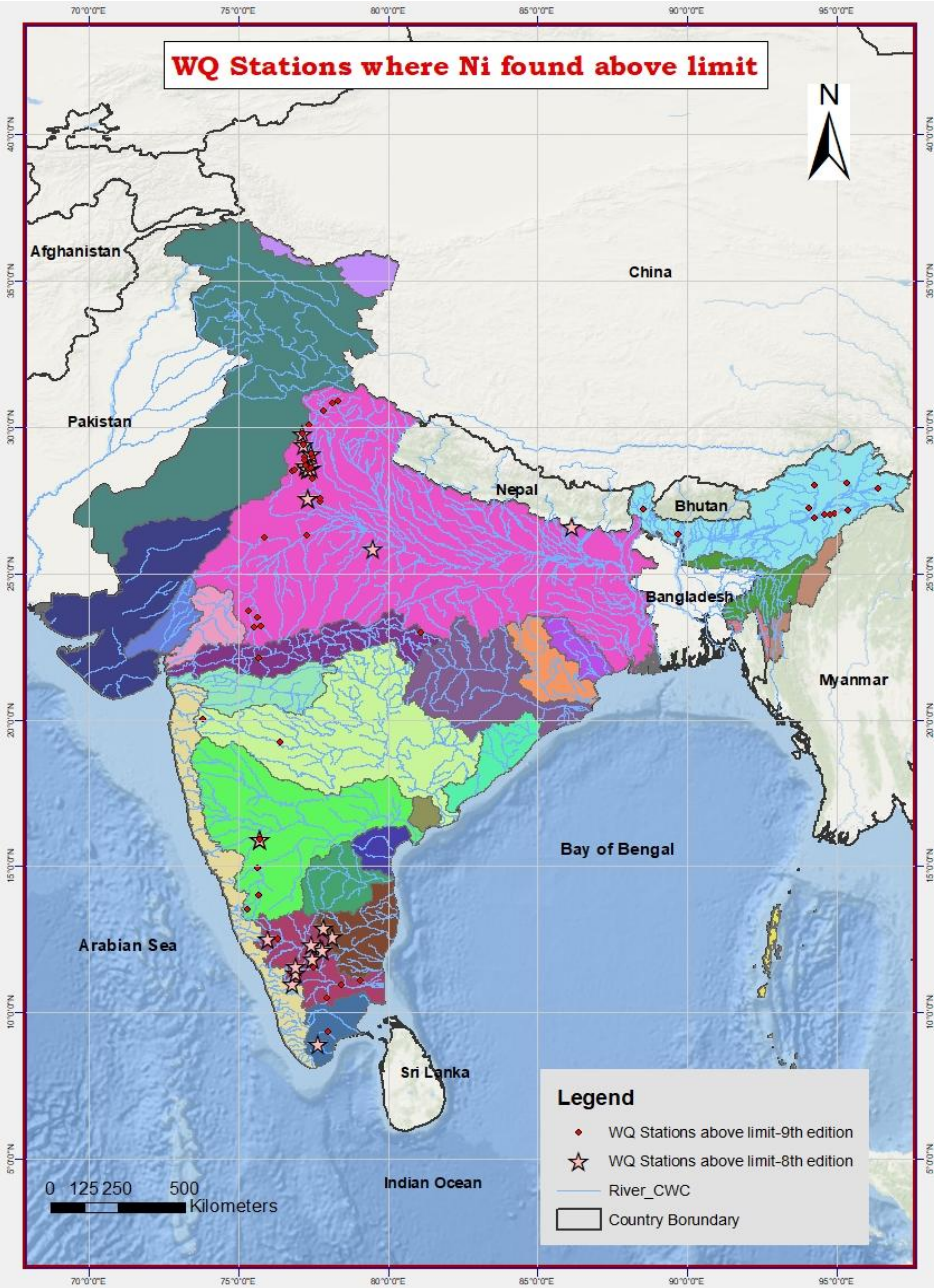

Figure 43: WQ stations where Nickel found above acceptable limit (both study periods)

7.9 Zinc (Zn)

Bureau of Indian Standards (BIS) 10500:2012 has recommended acceptable limit of 5 mg/L (5000 µg/L) of Zinc in drinking water. Out of total 6691 river water samples analysed, no sample is found to have zinc concentration beyond the acceptable limit. The zinc concentration varies from 0.000 to 2797.65 µg/L. Maximum zinc concentration (2797.65 µg/L) was observed at Bardoh (Chhapriyal) water quality monitoring station on Manawar Tawi River on 21.10.2025. The data indicates that while zinc concentrations remained within acceptable limits in last 3 years.

8. CONCLUSION

The analysis results of 9 metals analysed in samples collected from 767 water quality monitoring stations spread over 20 river basins were considered for the study. Drinking water standard; BIS: 10500:2012 is used as a benchmark due to the absence of any river-specific water quality standards.

- The comprehensive analysis of water samples across numerous stations has revealed concerning levels of various heavy metals, each governed by specific acceptable limits prescribed by BIS (10500:2012). The analysis results of 9 trace and toxic metals analysed in river water samples collected from 767 water quality (WQ) monitoring stations spread across various river basins were considered for the study. The drinking water standard, BIS:10500:2012, was used as a benchmark in the absence of river-specific water quality standards.
- The comprehensive analysis of water samples indicates that, overall, water quality remains within acceptable limits at a majority of locations, with 494 out of 767 stations (64.41%) complying with the prescribed standards, while 273 stations showed exceedance of one or more metals.
- The results highlight the presence of heavy metal exceedance at several locations, with varying degrees of exceedance across different metals including arsenic, cadmium, chromium, copper, iron, lead, mercury, and nickel.
- Arsenic exceeded the acceptable limit (10 µg/L) in 65 samples from 42 stations, indicating localized exceedance in specific basins.
- Cadmium and chromium showed relatively limited exceedances, each recorded in only 7 samples, affecting 7 and 6 stations respectively, suggesting minimal but critical contamination.
- Copper exceeded permissible limits in 12 samples from 11 stations, indicating sporadic contamination possibly linked to anthropogenic activities.
- Iron emerged as the most significant contaminant, with 409 samples from 209 stations exceeding the acceptable limit of 1000 µg/L, making it the most widespread metal of concern in the study.
- Lead exceedance was observed in 41 samples from 38 stations, while mercury exceeded limits in 13 samples from 8 stations, reflecting the presence of toxic elements that pose serious environmental and health risks.
- Nickel also showed notable exceedances, with 66 samples from 50 stations crossing the acceptable limit, indicating its relatively higher occurrence among toxic metals.
- Zinc was found to be within acceptable limits in all analysed samples, indicating no significant concern with respect to this metal.
- The findings clearly demonstrate that while exceedance is not uniformly widespread, certain stations and basins exhibit elevated concentrations of one or more metals, with iron being the dominant contributor followed by nickel and arsenic.
- These results emphasize the need for continuous monitoring, identification of pollution sources, and implementation of effective mitigation and management

strategies. Priority should be given to hotspots with multi-metal exceedance and high iron concentrations to safeguard water quality, protect aquatic ecosystems, and ensure public health safety.

The analysis of 767 water quality (WQ) stations revealed that a total of 273 stations exhibited one or more metals exceeding the acceptable limits, while 494 stations (64.41%) were found to have all toxic metals within permissible limits. The overall summary of metal exceedance across the 767 stations is presented below:

- Table 20 indicates that among the 273 affected stations, Iron was the most dominant contaminant, observed alone above the acceptable limit at 155 stations, followed by Arsenic at 18 stations, Nickel at 9 stations, Lead at 11 stations, Mercury at 4 stations, Copper at 6 stations, Cadmium at 3 stations and Chromium at 1 station each. Zinc was not found to exceed the acceptable limit in any station. Additionally, 66 stations showed exceedance due to two or more metals, indicating the occurrence of mixed metal pollution at certain locations.

- The predominance of Iron exceedance in Indian rivers suggests that geogenic sources, such as weathering of iron-bearing minerals, may play a significant role, although localized anthropogenic influences cannot be ruled out. The comparatively lower occurrence of other toxic metals indicates limited but site-specific exceedance.

Table 20: Overall Statistics of Analysis

Sl. No	Parameters	No. of Stations where metal found above acceptable limit
1	Arsenic only	**18**
2	Cadmium only	**3**
3	Chromium only	**1**
4	Copper only	**6**
5	Iron only	**155**
6	Lead only	**11**
7	Mercury only	**4**
8	Nickel only	**9**
9	Zinc only	**0**
10	Two or More metals	**66**
Total WQ stations where one or more metals found above acceptable limits		**273**
Total WQ Stations where all toxic metals found within acceptable limits		**494**
Total WQ Stations under study		**767**

Table 21: Overall Status of 273 stations where one or more metals found above acceptable limits

No. of stations where 4 metals found to be above limit	**11**
No. of stations where 3 metals found to be above limit	**10**
No. of stations where 2 metals found to be above limit	**45**
No. of stations where only 1 metal found to be above limit	**207**

- Table 21 further classifies the 273 contaminated stations based on the number of metals exceeding the limits. It shows that eleven (11) stations had four metals exceeding the permissible limits, ten (10) stations had three metals, forty-five (45) stations had two metals, and a majority of two hundred seven (207) stations had only one metal exceeding the acceptable limit.
- The results clearly indicate that single-metal exceedance is the most common scenario, accounting for a significant proportion of the affected stations. This suggests that exceedance in most locations is isolated rather than due to multiple sources or cumulative pollution.
- However, the presence of 66 stations (with two or more metals exceeding limits) highlights areas of concern where combined effects of multiple contaminants may pose greater environmental and health risks. These locations may be influenced by anthropogenic activities such as industrial discharge, urban runoff, or agricultural inputs.
- Overall, while a large proportion of stations (64.41%) remain within safe limits, the occurrence of metals above limit at 273 stations-particularly the dominance of Iron and the presence of multi-metal exceedance in certain areas-calls for continuous monitoring, source identification, and implementation of appropriate mitigation measures to safeguard water quality.

The analysis of water quality (WQ) stations across various basins reveals significant variations in the presence of metals above the acceptable limits. Out of the total 767 WQ stations studied across the basins, a substantial proportion of these stations showed metal concentrations exceeding the permissible limits.

Table 22 presents the basin-wise distribution of water quality (WQ) stations monitored and the number of stations where one or more metals were found above acceptable limits across different river basins.

- Out of a total of 767 water quality monitoring stations studied across various river basins in India, 273 stations (35.59%) were found to have one or more metals exceeding acceptable limits, while 494 stations (64.41%) had all metals within acceptable limits.

- High percentages of exceedance were also recorded in the Brahmani & Baitarani Basin (22 out of 25; 88%), Subarnarekha Basin (13 out of 15; 86.67%), Mahi Basin(4 out of 5; 80%), Barak & Other Basin (25 out of 33, 75.76%), Sabarmati Basin (2 out of 3 stations; 66.67%), EFR South of Cauvery Basin (6 out of 9; 66.67%), Cauvery Basin (22 out of 39; 56.41%), and Krishna Basin (23 out of 45; 51.11%).
- Moderate levels of exceedances were observed in the Ganga Basin (81 out of 223; 36.32%), Narmada Basin (11 out of 34; 32.35%), Brahmaputra Basin (48 out of 152; 31.58%), EFR b/w Mahanadi & Godavari Basin (2 out of 7; 28.57%), Tapi Basin (1 out of 4; 25%), and Godavari Basin(10 out of 55; 18.18%).

Table 22: Basin-wise Summary of Analysis

Sl. No.	Basin	No. of WQ stations studied	WQ stations where one or more metals found above acceptable limits	No metal found above the limit
1	Barak & Other Basin	33	25	8
2	Brahmaputra Basin	152	48	104
3	Cauvery Basin	39	22	17
4	EFR South of Cauvery Basin	9	6	3
5	WFR South of Tapi Basin	43	2	41
6	Brahmani & Baitarani Basin	25	22	3
7	EFR b/w Mahanadi & Godavari	7	2	5
8	EFR b/w Pennar & Cauvery	10	0	10
9	Ganga Basin	223	81	142
10	Godavari Basin	55	10	45
11	Indus Basin	11	0	11
12	Krishna Basin	45	23	22
13	Mahanadi Basin	42	1	41
14	Mahi Basin	5	4	1
15	Narmada Basin	34	11	23
16	Pennar	8	0	8
17	Sabarmati Basin	3	2	1
18	Subarnarekha Basin	15	13	2
19	Tapi Basin	4	1	3
20	WFR of Kutch & Saurashtra including Luni Basin	4	0	4
Total		767	273	494

- Certain basins such as Cauvery Basin (22 out of 39; 56.41%) and EFR South of Cauvery (6 out of 9; 66.67%) also exhibited relatively higher proportions of exceedance, indicating localized pollution stress.
- In contrast, no metal exceedances were reported in basins such as Indus, EFR between Pennar & Cauvery, Pennar, and WFR of Kutch & Saurashtra including Luni Basin, where 100% of the stations complied with acceptable limits, indicating relatively good water quality conditions.
- Low levels of exceedance were observed in basins like WFR South of Tapi Basin (2 out of 43;4.65%) and Mahanadi Basin (1 out of 42; 2.38%), suggesting minimal pollution impact.
- Overall, the results highlight significant regional disparities in metal exceedance across river basins. Basins such as Brahmani & Baitarani, Subarnarekha, Mahi and Barak & Others exhibit higher exceedance levels, likely due to intense anthropogenic activities including industrial discharge, urbanization, and agricultural runoff. On the other hand, basins with no or minimal exceedances reflect comparatively lesser pollution pressure or effective dilution and management conditions. These findings emphasize the need for basin-specific monitoring, targeted mitigation measures, and stricter pollution control strategies to manage and reduce metal exceedance in vulnerable regions.

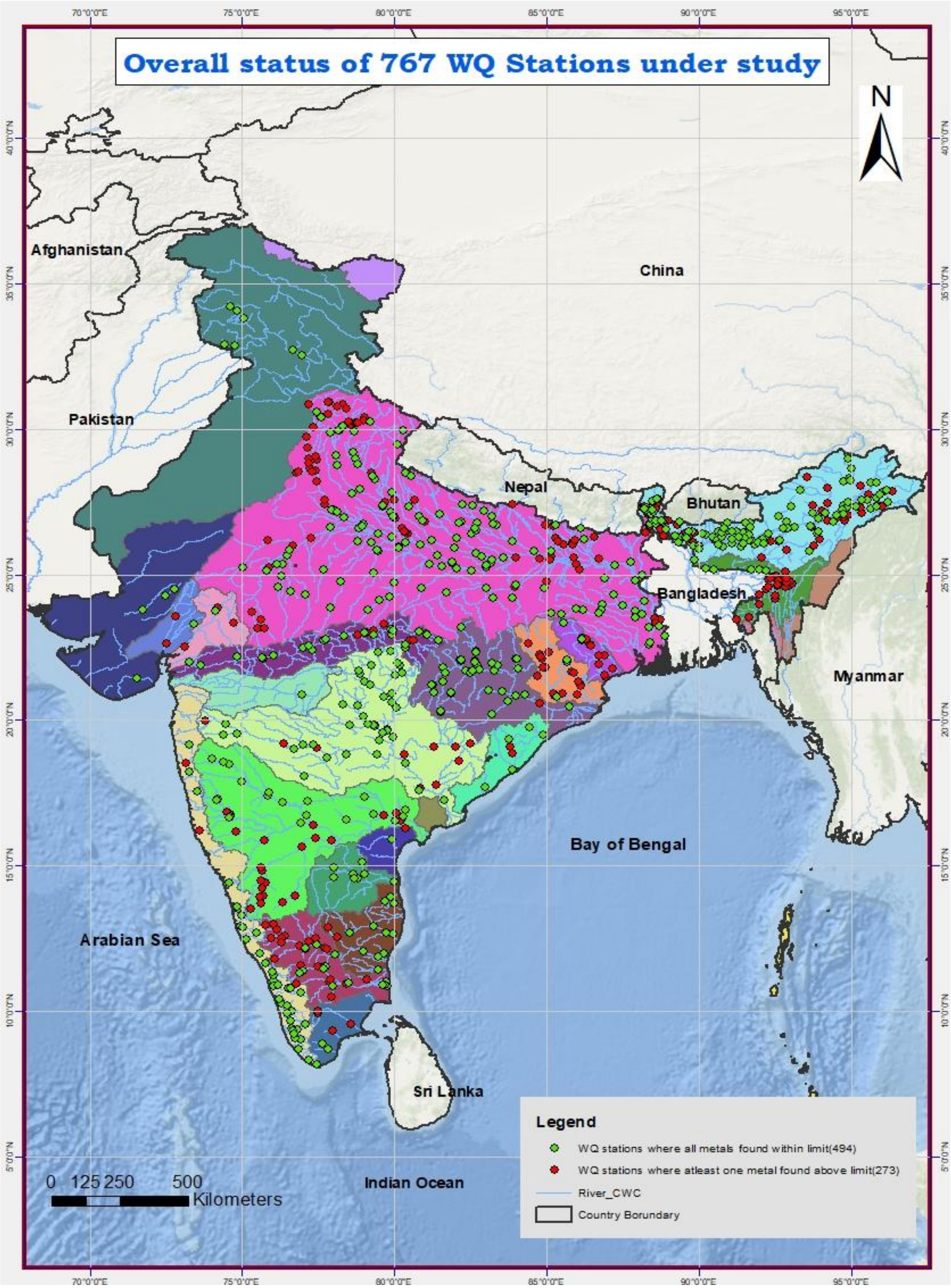

Figure 44: Overall status of 767 stations under study

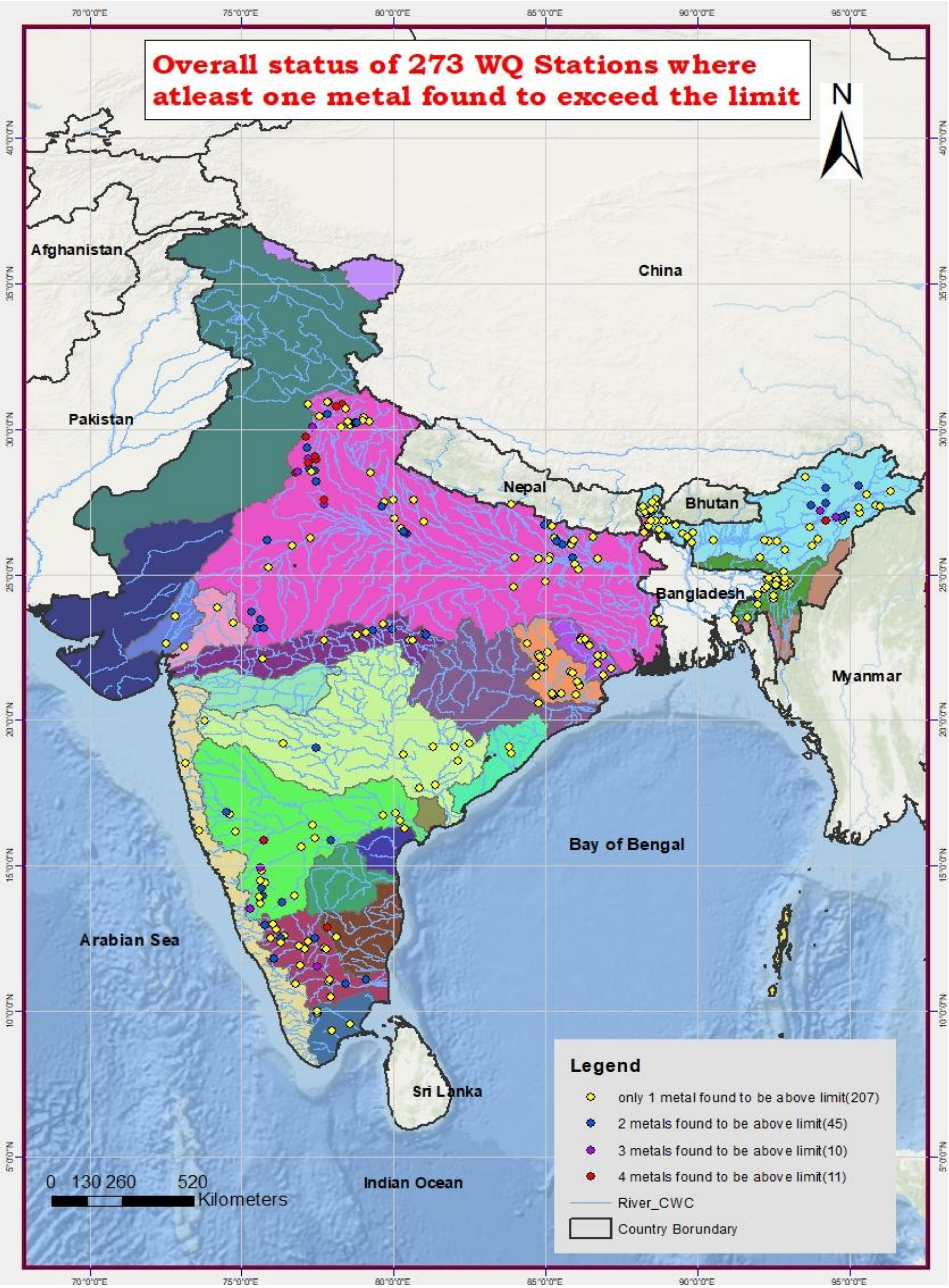

Figure 45: Overall status of 273 stations where at least one metal is found above the limit

Comparison with 8th edition

The analysis results of trace and toxic metal concentrations in river water samples for the years 2024 and 2025 have been compared to assess compliance with the acceptable limits specified by BIS: 10500, 2012.

Table 23: Comparison of Metal-wise Analysis Result

Analysis result (2024)							Analysis result (2025)			
Sl. No	Heavy metal	Accepta-ble limit as per BIS:10500, 2012 (in µg/L)	No. of samples ana-lysed	No. of samples where metal found within accepta-ble limit	No. of samples where metal found above ac-ceptable limit	% of samples where metal found above accepta-ble limit	No. of samples analysed	No. of samples where metal found within ac-ceptable limit	No. of samples where metal found above ac-ceptable limit	% of samples where metal found above ac-ceptable limit
1	Arsenic (As)	**10**	5456	5415	41	0.75	6660	6595	65	0.98
2	Cadmium (Cd)	**3**	5459	5452	07	0.13	6667	6660	7	0.10
3	Chromium (Cr)	**50**	5039	5025	14	0.28	6660	6653	7	0.11
4	Copper (Cu)	**50**	5457	5450	07	0.13	6667	6655	12	0.18
5	Iron (Fe)	**1000**	5417	5092	325	6.00	6459	6050	409	6.33
6	Lead (Pb)	**10**	5265	5185	80	1.52	6549	6508	41	0.63
7	Mercury (Hg)	**1**	5361	5326	35	0.65	5120	5107	13	0.25
8	Nickel (Ni)	**20**	5014	4981	33	0.66	6648	6582	66	0.99
9	Zinc (Zn)	**5000**	5456	5456	00	0.00	6691	6691	0	0.00

Table 24: Overall comparison of 2 reports

WQ stations	Year 2025	Year 2024	WQ Samples	Year 2025	Year 2024
No of stations where no metal found above acceptable limit	494	322	No of samples where no metal found above acceptable limit	6139	5005
No of stations where at least one metal found above acceptable limit	273	112	No of samples where at least one metal found above acceptable limit	552	455
Total Stations under study	767	434	Total Samples under study	6691	5460

It is important to emphasize that the number of monitoring stations considered for study, has increased significantly over time, from 434 in 2024 to 767 in 2025, covering almost all important river basins across India. While enhanced monitoring has revealed wider exceedance, the persistence of exceedances across a large proportion of stations indicates that heavy metal pollution remains a significant and ongoing concern.

9.MEASURES & WAY FORWARD

Metal contamination in water bodies is a key environmental concern that requires immediate and sustained intervention to protect ecosystems and public health. The following strategic measures are recommended to effectively address and manage metal pollution:

Continuous Monitoring and Assessment:

Regular and systematic water quality monitoring should be undertaken to detect and quantify trace and toxic metals in river systems. This will provide a reliable database for identifying trends and formulating targeted mitigation strategies.

Source Identification and Control:

A priority step is to accurately identify the sources of metal contamination—whether industrial, agricultural, or geogenic—to prevent further discharge and enable focused remedial actions.

Implementation of Pollution Control Measures:

A comprehensive approach is required to minimize the release of contaminants into rivers, including the following key strategies:

- ***Upgradation of Effluent Treatment Systems:***

Existing wastewater treatment infrastructure should be strengthened through the adoption of advanced treatment technologies, improved operational practices, and stringent monitoring mechanisms. Integration of innovative and emerging metal removal technologies can significantly enhance treatment efficiency.

- ***Sustainable Agricultural Practices:***

Improved irrigation management, optimized fertilizer application, and adoption of eco-friendly farming techniques can reduce the entry of metal contaminants from agricultural runoff into water bodies.

- ***Wastewater Recycling and Reuse:***

Promoting the reuse of properly treated wastewater can reduce dependence on freshwater resources and prevent the discharge of untreated or partially treated effluents into rivers.

- ***Sediment Quality Studies:***

Detailed investigations on metal accumulation in river sediments should be carried out to better understand pollution pathways, long-term storage, and potential remobilization of metals.

- ***Advanced Metal Removal Techniques:***

Adoption of efficient treatment methods such as chemical precipitation, electrochemical processes, membrane filtration, and biosorption can help in the effective removal of heavy metals from contaminated water.

• ***Soil Remediation Measures:***

Control of metal release from contaminated soils can be achieved through techniques such as excavation, in-situ stabilization, and phytoremediation. These approaches help in preventing further leaching of metals into river systems.

Overall, a combination of technological advancement, regulatory enforcement, and sustainable practices is essential to mitigate metal contamination and ensure long-term protection of water resources.

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11.ANNEXURE I

List of 767 Water Quality Monitoring Stations

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
1	A.B. Road crossing	No metals found	Madhya Pradesh	Guna	Ganga Basin	Ganga/Yamuna/Chambal/Parwati	24.34	77.10
2	A.P. Puram	No metals found	Tamil Nadu	Tirunelveli	EFR South of Cauvery Basin	Tambraparani/Chittar	8.90	77.65
3	A.P.Ghat	Fe	Assam	Cachar	Barak & Other Basin	Barak	24.83	92.79
4	Abu Road	No metals found	Rajasthan	Sirohi	WFR of Kutch & Saurashtra including Luni Basin	Banas	24.49	72.79
5	Adarsh Gaon	Fe	Sikkim	Mangan	Brahmaputra Basin	Teesta	27.23	88.49
6	Addoor	No metals found	Karnataka	Dakshina Kannada	WFR South of Tapi Basin	Gurupur	12.93	74.95
7	Adityapur	No metals found	Jharkhand	Purba Singhbhum	Subarnarekha Basin	Kharkai	22.79	86.17
8	Agra (Jawahar bridge)	No metals found	Uttar Pradesh	Agra	Ganga Basin	Yamuna	27.20	78.04
9	Agra (Poiyaghat)	No metals found	Uttar Pradesh	Agra	Ganga Basin	Yamuna	27.25	78.02
10	Agra Canal, Kalindikunj	Fe,Ni	Delhi	South Delhi	Ganga Basin	Ganga/Yamuna	28.54	77.31
11	Aheri Gudem Bridge	No metals found	Maharashtra	Gadchiroli	Godavari Basin	Godavari/Pranhita	19.42	79.97
12	Aie NH Crossing	No metals found	Assam	Bongaigaon	Brahmaputra Basin	Aie	26.50	90.65
13	Akbarpur	No metals found	Uttar Pradesh	Ambedkar Nagar	Ganga Basin	Chhoti sarju	26.43	82.55
14	Akhnoor	No metals found	Jammu & Kashmir	Jammu	Indus Basin	Chenab	32.90	74.76
15	Akkihebbal	Fe	Karnataka	Mandya	Cauvery Basin	Cauvery/Hemavathi	12.60	76.40

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
16	Aklera	No metals found	Rajasthan	Jhalawar	Ganga Basin	Ganga/Yamuna/Chambal/Kalisindh /Parwan	24.43	76.60
17	Alandurai	Fe	Tamil Nadu	Coimbatore	Cauvery Basin	Cauvery/Noyyal	10.95	76.79
18	Alladupalli	No metals found	Andhra Pra-desh	Kadapa	Pennar Basin	Pennar/Kunderu	14.72	78.67
19	Allahabad	No metals found	Uttar Pradesh	Allahabad	Ganga Basin	Ganga	25.40	81.91
20	Altuma	Fe	Odisha	Dhenkanal	Brahmani & Baitarani Basin	Ramial	20.93	85.52
21	Amarpur	Fe	Tripura	Gomati	Barak & Other Basin	Meghna/Gumti	23.53	91.65
22	Ambarampalayam	No metals found	Tamil Nadu	Coimbatore	WFR South of Tapi Basin	Bharathapuzha/ Kannadipuzha/A liyar	10.63	76.95
23	Ambari	Fe	West Bengal	Coochbehar	Brahmaputra Basin	Brahmaputra/Torsa/Kaljani	26.42	89.54
24	Ambasamudram	Fe	Tamil Nadu	Theni	EFR South of Cauvery Basin	Vaigai	9.93	77.51
25	Amraghat	Fe	Assam	Cachar	Barak & Other Basin	Sonai	24.61	92.95
26	Anakapalle	No metals found	Andrapradesh	Visakhapatnam	EFR between Mahanadi & Go-davari Basin	Sarada	17.69	83.00
27	Anandapur	Fe	Odisha	Keonjhar	Brahmani & Baitarani Basin	Baitarani	21.21	86.12
28	Andhiyarkhore	No metals found	Chhattisgarh	Bemetara	Mahanadi Basin	Hamp	21.83	81.60
29	Ankinghat	Fe	Uttar Pradesh	Kanpur Nagar	Ganga Basin	Ganga	26.93	80.03
30	Annavasal	No metals found	Puducherry	Karaikal	Cauvery Basin	Cauvery/Nattar	10.98	79.75
31	Aradei	No metals found	Odisha	Keonjhar	Brahmani & Baitarani Basin	Aradei	22.00	85.67
32	Arangaly	No metals found	Kerala	Thrissur	WFR South of Tapi Basin	Periyar/Chalakudy	10.28	76.32
33	Arcot	No metals found	Tamil Nadu	Ranipet	EFR between Pennar & Cau-very Basin	Palar	12.91	79.33

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
34	Arjunwad (seasonal)	Fe	Maharashtra	Kolhapur	Krishna Basin	Krishna	16.78	74.63
35	Arnota	No metals found	Uttar Pradesh	Agra	Ganga Basin	Yamuna/Uttangan	26.96	78.36
36	Ashramam	No metals found	Tamil Nadu	Kanyakumari	WFR South of Tapi Basin	Pazhayar	8.16	77.46
37	Ashti	No metals found	Maharashtra	Gadchiroli	Godavari Basin	Godavari/Pranhita/Wainganga	19.68	79.79
38	Ashti (AHL) Papermill	No metals found	Maharashtra	Gadchiroli	Godavari Basin	Godavari/Pranhita/Wainganga	19.67	79.79
39	Ashti D/S	No metals found	Maharashtra	Gadchiroli	Godavari Basin	Godavari/Pranhita/Wainganga	19.67	79.79
40	Augustmuni D/S	Fe	Uttrakhand	Rudraprayag	Ganga Basin	Ganga/Alaknanda/Mandakini	30.39	79.02
41	Augustmuni U/S	Fe	Uttrakhand	Rudraprayag	Ganga Basin	Ganga/Alaknanda/Mandakini	30.40	79.04
42	Auraiya	No metals found	Uttar Pradesh	Auraiya	Ganga Basin	Yamuna	26.43	79.48
43	Avarankuppam	No metals found	Tamil Nadu	Vellore	EFR South of Cauvery Basin	Palar	12.68	78.54
44	Avershe	No metals found	Karnataka	Udupi	WFR South of Tapi Basin	Sita	13.52	74.88
45	Ayilam	No metals found	Kerala	Thiruvananthapuram	WFR South of Tapi Basin	Vamanapuram	8.72	76.85
46	Ayodhya	No metals found	Uttar Pradesh	Ayodhya	Ganga Basin	Ganga/Ghaghra	26.81	82.21
47	Azmabad	No metals found	Bihar	Bhagalpur	Ganga Basin	Ganga	25.34	87.27
48	B.P.Ghat	Fe	Assam	Karimganj	Barak & Other Basin	Barak	24.88	92.58
49	Bachhwara	As,Hg	Bihar	Begusarai	Ganga Basin	Ganga/Baya	25.58	85.89

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
50	Badatighat	No metals found	Assam	Lakhimpur	Brahmaputra Basin	Subansiri	26.93	93.96
51	Badlapur	No metals found	Maharashtra	Thane	WFR South of Tapi Basin	Ulhas	19.16	73.25
52	Baghbazar Ghat	No metals found	West Bengal	Kolkata	Ganga Basin	Hooghly	22.61	88.36
53	Baghmara	No metals found	Meghalaya	South Garo Hills	Barak & Other Basin	Meghna/Bugi	25.23	90.24
54	Baghpat	As,Fe,Ni	Uttar Pradesh	Baghpat	Ganga Basin	Ganga/Yamuna	28.99	77.20
55	Bahalpur	No metals found	Assam	Dhubri	Brahmaputra Basin	Champabati	26.32	90.47
56	Bairabi	Fe	Mizoram	Kolasib	Barak & Other Basin	Tlawng	24.18	92.54
57	Bairgania	Pb	Bihar	Sitamarhi	Ganga Basin	Ganga/Kosi/Bagmati/Lalbekia	26.67	85.25
58	Bakchachu	Fe	Sikkim	Mangan	Brahmaputra Basin	Teesta/DikChu/Bakcha Chu	27.42	88.63
59	Bakhari	No metals found	Madhya Pra-desh	Seoni	Godavari Basin	Godavari/Pranhita/Wainganga	22.32	79.47
60	Baladoba	No metals found	Assam	Dhubri	Brahmaputra Basin	Brahmaputra/Sankosh	26.02	89.83
61	Baleni	As,Fe,Cr,Ni	Uttar Pradesh	Baghpat	Ganga Basin	Ganga/Yamuna/Hindon	28.96	77.47
62	Balighat (Subansiri)	No metals found	Assam	Lakhimpur	Brahmaputra Basin	Subansiri	27.11	94.15
63	Balighat(Burhabalanga)	Fe	Odisha	Balasore	Subarnarekha Basin	Burhabalanga	21.49	86.95
64	Balijagaon	No metals found	Assam	Dibrugarh	Brahmaputra Basin	Buridehing	27.35	95.19
65	Ballarshapapermil l	No metals found	Maharashtra	Chandrapur	Godavari Basin	Godavari/Pranhita/Wardha	19.84	79.36
66	Balrampur	No metals found	Uttar Pradesh	Balrampur	Ganga Basin	Ganga/Ghaghra/Rapti	27.44	82.23

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
67	Baltara	Pb	Bihar	Khagaria	Ganga Basin	Ganga/Kosi	25.54	86.72
68	Baluaghat	No metals found	Uttar Pradesh	Varanasi	Ganga Basin	Ganga	25.42	83.18
69	Bamni	No metals found	Madhya Pra-desh	Mandla	Narmada Basin	Banjar	22.48	80.38
70	Bamni (ballarsha)	No metals found	Maharashtra	Chandrapur	Godavari Basin	Godavari/Pranhita/Wardha	19.81	79.38
71	Bamni U/S	No metals found	Maharashtra	Chandrapur	Godavari Basin	Godavari/Pranhita/Wardha	19.85	79.34
72	Bamnidih	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	21.91	82.71
73	Banda	No metals found	Uttar Pradesh	Banda	Ganga Basin	Yamuna/Ken	24.14	79.50
74	Bangapani	No metals found	Uttrakhand	Pithoragarh	Ganga Basin	Ganga/Ghaghra/Sharda/Gaurigang a	29.96	80.30
75	Banglabasti	No metals found	Assam	Nagaon	Brahmaputra Basin	Harianadi	26.20	92.67
76	Banjari	No metals found	Bihar	Rohtas	Ganga Basin	Ganga/Sone	24.67	84.00
77	Banka	No metals found	Bihar	Banka	Ganga Basin	Ganga/Chandan	24.89	86.93
78	Banpur	As	West Bengal	Nadia	Ganga Basin	Bhagirathi/Mathabhanga	23.45	88.75
79	Bansi	No metals found	Uttar Pradesh	Siddharthnagar	Ganga Basin	Ganga/Ghaghra/Rapti	27.19	82.94
80	Bantwal	No metals found	Karnataka	Dakshina Kannada	WFR South of Tapi Basin	Netravathi	12.88	75.04
81	Baranwada	Fe	Rajasthan	Sawai- madhopu r	Ganga Basin	Ganga/Yamuna/Chambal/Banas	26.00	76.67

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
82	Bardoh (Chhapriyal)	No metals found	Jammu & Kash-mir	Jammu	Indus Basin	Chenab/Manawar Tawi	32.92	74.42
83	Bareilly	No metals found	Uttar Pradesh	Bareilly	Ganga Basin	Ganga/Ramganga	28.30	79.37
84	Barginagar	No metals found	Madhya Pra-desh	Jabalpur	Narmada Basin	Narmada	22.94	79.92
85	Baridhi	Fe	Jharkhand	Paschim Singhbhum	Subarnarekha Basin	Subarnarekha	22.80	86.26
86	Baripada	Fe	Odisha	Mayurbhanj	Subarnarekha Basin	Burhabalanga	21.92	86.72
87	Barmanghat	No metals found	Madhya Pra-desh	Narsingpur	Narmada Basin	Narmada	23.03	79.02
88	Barobisha	No metals found	West Bengal	Alipurduar	Brahmaputra Basin	Brahmaputra/Sankosh/Raidak-II	26.47	89.79
89	Barod	No metals found	Rajasthan	Kota	Ganga Basin	Ganga/Yamuna/Chambal/Kalisindh	25.38	76.32
90	Baronda	No metals found	Chhattisgarh	Gariaband	Mahanadi Basin	Pairi	20.91	81.89
91	Basantpur(Ganga)	No metals found	Uttar Pradesh	Bijnaur	Ganga Basin	Ganga	29.10	78.10
92	Basantpur(Mahanadi)	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Mahanadi	21.73	82.79
93	Basoda	No metals found	Madhya Pra-desh	Vidisha	Ganga Basin	Yamuna/Betwa	23.89	77.92
94	Basti	No metals found	Uttar Pradesh	Basti	Ganga Basin	Ganga/Ghaghra/Kwano	26.78	82.71
95	Basti D/S	No metals found	Uttar Pradesh	Basti	Ganga Basin	Ganga/Ghaghra/Kwano	26.61	82.64
96	Basti U/S	No metals found	Uttar Pradesh	Basti	Ganga Basin	Ganga/Ghaghra/Kwano	26.78	82.72

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
97	Bawapuram	As,Hg	Andhra Pradesh	Kurnool	Krishna Basin	Krishna/Tungabhadra	15.88	77.96
98	Beki Road Bridge	No metals found	Assam	Barpeta	Brahmaputra Basin	Beki	26.49	90.92
99	Belkheri	No metals found	Madhya Pradesh	Narsingpur	Narmada Basin	Sher	22.93	79.34
100	Belne bridge	Fe	Maharashtra	Sindudurg	WFR South of Tapi Basin	Gad	16.22	73.59
101	Belodi	No metals found	Chhattisgarh	Durg	Mahanadi Basin	Seonath	21.23	81.27
102	Bendrahalli	Fe	Karnataka	Chamaraja Nagar	Cauvery Basin	Cauvery/Suvarnavathi	12.13	77.08
103	Berhampore	No metals found	West Bengal	Murshidabad	Ganga Basin	Ganga/Bhagirathi- II(WB)*	24.09	88.24
104	Bhadana Village D/S of Kota City	Fe	Rajasthan	Kota	Ganga Basin	Ganga/Yamuna/C hambal/Parwati	25.24	75.88
105	Bhadrachalam	As	Telangana	Bhadradri Kothagudem	Godavari Basin	Godavari	17.67	80.87
106	Bhalukpong	No metals found	Arunachal Pradesh	West Kameng	Brahmaputra Basin	Kameng	27.02	92.64
107	Bhalwara	Fe,Pb	Madhya Pradesh	Jabalpur	Narmada Basin	Gaur	23.11	79.97
108	Bhatpalli	No metals found	Telangana	Kumuram Bheem Asifabad	Godavari Basin	Godavari/Pranhita/Peddavagu	19.33	79.50
109	Bhind	No metals found	Madhya Pradesh	Bhind	Ganga Basin	Yamuna/Sindh/Kunwari	26.61	78.86
110	Bhitaura	No metals found	Uttar Pradesh	Fatehpur	Ganga Basin	Ganga	26.04	80.86
111	Bhomoraguri	No metals found	Assam	Sonitpur	Brahmaputra Basin	Brahmaputra	26.61	92.86

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
112	Bido	No metals found	Odisha	Dhenkanal	Brahmani & Baitarani Basin	Brahamani	20.81	85.35
113	Bigod	No metals found	Rajasthan	Bhilwara	Ganga Basin	Ganga/Yamuna/C hambal/Banas	25.25	75.03
114	Bihubar	Fe	Assam	Sivasagar	Brahmaputra Basin	Dikhow	26.86	94.80
115	Biligundulu	Cd	Tamil Nadu	Krishnagiri	Cauvery Basin	Cauvery	12.18	77.72
116	Birdghat	No metals found	Uttar Pradesh	Gorakhpur	Ganga Basin	Ganga/Ghaghra/Rapti	26.73	83.35
117	Biswanath Ghat	No metals found	Assam	Biswanath	Brahmaputra Basin	Brahmaputra	26.66	93.17
118	Bithoor	As	Uttar Pradesh	Kanpur	Ganga Basin	Ganga	26.62	80.28
119	Bogibeel	No metals found	Assam	Dibrugarh	Brahmaputra Basin	Brahmaputra	27.39	94.78
120	Bokajan	Fe	Assam	Karbi Anglong	Brahmaputra Basin	Dhansiri	26.02	93.79
121	Bokaro DN	No metals found	Jharkhand	Bokaro	Ganga Basin	Damodar	23.80	86.20
122	Bokaro UP	No metals found	Jharkhand	Bokaro	Ganga Basin	Damodar	23.83	85.97
123	Bolani	Fe	Odisha	Sundargarh	Brahmani & Baitarani Basin	Brahamani	22.11	84.85
124	Boleng	No metals found	Arunachal Pra-desh	Siang	Brahmaputra Basin	Siang	28.31	94.96
125	Bomjir	No metals found	Arunachal Pra-desh	Tinsukia	Brahmaputra Basin	Dibang	28.16	95.67
126	Bonaigarh	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Brahamani	21.81	84.97
127	Bop	No metals found	Sikkim	Mangan	Brahmaputra Basin	LachungChu	27.61	88.66
128	Boudh	No metals found	Odisha	Angul	Mahanadi Basin	Mahanadi	20.87	84.31

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
129	Burhanpur	No metals found	Madhya Pra-desh	Burhanpur	Tapi Basin	Tapi	21.30	76.24
130	Buxar	As	Bihar	Buxar	Ganga Basin	Ganga	25.60	84.00
131	Byaladahalli	Fe	Karnataka	Davanagere	Krishna Basin	Krishna/Tungabhadra/Haridra	14.43	75.78
132	Byrnihat	No metals found	Meghalaya	Ri-Bhoi	Barak & Other Basin	Umtru/Brahmaputra	26.04	91.87
133	C.S-97 A, Farakka	No metals found	West Bengal	Murshidabad	Ganga Basin	Ganga	23.75	87.93
134	Chaklagaon	No metals found	Assam	Bongaigaon	Brahmaputra Basin	Manas	26.39	90.81
135	Champa Road Bridge	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	22.02	82.64
136	Champasari	No metals found	West Bengal	Darjeeling	Ganga Basin	Ganga/Mahananda	26.74	88.42
137	Champua	No metals found	Odisha	Keonjhar	Brahmani & Baitarani Basin	Baitarani	22.07	85.67
138	Chandrika Devi	No metals found	Uttar Pradesh	Lucknow	Ganga Basin	Ganga/Gomti	27.03	80.84
139	Chandwada	No metals found	Gujarat	Vadodara	Narmada Basin	Orsang	22.01	73.25
140	Changsari	No metals found	Assam	Kamrup	Brahmaputra Basin	Kurijari	26.25	91.66
141	Chapra	As	West Bengal	Nadia	Ganga Basin	Bhagirathi/Jalangi	23.50	88.55
142	Chel	Fe	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Tees ta/Chel	26.86	88.64
143	Chengalpet	No metals found	Tamil Nadu	Chengalpet	EFR between Pennar & Cau-very Basin	Palar	12.65	79.95
144	Chenimari	No metals found	Assam	Dibrugarh	Brahmaputra Basin	Buridehing	27.32	94.88

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
145	Chennur	No metals found	Andhra Pra-desh	Kadapa	Pennar Basin	Pennar	14.57	78.80
146	Chepan	No metals found	West Bengal	Alipurduar	Brahmaputra Basin	Brahmaputra/Torsa/Raidak-I	26.49	89.70
147	Chhidgaon	No metals found	Madhya Pra-desh	Harda	Narmada Basin	Ganjal	22.41	77.31
148	Chilla Gaon	Cr,Fe,Ni	Delhi	East Delhi	Ganga Basin	Ganga/Yamuna/Hindon	28.59	77.30
149	Chindnar	Fe	Chhattisgarh	Dantewada	Godavari Basin	Godavari/Indrava ti	19.08	81.30
150	Chitrasani	No metals found	Gujarat	Banaskantha	WFR of Kutch & Saurashtra in-cluding Luni Basin	Balaram	24.29	72.50
151	Cholachagudda	Fe,Pb,Cr,Ni	Karnataka	Bagalkot	Krishna Basin	Krishna/Malaprabha	15.88	75.72
152	Chopan	No metals found	Uttar Pradesh	Sonebhadra	Ganga Basin	Sone	24.53	83.02
153	Chotabekra	Fe	Manipur	Jiribam	Barak & Other Basin	Barak	24.68	93.10
154	Chotogorjan/Kal iajari	No metals found	Assam	Morigaon	Brahmaputra Basin	Pokoriya (Udori)	26.28	92.19
155	Chouldhowaghat	As,Pb	Assam	Lakhimpur	Brahmaputra Basin	Subansiri	27.45	94.25
156	Chowkhamghat	No metals found	Arunachal Pra-desh	Lohit	Brahmaputra Basin	Lohit	27.85	96.03
157	Chunchunkatte	Fe,Ni	Karnataka	Mysore	Cauvery Basin	Cauvery	12.51	76.30
158	Coronation	No metals found	West Bengal	Darjeeling	Brahmaputra Basin	Brahmaputra/Teesta	26.90	88.47
159	CRB	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	22.02	82.64
160	D/S Belkhedi	Fe	Madhya Pra-desh	Narmadapuram	Narmada Basin	Sher	23.01	79.09
161	D/S Dindori	Pb	Madhya Pra-desh	Jabalpur	Narmada Basin	Narmada	22.97	81.05

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
162	D/S Jabalpur	No metals found	Madhya Pradesh	Jabalpur	Narmada Basin	Narmada	23.11	79.87
163	D/S Narmadapuram	No metals found	Madhya Pradesh	Narmadapuram	Narmada Basin	Narmada	22.76	77.69
164	D/S Patan	Fe,Pb	Madhya Pradesh	Jabalpur	Narmada Basin	Hiran	23.10	79.34
165	Dabri	As	Uttar Pradesh	Shahjahanpur	Ganga Basin	Ganga/Ramganga	27.50	79.70
166	Dadahu (Renuka)	No metals found	Himachal Pradesh	Sirmaur	Ganga Basin	Ganga/Yamuna/Giri	30.60	77.44
167	Dadri	As,Pb,Fe,Ni	Haryana	Jhajjar	Ganga Basin	Ganga/Yamuna/Sahibi	28.50	76.79
168	Dameracherla	As	Telangana	Nalgonda	Krishna Basin	Krishna/Musi	16.74	79.67
169	Daporizo	Fe,Ni	Arunachal Pradesh	Upper Subansiri	Brahmaputra Basin	Subansiri	27.99	94.23
170	Darang Reserve Forest(D.R.F)	No metals found	Assam	Baksa (BTAD)	Brahmaputra Basin	Puthimari	26.78	91.69
171	Dawki	No metals found	Meghalaya	West Jaintia Hills	Barak & Other Basin	Meghna/Umngot	25.19	92.02
172	Delhi Railway Bridge	Fe,Ni	Delhi	North Delhi	Ganga Basin	Ganga/Yamuna	28.66	77.25
173	Deongaon Bridge	No metals found	Karnataka	Bijapur	Krishna Basin	Krishna/Bhima	17.17	76.33
174	Deosugur	Hg	Karnataka	Raichur	Krishna Basin	Krishna	16.38	77.36
175	Derol Bridge	Cu	Gujarat	Sabarkantha	Sabarmati Basin	Sabarmati	23.58	72.81
176	Desangpani	Fe,Ni	Assam	Charaideo	Brahmaputra Basin	Desang	27.05	94.91
177	Devprayag (G)	Fe	Uttrakhand	Pauri Garhwal	Ganga Basin	Ganga	30.14	78.60
178	Dhalegaon	Ni	Maharashtra	Parbhani	Godavari Basin	Godavari	19.22	76.36
179	Dhamkund	No metals found	Jammu & Kashmir	Jammu	Indus Basin	Chenab/Manawar Tawi	32.92	74.42
180	Dhaneta	As	Uttar Pradesh	Bareilly	Ganga Basin	Ganga/Ramganga/Kichha(Gaula)	28.50	79.25

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
181	Dhansa	Fe,Ni,Pb	Delhi	South Delhi	Ganga Basin	Ganga/Yamuna/Sahibi	28.53	76.87
182	Dharamtul	Fe	Assam	Morigaon	Brahmaputra Basin	Kopili	26.17	92.36
183	Dhareri	Fe,Ni	Madhya Pra-desh	Ujjain	Ganga Basin	Ganga/Yamuna/C hambal	23.15	75.51
184	Dhengbridge	No metals found	Bihar	Sitamarhi	Ganga Basin	Ganga/Kosi/Bagmati	26.72	85.33
185	Dholai	Fe	Assam	Cachar	Barak & Other Basin	Barak/Rukni	24.59	92.85
186	Dholla	Fe	Assam	Tinsukia	Brahmaputra Basin	Lohit	27.76	95.58
187	Dholpur	No metals found	Rajasthan	Dholpur	Ganga Basin	Yamuna/Chambal	26.66	77.90
188	Dhond	No metals found	Maharashtra	Pune	Krishna Basin	Bhima	18.48	74.57
189	Dhubri	No metals found	Assam	Dhubri	Brahmaputra Basin	Brahmaputra	25.99	90.02
190	Dhulsar	No metals found	Madhya Pra-desh	Dhar	Narmada Basin	Uri	22.21	74.85
191	Diana	Fe	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Jaldhaka/Diana	26.86	89.00
192	Dibrugarh	No metals found	Assam	Dibrugarh	Brahmaputra Basin	Brahmaputra	27.49	94.91
193	Dihingmukh	No metals found	Assam	Sivasagar	Brahmaputra Basin	Buridehing	27.26	94.74
194	Dillighat	Ni	Assam	Dibrugarh	Brahmaputra Basin	Desang	27.14	95.37
195	Dimapara	No metals found	Meghalaya	South Garo Hills	Barak & Other Basin	Meghna/Bugi	25.23	90.24
196	Dindori	Cd,Ni	Madhya Pra-desh	Dindori	Narmada Basin	Narmada	22.95	81.08
197	Dipranggaon	No metals found	Assam	Morigaon	Brahmaputra Basin	Kopili	26.18	92.09

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Latitude	Longitude
198	Dobhi	No metals found	Bihar	Gaya	Ganga Basin	Ganga/Phalgu	24.53	84.92
199	Doimukh	No metals found	Arunachal Pradesh	Papumpare	Brahmaputra Basin	Dikrong	27.14	93.75
200	Domohani	Fe	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Teesta	26.56	88.76
201	Domuhani	Fe	Jharkhand	Purba Singhbhum	Subarnarekha Basin	Subarnarekha	22.84	86.16
202	Doomduma	No metals found	Assam	Tinsukia	Brahmaputra Basin	Dibru	27.57	95.55
203	Duddhi	No metals found	Uttar Pradesh	Sonebhadra	Ganga Basin	Kanhar	24.22	83.27
204	Dudhnoi	No metals found	Assam	Goalpara	Brahmaputra Basin	Dhudnoi	25.98	90.79
205	Durvesh	No metals found	Maharashtra	Palghar	WFR south of Tapi Basin	Vaitarna	19.71	72.93
206	Ekmighat	As,Cd	Bihar	Darbhanga	Ganga Basin	Ganga/Kosi/Bagmat i/Adhwara-Group	26.12	85.88
207	Elgin Bridge	No metals found	Uttar Pradesh	Barabanki	Ganga Basin	Ganga/Ghaghra	27.10	81.49
208	Elunuthi Mangalam	Fe	Tamil Nadu	Erode	Cauvery Basin	Cauvery/Noyyal	11.03	77.88
209	English Bazar	No metals found	West Bengal	Malda	Ganga Basin	Padma/Mahananda	25.00	88.15
210	Erinjipuzha	No metals found	Kerala	Kasargod	WFR South of Tapi Basin	Payaswani	12.48	75.15
211	Etawah	No metals found	Uttar Pradesh	Etawah	Ganga Basin	Yamuna	26.75	78.98
212	Faizabad U/S	No metals found	Uttar Pradesh	Ayodhya	Ganga Basin	Ganga/Ghaghra	26.80	82.12
213	Fakira Bazar	Fe	Assam	Karimganj	Barak & Other Basin	Longai	24.86	92.29

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
214	Farakka (HR)	No metals found	West Bengal	Murshidabad	Ganga Basin	Bhagirathi/FeederCanal	24.80	87.92
215	Fatehgarh	No metals found	Uttar Pradesh	Farrukhabad	Ganga Basin	Ganga	27.40	79.62
216	Fatehpora	No metals found	Jammu & Kash-mir	Jammu	Indus Basin	Chenab/Manawar Tawi	32.92	74.42
217	Fuletral	Fe	Assam	Cachar	Barak & Other Basin	Barak	24.79	93.01
218	G R Bridge	No metals found	Maharashtra	Parbhani	Godavari Basin	Godavari	19.02	76.73
219	Gadarwara	Fe	Madhya Pra-desh	Narsingpur	Narmada Basin	Shakkar	22.92	78.79
220	Gadat	No metals found	Gujarat	Valsad	WFR South of Tapi Basin	Ambika	20.86	72.98
221	Gaisabad	No metals found	Madhya Pra-desh	Damoh	Ganga Basin	Yamuna/Ken/Sonar/Bearma	24.24	79.84
222	Galeta	Cr,Fe,Hg,Ni	Uttar Pradesh	Baghpat	Ganga Basin	Ganga/Yamuna/Hindon	29.08	77.44
223	Gandhavayal	No metals found	Tamil Nadu	Coimbatore	Cauvery Basin	Bhavani/Gandhay ar	11.37	76.99
224	Gandhighat	As	Bihar	Patna	Ganga Basin	Ganga	25.62	85.17
225	Gandlapet	No metals found	Telangana	Nizamabad	Godavari Basin	Godavari/Peddav agu	18.83	78.44
226	Ganguwala	Pb	Himachal Pra-desh	Sirmaur	Ganga Basin	Ganga/Yamuna/Bata	30.44	77.58
227	Garampani/ Tenganighat	No metals found	Assam	Karbi Anglong	Brahmaputra Basin	Dhansiri(S)	26.41	93.90
228	Garhakota	No metals found	Madhya Pra-desh	Sagar	Ganga Basin	Yamuna/Ken/Sonar	23.78	79.14

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
229	Garhmukteshwar	No metals found	Uttar Pradesh	Hapur	Ganga Basin	Ganga	28.76	78.14
230	Garhwa	No metals found	Jharkhand	Palamu	Ganga Basin	Ganga/Sone/ NorthKoel	24.21	83.88
231	Garrauli	No metals found	Madhya Pra-desh	Chhatarpur	Ganga Basin	Yamuna/Betwa/Dhasan	25.08	79.34
232	Gatora	No metals found	Chhattisgarh	Bilaspur	Mahanadi Basin	Arpa	22.05	82.22
233	Gatora-1	No metals found	Chhattisgarh	Bilaspur	Mahanadi Basin	Arpa	22.09	82.15
234	Gatora-2	No metals found	Chhattisgarh	Bilaspur	Mahanadi Basin	Arpa	22.07	82.19
235	Gaya	Fe	Bihar	Gaya	Ganga Basin	Ganga/Phalgu	24.77	85.01
236	Gazaldoba	No metals found	West Bengal	Jalpaiguri	Brahmaputra Basin	Brhamaputra/Teesta	26.75	88.58
237	Gelabil	Fe	Assam	Golaghat	Brahmaputra Basin	Doyang	26.24	93.98
238	GH.Rd.Bridge	Fe	Jharkhand	Purba Singhbhum	Subarnarekha Basin	Subarnarekha	22.59	86.45
239	Gharmura	Fe	Assam	Hailakandi	Barak & Other Basin	Dhaleswari	24.29	92.52
240	Ghat	No metals found	Uttrakhand	Pithoragarh	Ganga Basin	Ganga/Ghaghra/Sharda/Saryu	29.50	80.13
241	Ghatshila	Fe	Jharkhand	Purba Singhbhum	Subarnarekha Basin	Subarnarekha	22.58	86.47
242	Ghazipur	No metals found	Uttar Pradesh	Ghazipur	Ganga Basin	Ganga	25.58	83.59
243	Ghish	No metals found	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Teesta/Ghish	26.87	88.61
244	Ghughumari	No metals found	West Bengal	COOCHBEHAR	Brahmaputra Basin	Brahmaputra/Torsa	26.29	89.46

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
245	Goalpara	No metals found	Assam	Goalpara	Brahmaputra Basin	Brahmaputra	26.18	90.63
246	Gokak	Fe	Karnataka	Belgaum	Krishna Basin	Krishna/Ghataprabha	16.18	74.80
247	Gokulbarrage (Mathura)	Pb,Fe,Ni	Uttar Pradesh	Mathura	Ganga Basin	Ganga/Yamuna	27.44	77.71
248	Golaghat	No metals found	Assam	Golaghat	Brahmaputra Basin	Dhansiri(S)	26.50	93.95
249	Golokganj	Fe	Assam	Dhubri	Brahmaputra Basin	Brahmaputra/Sankosh	26.11	89.82
250	Gomlai	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Brahamani	21.83	84.91
251	Gomtinagar	As	Uttar Pradesh	Lucknow	Ganga Basin	Ganga/Gomti	26.82	81.01
252	Gopalkheda	No metals found	Maharashtra	Akola	Tapi Basin	Purna	20.88	76.99
253	Gopiballavpur	Fe	West Bengal	Paschim Midnapur	Subarnarekha Basin	Subarnarekha	22.22	86.90
254	Gopurajapuram	No metals found	Tamil Nadu	Nagapattinam	Cauvery Basin	Cauvery/Puravidaiyanar	10.85	79.79
255	Gorakhpur	No metals found	Madhya Pra-desh	Dindori	Narmada Basin	Narmada	22.77	81.45
256	Gorakhpur D/S	No metals found	Uttar Pradesh	Gorakhpur	Ganga Basin	Ganga/Ghaghra/Rapti	26.71	83.35
257	Gorakhpur U/S	No metals found	Uttar Pradesh	Gorakhpur	Ganga Basin	Ganga/Ghaghra/Rapti	26.75	83.26
258	Govindpur(NH-5)	Fe	Odisha	Balasore	Subarnarekha Basin	Burhabalanga	21.55	86.92
259	Gudari	No metals found	Odisha	Rayagada	EFR between Mahanadi & Go-davari Basin	Vamsadhara	19.35	83.78
260	Gummanur	Cd	Tamil Nadu	Krishnagiri	EFR South of Cauvery Basin	Ponnaiyar	12.56	78.14
261	Gumra Bazar	Fe	Assam	Cachar	Barak & Other Basin	Meghna/Surma/Gumra	24.98	92.52
262	Gunderdehi	No metals found	Chhattisgarh	Balod	Mahanadi Basin	Tandula	20.95	81.29

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
263	Gunupur	Fe	Odisha	Rayagada	EFR between Mahanadi & Go-davari Basin	Vamsadhara	19.08	83.81
264	Gurudeshwar	No metals found	Gujarat	Bharuch	Narmada Basin	Narmada	21.89	73.65
265	Gutang	No metals found	Assam	Tinsukia	Brahmaputra Basin	Dibru	27.57	95.37
266	Guwahati D.C Court	No metals found	Assam	Kamrup	Brahmaputra Basin	Brahmaputra	26.19	91.74
267	Halady	No metals found	Karnataka	Udupi	WFR South of Tapi Basin	Haladi	13.58	74.86
268	Halia	No metals found	Telangana	Nalgonda	Krishna Basin	Krishna/Halia	16.79	79.34
269	Hamirpur	No metals found	Uttar Pradesh	Hamirpur	Ganga Basin	Yamuna	25.96	80.15
270	Handia	No metals found	Madhya Pra-desh	Harda	Narmada Basin	Narmada	22.49	76.99
271	Hanskhali	As	West Bengal	Nadia	Ganga Basin	Bhagirathi/Churni	23.36	88.61
272	Haralahalli	Fe	Karnataka	Haveri	Krishna Basin	Krishna/Tungabhadra	14.83	75.67
273	Harangajao	Fe	Assam	Dima Hasao	Barak & Other Basin	Jatinga	25.12	92.86
274	Haridwar	No metals found	Uttrakhand	Haridwar	Ganga Basin	Ganga	29.98	78.19
275	Haridwar D/S	No metals found	Uttrakhand	Haridwar	Ganga Basin	Ganga	29.96	78.17
276	Haridwar U/S	No metals found	Uttrakhand	Haridwar	Ganga Basin	Ganga	29.97	78.18
277	Hariharapura	Fe,Pb,Ni	Karnataka	Chikamagaluru	Krishna Basin	Krishna/Tungabhadra/Tunga	13.52	75.30
278	Haripur	Fe,Ni	Uttrakhand	Dehradun	Ganga Basin	Ganga/Yamuna/Tons(South)	30.54	77.83
279	Hasimara	Fe	West Bengal	Alipurduar	Brahmaputra Basin	Brahmaputra/Torsa	26.73	89.33

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati- tude	Lon- gi- tude
280	Hathidah	Pb	Bihar	Patna	Ganga Basin	Ganga	25.39	85.99
281	Hathikhana	As,Fe	Uttar Pradesh	Fatehgarh	Ganga Basin	Ganga	27.35	79.64
282	Hayaghat	As	Bihar	Darbhanga	Ganga Basin	Ganga/Kosi/Bagmati	26.04	85.89
283	Hivra	No metals found	Maharashtra	Wardha	Godavari Basin	Godavari/Pranhita/Wardha	20.55	78.33
284	Hogenakkal	Fe	Tamil Nadu	Dharmapuri	Cauvery Basin	Cauvery/Chinnar	12.12	77.79
285	Holehonnur	Fe,Ni	Karnataka	Shimoga	Krishna Basin	Krishna/Tungabhadra/Bhadra	13.98	75.69
286	Honnali	Fe,Pb	Karnataka	Davanagere	Krishna Basin	Krishna/Tungabhadra	14.24	75.66
287	Hoovinahole	Fe	Karnataka	Chitradurga	Krishna Basin	Krishna/Tungabhadr a/Suvarnamu- khi	13.98	76.75
288	Huvinhedgi	No metals found	Karnataka	Raichur	Krishna Basin	Krishna	16.49	76.92
289	Irukkankudi	Ni	Tamil Nadu	Viruthunagar	EFR South of Cauvery Basin	Vaigai/Vaippar	9.32	77.99
290	Jagdalpur	Fe	Chhattisgarh	Bastar	Godavari Basin	Godavari/Indrava ti	19.11	82.02
291	Jagibhakatgaon	Fe	Assam	Morigaon	Brahmaputra Basin	Kopili	26.18	92.22
292	Jagunghat	Fe	Assam	Tinsukia	Brahmaputra Basin	Buridehing	27.40	95.89
293	Jaigaon	No metals found	West Bengal	Alipurduar	Brahmaputra Basin	Brahmaputra/Torsa	26.85	89.37
294	Jainagar	No metals found	Bihar	Madhubani	Ganga Basin	Ganga/Kosi/Bagmat i/KamlaBalan	26.59	86.15
295	Jairampur	Cr	Arunachal Pra- desh	Changlang	Brahmaputra Basin	Namchik	27.33	96.05
296	Jajmau	As,Fe	Uttar Pradesh	Kanpur	Ganga Basin	Ganga	26.41	80.44
297	Jaldhaka NH- 31	No metals found	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Jaldhaka	26.57	88.94
298	Jammu Tawi (Sidhra)	No metals found	Jammu & Kash- mir	Jammu	Indus Basin	Chenab/Manawar Tawi	32.92	74.42
299	Jamshedpur	Fe	Jharkhand	Purba Singhbhum	Subarnarekha Basin	Subarnarekha	22.82	86.22

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
300	Jamsolaghat	Fe	Odisha	Mayurbhanj	Subarnarekha Basin	Subarnarekha	22.22	86.72
301	Jamtara	No metals found	Jharkhand	Jamtara	Ganga Basin	Ajay	23.98	86.86
302	Japla	Fe	Jharkhand	Palamu	Ganga Basin	Ganga/Sone	24.57	83.98
303	Jaraikela	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Koel	22.33	85.08
304	Jaunpur	No metals found	Uttar Pradesh	Jaunpur	Ganga Basin	Gomti	25.75	82.69
305	Jenapur	Fe	Odisha	Jajpur	Brahmani & Baitarani Basin	Brahamani	20.89	86.01
306	Jhalawar	No metals found	Rajasthan	Jhalawar	Ganga Basin	Ganga/Yamuna/C hambal/Kalis-indh	24.59	76.19
307	Jhanjharpur	No metals found	Bihar	Madhubani	Ganga Basin	Ganga/Kosi/Bagmat i/KamlaBalan	26.23	86.26
308	Jhanji/Teok	No metals found	Assam	Jorhat	Brahmaputra Basin	Jhanji	26.83	94.42
309	Jhansi Mirjapur Road Bridge	No metals found	Uttar Pradesh	Hamirpur	Ganga Basin	Betwa	25.95	80.15
310	Jiabharali NT Road X-ing	No metals found	Assam	Sonitpur	Brahmaputra Basin	Jiabharali	26.81	92.88
311	Jondhra	No metals found	Chhattisgarh	Bilaspur	Mahanadi Basin	Mahanadi/Seonath	21.72	82.34
312	K.M. Vadi	Fe	Karnataka	Mysore	Cauvery Basin	Cauvery/Lakshmanthirtha	12.35	76.29
313	Kabirganj	No metals found	Uttar Pradesh	Pilibhit	Ganga Basin	Ganga/Ghaghra/Sharda	28.51	80.38
314	Kabubasti	No metals found	Arunachal Pra-desh	West Siang	Brahmaputra Basin	Siyum	28.19	94.77
315	Kachhlabridge	No metals found	Uttar Pradesh	Badaun	Ganga Basin	Ganga	27.93	78.86
316	Kadamtala	Fe	Tripura	North Tripura	Barak & Other Basin	Talgang	24.50	92.22

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
317	Kailas Mandir, Agra	No metals found	Uttar Pradesh	Agra	Ganga Basin	Yamuna	27.24	77.93
318	Kailashahar	Fe	Tripura	Unakoti	Barak & Other Basin	Manu	24.32	91.99
319	Kakarghatti	As	Bihar	Darbhanga	Ganga Basin	Ganga/Kosi/Bagmat i/Jivach	26.19	85.95
320	Kakripara	No metals found	Assam	South Salmara-Mankachar	Brahmaputra Basin	Jinjiram	25.51	89.87
321	Kalain	Fe	Assam	Cachar	Barak & Other Basin	Kakrakhal	24.97	92.56
322	Kalampur	No metals found	Kerala	Ernakulam	WFR South of Tapi Basin	Muvattupuzha/ Kaliyar	9.99	76.63
323	Kalanaur	Pb,Fe,Ni	Uttar Pradesh	Saharanpur	Ganga Basin	Ganga/Yamuna	30.07	77.35
324	Kalasapadu	No metals found	Andhra Pra-desh	Kadapa	Pennar Basin	Sagileru	15.11	78.94
325	Kallooppara	No metals found	Kerala	Pathanamthitta	WFR South of Tapi Basin	Pampa/Manima la	9.40	76.65
326	Kalma	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Mahanadi	21.69	83.28
327	Kalna (EBB)*	No metals found	West Bengal	Purba Bardhaman	Ganga Basin	Ganga/Bhagirathi- II(WB)*	23.22	88.37
328	Kalna (Flow)*	No metals found	West Bengal	Purba Bardhaman	Ganga Basin	Ganga/Bhagirathi- II(WB)*	23.22	88.37
329	Kalpi	No metals found	Uttar Pradesh	Jalaun	Ganga Basin	Yamuna	26.13	79.25
330	Kamalanga	Fe	Odisha	Angual	Brahmani & Baitarani Basin	Brahamani	20.85	85.28
331	Kamalapuram	No metals found	Andhra Pra-desh	Kadapa	Pennar Basin	Pennar/Papagni	14.58	78.68
332	Kamalpur	No metals found	Gujarat	Banaskantha	WFR of Kutch & Saurashtra in-cluding Luni Basin	Banas	23.81	71.74
333	Kampur	Fe	Assam	Nagaon	Brahmaputra Basin	Kopili	26.15	92.65

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
334	Kanker	No metals found	Chhattisgarh	Kanker	Mahanadi Basin	Dhudh	20.28	81.52
335	Kannapoor	No metals found	Puducherry	Karaikal	Cauvery Basin	Cauvery/Vanjiyar	10.97	79.74
336	Kannauj	No metals found	Uttar Pradesh	Kannauj	Ganga Basin	Ganga/Kali	27.01	79.98
337	Kanpur	As,Fe	Uttar Pradesh	Kanpur	Ganga Basin	Ganga	26.47	80.38
338	Kantamal	No metals found	Odisha	Baudh	Mahanadi Basin	Tel	20.66	83.73
339	Kanti	As	Bihar	Muzaffarpur	Ganga Basin	Ganga/BurhiGandak	26.27	85.30
340	Karad	No metals found	Maharashtra	Satara	Krishna Basin	Krishna	17.29	74.19
341	Karathodu	No metals found	Kerala	Malappuram	WFR South of Tapi Basin	Kadalundi	11.06	76.04
342	Karimganj	Fe	Assam	Karimganj	Barak & Other Basin	Kushiyara	24.88	92.36
343	Karnal	As,Pb,Fe,Ni	Haryana	karnal	Ganga Basin	Ganga/Yamuna	29.76	77.13
344	Karnaprayag (P)	Fe	Uttrakhand	Chamoli	Ganga Basin	Ganga/Alaknanda/Pinder	30.26	79.22
345	Karnaprayag Confluence D/S	No metals found	Uttrakhand	Chamoli	Ganga Basin	Ganga/Alaknanda	30.26	79.21
346	Karnaprayag Confluence U/S	Fe	Uttrakhand	Chamoli	Ganga Basin	Ganga/Alaknanda	30.26	79.22
347	Kasganj	No metals found	Uttar Pradesh	Kasganj	Ganga Basin	Ganga/Kali	27.79	78.63
348	Kashinagar	Fe	Odisha	Gajapati	EFR between Mahanadi & Go-davari Basin	Vamsadhara	18.85	83.87
349	Katigora	Fe	Assam	Cachar	Barak & Other Basin	Katakhal	24.82	92.65
350	Katriumrauli	No metals found	Uttar Pradesh	Kannauj	Ganga Basin	Ganga	27.15	79.88

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
351	Katwa	No metals found	West Bengal	Purba Bardhaman	Ganga Basin	Ganga/Bhagirathi- II(WB)*	23.64	88.15
352	Kazipura	No metals found	Uttar Pradesh	Moradabad	Ganga Basin	Ganga/Ramganga	28.99	78.74
353	Keesara	No metals found	Andhra Pra-desh	NTR	Krishna Basin	Krishna/Munneru	16.72	80.32
354	Kellodu	Fe,Pb	Karnataka	Chitradurga	Krishna Basin	Krishna/Tungabhadr a/Vedavathi	13.75	76.32
355	Kelo	No metals found	Chhattisgarh	Raigarh	Mahanadi Basin	Kelo	21.88	83.40
356	Kenduapada	Fe	Odisha	Keonjhar	Brahmani & Baitarani Basin	Kanijhari	21.67	85.84
357	Keolari	No metals found	Madhya Pra-desh	Seoni	Godavari Basin	Godavari/Pranhita/Wainganga	22.38	79.90
358	Kesinga	No metals found	Odisha	Kalahandi	Mahanadi Basin	Tel	20.20	83.23
359	Khairmal	No metals found	Odisha	Baudh	Mahanadi Basin	Mahanadi	20.83	84.00
360	Khanitar	Fe	Sikkim	Pakyong	Brahmaputra Basin	Brahmaputra/Teesta	27.18	88.51
361	Khanpur	Cu	Gujarat	Anand	Mahi Basin	Mahi	22.54	73.14
362	Kharkhana	No metals found	Meghalaya	West Jaintia Hills	Barak & Other Basin	Myntdu/Meghna	25.16	92.21
363	Khatoli	No metals found	Rajasthan	Kota	Ganga Basin	Ganga/Yamuna/C hambal/Parwati	25.68	76.48
364	Kheronighat	Fe	Assam	Karbi/Anglong	Brahmaputra Basin	Kopili	25.85	92.89
365	Khudrakhowa	No metals found	Assam	Barpeta	Brahmaputra Basin	Manas	26.31	90.75
366	Kidangoor	No metals found	Kerala	Kottayam	WFR South of Tapi Basin	Meenachil	9.68	76.61
367	Kirtinagar D/S	As,Fe	Uttrakhand	Tehri Garhwal	Ganga Basin	Ganga/Alaknanda	30.23	78.73

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
368	Kirtinagar U/S	As,Fe	Uttrakhand	Tehri Garhwal	Ganga Basin	Ganga/Alaknanda	30.21	78.75
369	Kodumudi	Cu	Tamil Nadu	Erode	Cauvery Basin	Cauvery	11.08	77.89
370	Koelwar	Fe	Bihar	Bhojpur	Ganga Basin	Ganga/Sone	25.57	84.80
371	Kogaon	Ni	Madhya Pra-desh	Khargone	Narmada Basin	Kundi	22.10	75.68
372	Koggedoddi	No metals found	Karnataka	Ramanagara	Cauvery Basin	Cauvery/Arkavathi	12.30	77.44
373	Kokiwada	No metals found	Madhya Pra-desh	Chhindawara	Godavari Basin	Godavari/Pranhita/Wainganga/Kanhan/Pench	21.90	79.23
374	Kokrajhar	No metals found	Assam	Kokrajhar	Brahmaputra Basin	Gaurang	26.40	90.25
375	Kollegal	No metals found	Karnataka	Chamaraja Nagar	Cauvery Basin	Cauvery	12.19	77.10
376	Koloriang	No metals found	Arunachal Pra-desh	Kurung Kamey	Brahmaputra Basin	Kurung	27.90	93.34
377	Konta	Fe	Chhattisgarh	Sukma	Godavari Basin	Godavari/Sabari	17.80	81.39
378	Koperagaon	No metals found	Maharashtra	Ahmednagar	Godavari Basin	Godavari	19.88	74.48
379	Kora	No metals found	Uttar Pradesh	Fatehpur	Ganga Basin	Yamuna/Rindh	26.11	80.38
380	Korba	No metals found	Chhattisgarh	Korba	Mahanadi Basin	Hasdeo	22.39	82.70
381	Korba-1	No metals found	Chhattisgarh	Korba	Mahanadi Basin	Hasdeo	22.34	82.69
382	Kota-By Pass Hanging Road Bridge U/S of Kota City	No metals found	Rajasthan	Kota	Ganga Basin	Ganga/Yamuna/C hambal/Parwati	25.14	75.80
383	Koteshwar	Fe	Uttrakhand	Tehri Garhwal	Ganga Basin	Ganga/Bhagirathi	30.27	78.50

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
384	Kotni	No metals found	Chhattisgarh	Durg	Mahanadi Basin	Seonath	21.24	81.25
385	Krishnabihari/Machaigaon	No metals found	Assam	Sivasagar	Brahmaputra Basin	Dirai	27.07	94.77
386	Krishnai	No metals found	Assam	Golpara	Brahmaputra Basin	Krishnai	26.03	90.67
387	Kudalaiyathur	No metals found	Tamil Nadu	Cuddalore	EFR between Pennar & Cau-very Basin	Vellar	11.42	79.47
388	Kudige	Fe	Karnataka	Kodagu	Cauvery Basin	Cauvery	12.50	75.96
389	Kuldah bridge	No metals found	Madhya Pra-desh	Sidhi	Ganga Basin	Sone	24.41	81.70
390	Kulpatanga	Fe	Jharkhand	Purba Singhbhum	Subarnarekha Basin	Kharkai	22.77	86.16
391	Kulsi	No metals found	Assam	Kamrup (Rural)	Brahmaputra Basin	Kulsi	25.98	91.39
392	Kumarapalayam	No metals found	Puducherry	Puducherry	EFR between Pennar & Cau-very Basin	Varahanadhi	11.98	79.68
393	Kumbidi	No metals found	Kerala	Palakkad	WFR South of Tapi Basin	Bharathapuzha	10.85	76.02
394	Kumhari	No metals found	Madhya Pra-desh	Balaghat	Godavari Basin	Godavari/Pranhita/Wainganga	21.88	80.18
395	Kuniyil	No metals found	Kerala	Malappuram	WFR South of Tapi Basin	Chaliyar	11.24	76.02
396	Kuppelur	Fe	Karnataka	Haveri	Krishna Basin	Krishna/Tungabhadr a/Kumudava-thi	14.50	75.63
397	Kuruabahi/ Ririgaon	No metals found	Assam	Golaghat	Brahmaputra Basin	Dhansiri(S)	26.67	93.69
398	Kurubhata	No metals found	Chhattisgarh	Raigarh	Mahanadi Basin	Mand	21.98	83.21

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
399	Kurundwad	No metals found	Maharashtra	Kolhapur	Krishna Basin	Krishna	16.68	74.60
400	Kusei	Fe	Odisha	Keonjhar	Brahmani & Baitarani Basin	Kushal/Kusei	21.17	86.12
401	Kusumbil	No metals found	Assam	Kokrajhar	Brahmaputra Basin	Tipkai	26.42	90.11
402	Kuthibari	No metals found	West Bengal	North Twenty Four Pargana	Ganga Basin	Padma/ Mathabhanga/Ichamati	23.23	88.71
403	Kuthnaur	As,Pb,Fe,Ni	Uttrakhand	Uttarakashi	Ganga Basin	Ganga/Yamuna	30.87	78.30
404	Kuttyadi	No metals found	Kerala	Kozhikode	WFR South of Tapi Basin	Kuttyadi	11.64	75.78
405	Kuzhithurai	No metals found	Tamil Nadu	Kanyakumari	WFR South of Tapi Basin	Tamarabarani	8.31	77.19
406	Labha	No metals found	Bihar	Katihar	Ganga Basin	Ganga/Fulhar	25.43	87.77
407	Lakhisarai	Fe	Bihar	Lakhisarai	Ganga Basin	Ganga/Kiul	25.18	86.10
408	Lakhoura	As,Pb	Bihar	East Champaran	Ganga Basin	Ganga/Burhi Gandak/Tiyar	26.72	84.97
409	Lakkavalli	Fe	Karnataka	Chikmagalur	Krishna Basin	Krishna/Tungabhadra/Bhadra	13.71	75.64
410	Lakshmananpatti	Ni	Tamil Nadu	Dindugal	Cauvery Basin	Cauvery/Kodagan ar	10.50	77.95
411	Lala	Fe	Assam	Hailakandi	Barak & Other Basin	Katakhal	24.61	92.61
412	Lalganj	No metals found	Bihar	Vaishali	Ganga Basin	Ganga/Gandak	25.83	85.17
413	Lalpur	No metals found	Uttar Pradesh	Kanpur	Ganga Basin	Yamuna/Sengar	26.31	79.92
414	Laven	No metals found	Sikkim	Mangan	Brahmaputra Basin	TalangChu	27.52	88.53
415	Lemeking	Fe	Arunachal Pra-desh	Upper Subansiri	Brahmaputra Basin	Subansiri	28.37	93.56

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
416	Ligribari/ B.G Road	No metals found	Assam	Sivasagar	Brahmaputra Basin	Brahmaputra	27.07	94.53
417	Lingdem HS	No metals found	Sikkim	Mangan District	Brahmaputra Basin	Talang chu/Teesta	27.53	88.47
418	Lodhikheda	No metals found	Madhya Pra-desh	Chhindawara	Godavari Basin	Godavari/Pranhita/Wainganga/Ka nhan/Jam	21.58	78.87
419	Lowara	No metals found	Gujarat	Bhavnagar	WFR of Kutch & Saurashtra in-cluding Luni Basin	Shetrunji	21.44	71.56
420	Lucknow	No metals found	Uttar Pradesh	Lucknow	Ganga Basin	Ganga/Gomti	26.86	80.95
421	Lupungdhi	Fe	Jharkhand	Saraikela kharsawan	Subarnarekha Basin	Subarnarekha	22.79	86.30
422	M H halli	Fe	Karnataka	Hassan	Cauvery Basin	Cauvery/Hemavathi	12.82	76.14
423	Maalpur	No metals found	Madhya Pra-desh	Dindori	Narmada Basin	Narmada	23.06	80.84
424	Madamon	No metals found	Kerala	Pathanamthitta	WFR South of Tapi Basin	Pamba	9.36	76.84
425	Madhira	No metals found	Telangana	Khammam	Krishna Basin	Krishna/Munneru /Wyra	16.92	80.36
426	Madhya Bharat Paper Ltd	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	22.01	82.65
427	Madla	No metals found	Madhya Pra-desh	Panna	Ganga Basin	Yamuna/Ken	24.73	80.01
428	Magaral	No metals found	Tamil Nadu	Kancheepuram	EFR between Pennar & Cau-very Basin	Palar/Cheyyar	12.71	79.75
429	Magardharra	No metals found	Madhya Pra-desh	Balaghat	Godavari Basin	Godavari/Pranhita/Wainganga	21.96	80.11
430	Mahalgaon	No metals found	Maharashtra	Gondia	Godavari Basin	Godavari/Pranhita/Wainganga	21.55	80.03

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
431	Maharo	No metals found	Jharkhand	Dumka	Ganga Basin	Mayurakshi	24.32	87.20
432	Mahidpur	Fe,Ni	Madhya Pra-desh	Ujjain	Ganga Basin	Ganga/Yamuna/C hambal/Shipra	23.48	75.64
433	Mahuwa	No metals found	Gujarat	Surat	WFR South of Tapi Basin	Purna	21.02	73.14
434	Maighat	No metals found	Uttar Pradesh	Jaunpur	Ganga Basin	Gomti	25.64	82.86
435	Maithon dam	No metals found	Jharkhand	Dhanbad	Ganga Basin	Barakar	23.79	86.81
436	Majitar	Fe	Sikkim	Namchi	Brahmaputra Basin	Brahmaputra/Teesta/Rangit	27.11	88.32
437	Malakkara	No metals found	Kerala	Pathanamthitta	WFR South of Tapi Basin	Pamba	9.33	76.66
438	Malibari	No metals found	Assam	Kamrup ®	Brahmaputra Basin	Jaljali	26.08	91.10
439	Malkhed	No metals found	Karnataka	Kalaburagi	Krishna Basin	Krishna/Bhima/Ka gna	17.20	77.16
440	Manas NH Crossing	No metals found	Assam	Bongaigaon	Brahmaputra Basin	Manas	26.46	90.75
441	Mancherial	No metals found	Telangana	Mancherial	Godavari Basin	Godavari	18.83	79.45
442	Mandawara	No metals found	Rajasthan	Kota	Ganga Basin	Ganga/Yamuna/C hambal	25.38	76.15
443	Manderial	Ni	Rajasthan	Karauli	Ganga Basin	Ganga/Yamuna/C hambal	26.28	77.28
444	Mandla	No metals found	Madhya Pra-desh	Mandla	Narmada Basin	Narmada	22.59	80.37
445	Mandleshwar	No metals found	Madhya Pra-desh	Khargone	Narmada Basin	Narmada	22.17	75.66

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
446	Manendragarh	No metals found	Chhattisgarh	Koriya	Mahanadi Basin	Hasdeo	23.20	82.21
447	Mangaon	No metals found	Maharashtra	Raigad	WFR South of Tapi Basin	Savitri/kal	18.23	73.28
448	Manjhi	No metals found	Bihar	Saran	Ganga Basin	Ganga/Ghaghra	25.83	84.58
449	Mankara	No metals found	Kerala	Palakkad	WFR South of Tapi Basin	Bharathapuzha	10.78	76.51
450	Manot	Cd	Madhya Pra-desh	Mandla	Narmada Basin	Narmada	22.74	80.51
451	Mantralayam	As	Andhra Pra-desh	Kurnool	Krishna Basin	Krishna/Tungabhadra	15.95	77.43
452	Manughat	Fe	Tripura	Dhalai	Barak & Other Basin	Manu	23.99	91.99
453	Marella	No metals found	Andhra Pra-desh	Prakasam	Krishna Basin	Gundlakamma	15.92	79.91
454	Margherita	No metals found	Assam	Tinsukia	Brahmaputra Basin	Buridehing	27.28	95.65
455	Marol	Fe,Pb,Ni	Karnataka	Haveri	Krishna Basin	Krishna/Tungabhadra/Varadha	14.94	75.62
456	Mataji	Pb	Madhya Pra-desh	Ratlam	Mahi Basin	Mahi	23.35	74.72
457	Mathabhanga	No metals found	West Bengal	COOCHBEHAR	Brahmaputra Basin	Brahmaputra/Jaldhaka	26.33	89.23
458	Mathanguri	No metals found	Assam	Baksa	Brahmaputra Basin	Beki	26.78	90.96
459	Matigara	Fe	West Bengal	Darjeeling	Ganga Basin	Ganga/Mahanand a/Balason	26.72	88.38
460	Matijuri	Fe	Assam	Hailakandi	Barak & Other Basin	Barak/Katakhal/Dhaleshwari	24.65	92.61
461	Matunga	No metals found	Assam	Baksa (BTAD)	Brahmaputra Basin	Kalanadi	26.79	91.54

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
462	Mawi	Fe,Ni	Uttar Pradesh	Shamli	Ganga Basin	Ganga/Yamuna	29.38	77.15
463	MBPL	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	22.01	82.65
464	Mehandipur	No metals found	Uttar Pradesh	Kannauj	Ganga Basin	Ganga	27.01	79.98
465	Mejaroad	No metals found	Uttar Pradesh	Allahabad	Ganga Basin	Tons	25.24	82.04
466	Mekhliganj	Fe	West Bengal	Coochbehar	Brahmaputra Basin	Brahmaputra/Teesta	26.33	88.86
467	Melli	No metals found	Sikkim	Namchi	Brahmaputra Basin	Teesta	27.09	88.45
468	Menangudi	No metals found	Tamil Nadu	Thiruvarur	Cauvery Basin	Cauvery/Noolar	10.95	79.70
469	Miao	No metals found	Arunachal Pra-desh	Changlang	Brahmaputra Basin	Noa-Dehing	27.49	96.21
470	Mirzapur	No metals found	Uttar Pradesh	Mirzapur	Ganga Basin	Ganga	25.15	82.53
471	Mohana	No metals found	Uttar Pradesh	Jalaun	Ganga Basin	Yamuna/Betwa	25.82	79.46
472	Mohgaon	Pb	Madhya Pra-desh	Mandla	Narmada Basin	Burhner	22.77	80.62
473	Mohna	Fe,Ni	Haryana	Faridabad	Ganga Basin	Ganga/Yamuna	28.22	77.46
474	Moradabad (R)	No metals found	Uttar Pradesh	Moradabad	Ganga Basin	Ganga/Ramganga	28.83	78.80
475	Mortakka	No metals found	Madhya Pra-desh	Khandwa	Narmada Basin	Narmada	22.22	76.04
476	Motinaroli	Hg	Gujarat	Surat	Tapi Basin	Kim	21.40	72.96
477	Mungoli Township	No metals found	Maharashtra	Yavatmal	Godavari Basin	Godavari/Pranhita/Wardha/Penga nga	19.86	79.13

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
478	Munugodu	Fe	Andhra Pra-desh	Palnadu	Krishna Basin	Yedduvagu	16.55	80.21
479	Muradpur	No metals found	Maharashtra	Ratnagiri	WFR South of Tapi Basin	Vashishti	17.54	73.52
480	Murappanadu	No metals found	Tamil Nadu	Tuticorin	EFR South of Cauvery Basin	Tambraparani	8.71	77.84
481	Muri	No metals found	Jharkhand	Ranchi	Subarnarekha Basin	Subarnarekha	23.37	85.58
482	Murti	No metals found	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Jaldhaka/Murti	26.84	88.83
483	Mushal	Fe	Odisha	Keonjhar	Brahmani & Baitarani Basin	Mushal/Mudala	21.33	86.04
484	Musiri	Cd,Ni	Tamil Nadu	Tiruchirapalli	Cauvery Basin	Cauvery	10.94	78.44
485	Muthankera	Fe,Pb	Kerala	Wayanad	Cauvery Basin	Cauvery/Kabini	11.81	76.08
486	Nagothane	Fe	Maharashtra	Raigad	WFR South of Tapi Basin	Amba	18.52	73.16
487	Nagrakata	Fe	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Jaldhaka	26.87	88.90
488	Naharkatia	Fe	Assam	Dibrugarh	Brahmaputra Basin	Buridehing	27.30	95.33
489	Naidupet	No metals found	Andhra Pra-desh	Nellore	EFR between Pennar & Cau-very Basin	Swarnamukhi	13.95	79.90
490	Nallamaranpatty	No metals found	Tamil Nadu	Karur	Cauvery Basin	Cauvery/Amarava thi	10.88	77.98
491	Nallathur	No metals found	Puducherry	Karaikal	Cauvery Basin	Cauvery/Nandalar	11.00	79.75
492	Namsai	No metals found	Arunachal Pra-desh	Namsai	Brahmaputra Basin	Noa-Dehing	27.64	95.85
493	Nanded	No metals found	Maharashtra	Nanded	Godavari Basin	Godavari	19.15	77.34
494	Nandgaon	No metals found	Maharashtra	Wardha	Godavari Basin	Godavari/Pranhita/Wardha/Wunn a	20.53	78.81

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
495	Nandipalli	No metals found	Andhra Pra-desh	Kadapa	Pennar Basin	Pennar/Sagileru	14.72	79.02
496	Nandira	Fe	Odisha	Angual	Brahmani & Baitarani Basin	Brahamani	20.89	85.26
497	Nanglamoraghat	Fe,Ni	Assam	Sivasagar	Brahmaputra Basin	Desang	26.98	94.78
498	Naraj	No metals found	Odisha	Cuttack	Mahanadi Basin	Mahanadi	20.47	85.76
499	Narmadapuram (Hoshanga-bad)	Pb	Madhya Pra-desh	Hoshangabad	Narmada Basin	Narmada	22.76	77.73
500	Nasik	Ni	Maharashtra	Nasik	Godavari Basin	Godavari	20.00	73.80
501	Naugaon	As,Pb,Fe,Ni	Uttrakhand	Uttarakashi	Ganga Basin	Ganga/Yamuna	30.79	78.14
502	Nawapara	No metals found	Chhattisgarh	Raipur	Mahanadi Basin	Mahanadi	20.97	81.87
503	Neamatighat	Pb,Fe,Ni,Cu	Assam	Jorhat	Brahmaputra Basin	Brahmaputra	26.87	94.25
504	Neeleeswaram	No metals found	Kerala	Ernakulam	WFR South of Tapi Basin	Periyar	10.18	76.47
505	Neemsar	No metals found	Uttar Pradesh	Sitapur	Ganga Basin	Ganga/Gomti	27.35	80.48
506	Nellipally	No metals found	Kerala	Kollam	WFR South of Tapi Basin	Kallada	9.03	76.92
507	Nellore	No metals found	Andhra Pra-desh	Nellore	Pennar Basin	Pennar	14.47	79.99
508	Neora	No metals found	West Bengal	Jalpaiguri	Brahmaputra Basin	Brahmaputra/Tees ta/Naora	26.88	88.77
509	Nirmali	Pb	Bihar	Supaul	Ganga Basin	Ganga/Kosi/Bagmat i/Tiljuga	26.30	86.58
510	Noida	Fe,Ni	Uttar Pradesh	Gautam Bhud Nagar	Ganga Basin	Ganga/Yamuna/Hindon	28.60	77.42
511	Nona	No metals found	Assam	Nalbari	Brahmaputra Basin	Nona	26.44	91.56
512	Noukaghat	Fe	West Bengal	Jalpaiguri	Ganga Basin	Mahananda	26.69	88.41

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
513	Nowrangpur	Fe	Odisha	Nabarangpu r	Godavari Basin	Godavari/Indrava ti	19.20	82.51
514	Numaligarh	Fe	Assam	Golghat	Brahmaputra Basin	Dhansiri(S)	26.63	93.73
515	Nutanhat	No metals found	West Bengal	Purba Bardhaman	Ganga Basin	Ajay	23.55	87.91
516	Odandurai	No metals found	Tamil Nadu	Coimbatore	Cauvery Basin	Bhavani/Kallar	11.32	76.89
517	Okhla Barrage D/s of Delhi	Fe	Delhi	South Delhi	Ganga Basin	Ganga/Yamuna	28.55	77.31
518	Orairathmarg	No metals found	Uttar Pradesh	Jalaun	Ganga Basin	Betwa	25.87	79.45
519	P G Bridge	No metals found	Maharashtra	Yavatmal	Godavari Basin	Godavari/Pranhita/Wardha/Penga nga	19.82	78.56
520	Pachawali	No metals found	Madhya Pra-desh	Shivpuri	Ganga Basin	Yamuna/Sind	25.18	77.69
521	Pachegaon	No metals found	Maharashtra	Ahmednagar	Godavari Basin	Godavari/Pravara	19.53	74.83
522	Padampur	No metals found	Odisha	Bargarh	Mahanadi Basin	Ong	21.02	83.10
523	Paderdibadi	No metals found	Rajasthan	Dungarpur	Mahi Basin	Mahi	23.77	74.14
524	Pagladiya N.T. Road Crossing	No metals found	Assam	Nalbari	Brahmaputra Basin	Pagladiya	26.45	91.46
525	Pagoda	No metals found	Arunachal Pra-desh	Namsai	Brahmaputra Basin	Tengpani	27.77	95.98
526	Palakadavu	No metals found	Kerala	Thrissur	WFR South of Tapi Basin	Karuvannur	10.43	76.24
527	Paleru Bridge	No metals found	Andhra Pra-desh	NTR	Krishna Basin	Krishna/Paleru	16.57	80.03

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
528	Pali	No metals found	Rajasthan	Sawai- madhopur	Ganga Basin	Ganga/Yamuna/C hambal	25.85	76.57
529	Paliakalan	No metals found	Uttar Pradesh	Lakhimpur Kheri	Ganga Basin	Ganga/Ghaghra/Sharda	28.38	80.55
530	Palla	Pb,As,Fe,Ni	Delhi	North West Delhi	Ganga Basin	Ganga/Yamuna	28.85	77.21
531	Panbari	No metals found	Assam	Chirang	Brahmaputra Basin	Burisuti	26.59	90.83
532	Pancharatna	Fe	Assam	Goalpara	Brahmaputra Basin	Brahmaputra	26.21	90.55
533	Panchet dam	No metals found	Jharkhand	Dhanbad	Ganga Basin	Damodar	23.68	86.75
534	Pandu	No metals found	Assam	Kamrup	Brahmaputra Basin	Brahmaputra	26.18	91.67
535	Pangin	No metals found	Arunachal Pra-desh	Siang	Brahmaputra Basin	Siang	28.23	95.00
536	Panihati Ferry Ghat	No metals found	West Bengal	Uttar24Parganas	Ganga Basin	Hooghly	22.69	88.40
537	Panposh	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Brahamani	22.24	84.80
538	Panposh-I	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Sankh	22.25	84.79
539	Panposh-II	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Koel	22.25	84.80
540	Paonta	No metals found	Himachal Pra-desh	Sirmaur	Ganga Basin	Ganga/Yamuna	30.43	77.62
541	Papan	No metals found	Madhya Pra-desh	Harda	Narmada Basin	Ganjal	22.56	77.21
542	Paramakudi	Cu	Tamil Nadu	Ramanathapura m	EFR South of Cauvery Basin	Vaigai	9.55	78.59
543	Pargaon	No metals found	Maharashtra	Pune	Krishna Basin	Bhima	18.56	74.38
544	Parmanpur	No metals found	Odisha	Jharsuguda	Mahanadi Basin	Bheden	21.77	84.08

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
545	Parmarthghat	As,Fe	Uttar Pradesh	Kanpur	Ganga Basin	Ganga	26.49	80.34
546	Parshuramkund	Ni	Arunachal Pradesh	Lohit	Brahmaputra Basin	Lohit	27.88	96.36
547	Parsohanghat	No metals found	Uttar Pradesh	Siddharthnagar	Ganga Basin	Ganga/Ghaghra/Rapti/Burhi Rapti	27.40	82.56
548	Pasighat	Cr,Ni	Arunachal Pradesh	East Siang	Brahmaputra Basin	Siang	28.07	95.33
549	Patacharkuchi	No metals found	Assam	Barpeta	Brahmaputra Basin	Kalodiya	26.51	91.24
550	Patala	No metals found	Maharashtra	Chandrapur	Godavari Basin	Godavari/Pranhita/Wardha	20.13	79.00
551	Patan	Fe	Madhya Pradesh	Jabalpur	Narmada Basin	Hiran	23.31	79.66
552	Patansaongi	No metals found	Maharashtra	Nagpur	Godavari Basin	Godavari/Pranhita/Wainganga/Kanhan/Chandrabhaga	21.32	79.02
553	Pathagudem	Fe	Chhattisgarh	Bijapur	Godavari Basin	Godavari/Indrava ti	18.82	80.35
554	Pathardih	No metals found	Chhattisgarh	Raipur	Mahanadi Basin	Mahanadi/Seonath/Kharun	21.34	81.59
555	Patharkandi	Fe	Assam	Karimganj	Barak & Other Basin	Longai	24.58	92.31
556	Pattazhy	No metals found	Kerala	Kollam	WFR South of Tapi Basin	Kallada	9.07	76.76
557	Pauni	No metals found	Maharashtra	Bhandara	Godavari Basin	Godavari/Pranhita/Wainganga	20.80	79.65
558	Perumannu	No metals found	Kerala	Kannur	WFR South of Tapi Basin	Valapattanam	11.98	75.58
559	Perur	No metals found	Telangana	Mulugu	Godavari Basin	Godavari	18.53	80.38

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
560	Phulgaon	No metals found	Maharashtra	Pune	Krishna Basin	Bhima	18.66	74.00
561	Phurtshachu HS	No metals found	Sikkim	Gyalsingh District	Brahmaputra Basin	Rangit/Teesta	27.25	88.30
562	PIL	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	21.99	82.67
563	Pingalwada	Hg	Gujarat	Vadodara	Mahi Basin	Dhadar	22.11	73.08
564	Pohumara	No metals found	Assam	Barpeta	Brahmaputra Basin	Pohumara	26.48	91.11
565	Polaguri/kurua	No metals found	Assam	Morigaon	Brahmaputra Basin	Brahmaputra	26.43	92.31
566	Polavaram	No metals found	Andhra Pra-desh	Eluru	Godavari Basin	Godavari	17.25	81.65
567	Porakudi	No metals found	Tamil Nadu	Nagapattinam	Cauvery Basin	Cauvery/Arasalar	10.90	79.71
568	Prakash Industries Ltd	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Hasdeo	21.99	82.67
569	Pratapgarh	No metals found	Uttar Pradesh	Pratapgarh	Ganga Basin	Sai	25.93	82.00
570	Pratappur(Godavari)	No metals found	Maharashtra	Ahmednagar	Godavari Basin	Godavari	19.52	74.40
571	Pratappur(Yamuna)	No metals found	Uttar Pradesh	Prayagraj	Ganga Basin	Yamuna	25.30	81.57
572	Premnagar	No metals found	Jammu & Kash-mir	Jammu	Indus Basin	Chenab/Manawar Tawi	32.92	74.42
573	Pudur	No metals found	Kerala	Palakkad	WFR South of Tapi Basin	Bharathapuzha/ Kannadipuzha	10.78	76.58
574	Pulamanthole	No metals found	Kerala	Palakkad	WFR South of Tapi Basin	Bharathapuzha/ Pulanthodu	10.90	76.19

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
575	Pulikukku	No metals found	Karnataka	Dakshina Kannada	WFR South of Tapi Basin	Netravathi/Kum aradhara	12.71	75.47
576	Pupunki	No metals found	Jharkhand	Hazaribagh	Ganga Basin	Damodar	23.70	85.17
577	Purashottampur	No metals found	Odisha	Ganjam	EFR between Mahanadi & Go-davari Basin	Rushikulya	19.52	84.88
578	Purna	No metals found	Maharashtra	Parbhani	Godavari Basin	Godavari/Purna	19.18	77.01
579	Purunagarh	Fe	Odisha	Deogarh	Brahmani & Baitarani Basin	Brahamani	21.53	84.71
580	Puthimari NH Road Crossing	No metals found	Assam	Kamrup	Brahmaputra Basin	Puthimari	26.37	91.65
581	R.S.P	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Brahamani	22.21	84.83
582	R.S.P-I	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Brahamani	22.20	84.83
583	R.S.P-II	Fe	Odisha	Sundergarh	Brahmani & Baitarani Basin	Brahamani	22.20	84.83
584	Raebareli	No metals found	Uttar Pradesh	Raebareli	Ganga Basin	Ganga/Gomti/Sai	26.20	81.25
585	Rahu	No metals found	Maharashtra	Pune	Krishna Basin	Mulamutha	18.57	74.27
586	Rajahmundry	No metals found	Andhra Pra-desh	EastGodavari	Godavari Basin	Godavari	17.01	81.76
587	Rajapur	No metals found	Uttar Pradesh	Chitrakoot	Ganga Basin	Yamuna	25.39	81.15
588	Rajegaon	No metals found	Madhya Pra-desh	Balaghat	Godavari Basin	Godavari/Pranhita/Wainganga/Ba gh	21.62	80.25
590	Rajghat (Betwa)	No metals found	Uttar Pradesh	Lalitpur	Ganga Basin	Betwa	24.77	78.24
589	Rajghat(Subarnarekha)	Fe	Odisha	Mayurbhanj	Subarnarekha Basin	Subarnarekha	21.76	87.16

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
591	Rajim	No metals found	Chhattisgarh	Gariaband	Mahanadi Basin	Mahanadi	20.98	81.88
592	Ram Munshi Bagh	No metals found	Jammu & Kash-mir	Srinagar	Indus Basin	Jhelum	34.07	74.84
593	Ramakona	No metals found	Madhya Pra-desh	Chhindawara	Godavari Basin	Godavari/Pranhita/Wainganga/Kanhan	21.72	78.82
594	Ramamangalam	No metals found	Kerala	Ernakulam	WFR South of Tapi Basin	Muvattupuzha	9.94	76.48
595	Ramdia	No metals found	Assam	Kamrup	Brahmaputra Basin	Barsali	26.27	91.52
596	Ramgarh	No metals found	Jharkhand	Ramgarh	Ganga Basin	Damodar	23.64	85.51
597	Rampur	No metals found	Chhattisgarh	Baloda Bazar	Mahanadi Basin	Jonk	21.65	82.52
598	Ranganadi NT Road Crossing	Pb,Fe,Ni	Assam	Lakhimpur	Brahmaputra Basin	Ranganadi	27.20	94.06
599	Rangapahar Siding/ Bokajan	No metals found	Assam	Karbi Anglong	Brahmaputra Basin	Dhansiri(S)	25.83	93.66
600	Rangeli	As	Rajasthan	Dungarpur	Mahi Basin	Som	23.87	74.22
601	Rangit Nagar	No metals found	Sikkim	Namchi	Brahmaputra Basin	Teesta/Rangit	27.30	88.31
602	Rangma Range	Fe	Sikkim	Mangan	Brahmaputra Basin	LachenChu	27.63	88.62
603	Rangpo	No metals found	West Bengal	Kalimpong	Brahmaputra Basin	Brahmaputra/Tees ta/Rangpochu	27.17	88.53
604	Rangpo Check Post	Fe,Ni	Sikkim	Pakyong	Brahmaputra Basin	Teesta/RangpoCh u	27.17	88.53
605	Ranipool	Fe	Sikkim	Gangtok	Brahmaputra Basin	Teesta/RaniKhola	27.28	88.59
606	Ranmarange	No metals found	Sikkim	Mangan	Brahmaputra Basin	LachenChu	27.63	88.62

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
607	Regauli	No metals found	Uttar Pradesh	Gorakhpur	Ganga Basin	Ganga/Ghaghra/Rapti	27.02	83.21
608	Rishikesh	No metals found	Uttrakhand	Dehradun	Ganga Basin	Ganga	30.10	78.30
609	Rishikesh D/S	Fe	Uttrakhand	Rishikesh	Ganga Basin	Ganga	30.08	78.29
610	Rishikesh U/S	No metals found	Uttrakhand	Rishikesh	Ganga Basin	Ganga	30.13	78.33
611	Roing	No metals found	Arunachal Pra-desh	Lower Dibang Valley	Brahmaputra Basin	Deopani	28.16	95.85
612	Roorkee D/S	No metals found	Uttrakhand	Haridwar	Ganga Basin	Ganga/Banganga/Solani	29.88	77.90
613	Roorkee U/S	No metals found	Uttrakhand	Haridwar	Ganga Basin	Ganga/Banganga/Solani	29.89	77.89
614	Rothak	Fe	Sikkim	Namchi	Brahmaputra Basin	Teesta/Rangit	27.17	88.30
615	Rudraprayag (A)	Fe	Uttrakhand	Rudraprayag	Ganga Basin	Ganga/Alaknanda	30.29	78.98
616	Safapora	No metals found	Jammu & Kash-mir	Baramula	Indus Basin	Jhelum	34.25	74.63
617	Sagbari	No metals found	Sikkim	Gyalsingh District	Brahmaputra Basin	Teesta/Rangit	27.25	88.31
618	Sahijana	No metals found	Uttar Pradesh	Hamirpur	Ganga Basin	Yamuna/Betwa	25.94	80.15
619	Saidpur	No metals found	Uttar Pradesh	Ghazipur	Ganga Basin	Ganga	25.53	83.22
620	Saigaon	No metals found	Karnataka	Bidar	Godavari Basin	Godavari/Manjira	18.08	77.05
621	Sakaleshpura	Fe,Pb	Karnataka	Hassan	Cauvery Basin	Cauvery/Hemavathi	12.94	75.79
622	Sakhra (Wadsa)	No metals found	Maharashtra	Gadchiroli	Godavari Basin	Godavari/Pranhita/Wainganga	20.62	79.94

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
623	Sakmur	No metals found	Maharashtra	Chandrapur	Godavari Basin	Godavari/Pranhita/Wardha	19.56	79.61
624	Sakra	As,Pb	Bihar	Muzaffarpur	Ganga Basin	Ganga/BurhiGandak	26.04	85.56
625	Salebardi	No metals found	Maharashtra	Bhandara	Godavari Basin	Godavari/Pranhita/Wainganga/Chulband	20.91	79.93
626	Salebhata	No metals found	Odisha	Balangir	Mahanadi Basin	Ong	20.98	83.54
627	Saloora	No metals found	Telangana	Nizamabad	Godavari Basin	Godavari/Manjira	18.71	77.80
628	Samdoli	Fe,Hg	Maharashtra	Sangli	Krishna Basin	Varna	16.86	74.50
629	Sandia	No metals found	Madhya Pra-desh	Hoshangabad	Narmada Basin	Narmada	22.92	78.35
631	Sangam(Godavari)	No metals found	Telangana	Bhadradri Ko-thagudem	Godavari Basin	Godavari/Kinnera sani	17.60	80.83
630	Sangam(Jhelum)	No metals found	Jammu & Kash-mir	Anantnag	Indus Basin	Jhelum	33.83	75.07
632	Sangod	No metals found	Rajasthan	Kota	Ganga Basin	Ganga/Yamuna/C hambal/ Kalis-indh/Parwan	24.96	76.30
633	Sankalang	Fe	Sikkim	Mangan	Brahmaputra Basin	Teesta	27.52	88.53
634	Sankosh LRP	Fe	West Bengal	Alipurduar	Brahmaputra Basin	Brahmaputra/Sankosh	26.46	89.86
635	Santheguli	No metals found	Karnataka	Uttara Kannada	WFR South of Tapi Basin	Aghanashini	14.43	74.59
636	Saradaput	Fe	Odisha	Malkangiri	Godavari Basin	Godavari/Sabari	18.61	82.14
637	Sarangkheda	No metals found	Maharashtra	Nandurbar	Tapi Basin	Tapi	21.43	74.53
638	Sarangpal	No metals found	Chhattisgarh	Kanker	Mahanadi Basin	Mahanadi	20.31	81.53

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
639	Sarati	No metals found	Maharashtra	Pune	Krishna Basin	Nira	17.91	75.01
640	Satna	No metals found	Madhya Pra-desh	Satna	Ganga Basin	Tons	24.57	80.91
641	Satpokholi	No metals found	Assam	Kamrup	Brahmaputra Basin	Koa	26.07	91.46
642	Satpuli D/S	No metals found	Uttrakhand	Pauri Garhwal	Ganga Basin	Ganga/Nayar	29.94	78.70
643	Satpuli U/S	No metals found	Uttrakhand	Pauri Garhwal	Ganga Basin	Ganga/Nayar	29.92	78.71
644	Satrapur	No metals found	Maharashtra	Nagpur	Godavari Basin	Godavari/Pranhita/Wainganga/Ka nhan	21.22	79.23
645	Satrapur kanhan Town	No metals found	Maharashtra	Nagpur	Godavari Basin	Godavari/Pranhita/Wainganga/Ka nhan	21.23	79.23
646	Satrapur U/S	No metals found	Maharashtra	Nagpur	Godavari Basin	Godavari/Pranhita/Wainganga/Ka nhan	21.23	79.23
647	Savandapur	Fe,Cu,Ni	Tamil Nadu	Erode	Cauvery Basin	Cauvery/Bhavani	11.52	77.51
648	Seohara	No metals found	Uttar Pradesh	Bijnaur	Ganga Basin	Ganga/Ramganga	29.24	78.66
649	Seondha	No metals found	Madhya Pra-desh	Datia	Ganga Basin	Yamuna/Sind	26.17	78.80
650	Seorinarayan	No metals found	Chhattisgarh	Janjgir-Champa	Mahanadi Basin	Mahanadi	21.72	82.60
651	Seppa	No metals found	Arunachal Pra-desh	East Kameng	Brahmaputra Basin	Kameng	27.36	93.05
652	Sevanur	No metals found	Tamil Nadu	Erode	Cauvery Basin	Cauvery/Chittar	11.55	77.73
653	Sevoke	Fe	West Bengal	Darjeeling	Brahmaputra Basin	Brahmaputra/Teesta	26.88	88.47

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
654	Shahjahanpur	No metals found	Uttar Pradesh	Shahjahanpur	Ganga Basin	Ganga/Deoha(Garra)/Khannaut	27.84	79.91
655	Shahzadpur	No metals found	Uttar Pradesh	Kaushambi	Ganga Basin	Ganga	25.67	81.42
656	Shaladang	No metals found	West Bengal	Coochbehar	Brahmaputra Basin	Brahmaputra/Torsa/Kaljani	26.30	89.59
657	Shastri Bridge	No metals found	Uttar Pradesh	Allahabad	Ganga Basin	Ganga	25.44	81.89
658	Shimoga	Fe	Karnataka	Shimoga	Krishna Basin	Krishna/Tungabhadra/Tunga	13.93	75.59
659	Sholmari	No metals found	Assam	Nalbari	Brahmaputra Basin	Chahaulkoa	26.31	91.34
660	Sibbari	No metals found	Meghalaya	South Garo Hills	Barak & Other Basin	Meghna/Dareng	25.19	90.50
661	Sikandarpur	As,Pb	Bihar	Muzaffarpur	Ganga Basin	Ganga/BurhiGandak	26.14	85.38
662	Silghat	No metals found	Assam	Nagaon	Brahmaputra Basin	Brahmaputra	26.62	92.94
663	Simga	No metals found	Chhattisgarh	Baloda Bazar	Mahanadi Basin	Seonath	21.63	81.69
664	Simultalia	No metals found	Assam	Morigaon	Brahmaputra Basin	Pokoriya	26.24	92.12
665	Singasadanapalli	Pb,Cd,Fe,Cu	Tamil Nadu	Krishnagiri	EFR South of Cauvery Basin	Ponnaiyar	12.87	77.84
666	Singavaram	No metals found	Andhra Pra-desh	Anantapur	Pennar Basin	Pennar/Chitravathi	14.60	78.01
667	Singimari	No metals found	West Bengal	Coochbehar	Brahmaputra Basin	Brahmaputra/Jaldhaka	26.11	89.35
668	Singtam	Fe	Sikkim	Pakyong	Brahmaputra Basin	Teesta/RaniKhola	27.23	88.50
669	Singtam(Adarsh Gaon)	No metals found	Sikkim	Namchi	Brahmaputra Basin	Teesta	27.23	88.49

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Latitude	Longitude
670	Sitapur	As	Uttar Pradesh	Sitapur	Ganga Basin	Ganga/Gomti/Sarayan	27.57	80.69
671	Sivasagar	As,Pb,Ni	Assam	Sivasagar	Brahmaputra Basin	Dikhow	26.98	94.58
672	Sonamura	Fe	Tripura	Sepahijala	Barak & Other Basin	Meghna/Gumti	23.47	91.26
673	Sonapur(Digaru)	No metals found	Assam	Kamrup (Rural)	Brahmaputra Basin	Digaru	26.12	91.98
674	Sonapur(Mahananda)	Fe	West Bengal	North Dinajpur	Ganga Basin	Ganga/Mahanand a	26.45	88.24
675	Sorada	No metals found	Odisha	Ganjam	EFR between Mahanadi & Godavari Basin	Rushikulya	19.76	84.45
676	South Salmara	No metals found	Assam	South Salmara Mankachar	Brahmaputra Basin	Brahmaputra	25.89	90.02
677	Srikakulam	No metals found	Andhra Pradesh	Srikakulam	EFR between Mahanadi & Godavari Basin	Nagavali	18.31	83.88
678	Srinagar	As,Fe	Uttrakhand	Pauri Garhwal	Ganga Basin	Ganga/Alaknanda	30.23	78.79
679	Sripalpur	Pb	Bihar	Patna	Ganga Basin	Ganga/Sripalpur	25.50	85.12
680	Suddakallu	No metals found	Telangana	Mahaboob Nagar	Krishna Basin	Dindi	16.57	78.42
681	Suklai	No metals found	Assam	Baksa (BTAD)	Brahmaputra Basin	Suklai	26.65	91.71
682	Suldaguri (Deocharai)	No metals found	West Bengal	Coochbehar	Brahmaputra Basin	Brahmaputra/Torsa	26.25	89.62
683	Sullurpet	No metals found	Andhra Pradesh	Nellore	EFR between Pennar & Cauvery Basin	Kalingi	13.71	80.01
684	Sultanpur	No metals found	Uttar Pradesh	Sultanpur	Ganga Basin	Gomti	26.28	82.07
685	Sundargarh	No metals found	Odisha	Sundargarh	Mahanadi Basin	Ib	22.12	84.01
686	Sundargarh(Town)	No metals found	Odisha	Sundargarh	Mahanadi Basin	Ib	22.13	84.02

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
687	Swampatana	Fe	Odisha	Keonjhar	Brahmani & Baitarani Basin	Baitarani	21.64	85.90
688	T Bekuppe	Pb,Cu	Karnataka	Ramanagara	Cauvery Basin	Cauvery/Arkavathi	12.51	77.43
689	T K Halli	Fe	Karnataka	Mandya	Cauvery Basin	Cauvery/Shimsha	12.41	77.19
690	T. Narasipur	Fe	Karnataka	Mysore	Cauvery Basin	Cauvery/Kabini	12.23	76.89
691	T. Ramapuram	Hg	Karnataka	Bellary	Krishna Basin	Krishna/Tungabha dra/Hagari	15.66	76.96
692	Tadipatri	No metals found	Andhra Pra-desh	Anantapur	Pennar Basin	Pennar	14.92	78.02
693	Takli	No metals found	Maharashtra	Solapur	Krishna Basin	Krishna/Bhima	17.42	75.85
694	Tal	Fe,Ni	Madhya Pra-desh	Ratlam	Ganga Basin	Ganga/Yamuna/C hambal	23.72	75.34
695	Talcher	Fe	Odisha	Angual	Brahmani & Baitarani Basin	Brahamani	20.92	85.24
696	Tanda D/S	No metals found	Uttar Pradesh	Ambedkar Nagar	Ganga Basin	Ganga/Ghaghra	26.55	82.70
697	Tanda U/S	No metals found	Uttar Pradesh	Basti	Ganga Basin	Ganga/Ghaghra	26.61	82.64
698	Tandi	No metals found	Himachal Pra-desh	Lahaul and Spiti	Indus Basin	Chenab/ Bhaga	32.55	76.98
699	Tarabari/Gumaphoolbari	No metals found	Assam	Barpeta	Brahmaputra Basin	Brahmaputra	26.22	91.11
700	Tarinipur	No metals found	West Bengal	North Twenty Four Pargana	Ganga Basin	Padma/ Mathabhanga/Ichamati	22.89	88.88
701	Terwad	No metals found	Maharashtra	Kolhapur	Krishna Basin	Panchaganga	16.68	74.58
702	Tezpur	No metals found	Assam	Sonitpur	Brahmaputra Basin	Brahmaputra	26.62	92.80
703	Tezu	No metals found	Arunachal Pra-desh	Lohit	Brahmaputra Basin	Lohit	27.91	96.17

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati- tude	Lon- gi- tude
704	Thandalaiputhur	No metals found	Tamil Nadu	Thiruchirapalli	Cauvery Basin	Cauvery/Ayyar	10.99	78.51
705	Thengudi	No metals found	Tamil Nadu	Thiruvarur	Cauvery Basin	Cauvery/Thirumalairajanar	10.92	79.64
706	Thengumarahada	Fe	Tamil Nadu	Nilgiris	Cauvery Basin	Cauvery/Bhavani/ Moyar	11.57	76.92
707	Theni	Fe	Tamil Nadu	Theni	EFR South of Cauvery Basin	Vaigai/Suruliar	10.00	77.49
708	Therriaghat	No metals found	Meghalaya	East Khasi hills	Barak & Other Basin	Umsohrynkiew	25.18	91.76
709	Thevur	No metals found	Tamil Nadu	Salem	Cauvery Basin	Cauvery/Saraben ga	11.53	77.75
710	Thimmanahalli	Fe	Karnataka	Hassan	Cauvery Basin	Cauvery/Hemavathi /Yagachi	12.99	76.04
711	Thoppur	No metals found	Tamil Nadu	Salem	Cauvery Basin	Cauvery/Thoppai yar	11.94	78.06
712	Thottathinkadavu	No metals found	Kerala	Kozhikode	WFR South of Tapi Basin	Iruvazhinjipuzh a	11.36	76.00
713	Thumpamon	No metals found	Kerala	Pathanamthitta	WFR South of Tapi Basin	Pampa/Achank ovil	9.23	76.71
714	Tiharkheda	No metals found	Uttar Pradesh	Bareilly	Ganga Basin	Ganga/Ramganga	28.42	79.29
715	Tikarpada	Fe	Odisha	Angul	Mahanadi Basin	Mahanadi	20.59	84.78
716	Tilga	Fe	Jharkhand	Simdega	Brahmani & Baitarani Basin	Sankh	22.62	84.42
717	Tilpara Mihirlal Barrage	No metals found	West Bengal	Birbhum	Ganga Basin	Mayurakshi	23.95	87.53
718	Todarpur	As	Uttar Pradesh	Hardoi	Ganga Basin	Ganga/Deoha(Garra)/Sukheta	27.58	80.00
719	Tonk	Fe,Ni	Rajasthan	Tonk	Ganga Basin	Ganga/Yamuna/C hambal/Banas	26.20	75.84
720	Toyum	No metals found	Sikkim	Gyalsingh	Brahmaputra Basin	Teesta/Rangit/Kal ezKhola	27.27	88.24

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
721	Triveni	Pb	Bihar	West Champaran	Ganga Basin	Ganga/Gandak	27.44	83.91
722	Tufanganj	Ni	West Bengal	Coochbehar	Brahmaputra Basin	Brahmaputra/Tors a/Raidak-I	26.31	89.68
723	Tuini (Pabar)	Fe	Uttrakhand	Dehradun	Ganga Basin	Ganga/Yamuna/Tons/Pabar	30.95	77.85
724	Tuini (Tons)	Fe	Uttrakhand	Dehradun	Ganga Basin	Ganga/Yamuna/Tons	30.94	77.85
725	Tulargram	Fe	Assam	Cachar	Barak & Other Basin	Sonai	24.72	92.89
726	Turtipar	No metals found	Uttar Pradesh	Ballia	Ganga Basin	Ganga/Ghaghra	26.14	83.87
727	Tuting	No metals found	Arunachal Pradesh	Upper Siang	Brahmaputra Basin	Siang	28.98	94.90
728	U/S Dindori	No metals found	Madhya Pradesh	Jabalpur	Narmada Basin	Narmada	22.95	81.10
729	U/S Jabalpur	No metals found	Madhya Pradesh	Jabalpur	Narmada Basin	Narmada	23.10	79.94
730	U/S Mandla Rangrejghat	No metals found	Madhya Pradesh	Jabalpur	Narmada Basin	Narmada	22.59	80.37
731	U/S Mandleshwar	No metals found	Madhya Pradesh	Khargone	Narmada Basin	Narmada	22.16	75.68
732	U/S Narmadapuram	No metals found	Madhya Pradesh	Narmadapuram	Narmada Basin	Narmada	22.77	77.76
734	Udaipur (Tirap)	No metals found	Assam	Tinsukia	Brahmaputra Basin	Tirap	27.34	95.85
733	Udaipur(Chandra)	No metals found	Himachal Pradesh	Lahaul and Spiti	Indus Basin	Chenab/ Chandra	32.72	76.66
735	Udharbond	Fe	Assam	Cachar	Barak & Other Basin	Madhura	24.90	92.91
736	Udi	No metals found	Uttar Pradesh	Etawah	Ganga Basin	Yamuna/Chambal	26.70	78.94
737	Ujjain	Fe,Ni	Madhya Pradesh	Ujjain	Ganga Basin	Ganga/Yamuna/C hambal/Shipra	23.18	75.76

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Lati-tude	Lon-gi-tude
738	Umkhen-II	Fe	Meghalaya	East Khasi hills	Barak & Other Basin	Umkhen/Brahmaputra	25.59	92.06
739	Umsiang	No metals found	Meghalaya	Ri- Bhoi	Barak & Other Basin	Umsiang/ Brahmaputra	26.07	92.17
740	Upper Rimbi	Fe	Sikkim	Gyalsingh	Brahmaputra Basin	Teesta/Rangit/Rathang Chu/Rimbi Khola	27.33	88.15
741	Urachikottai	No metals found	Tamil Nadu	Erode	Cauvery Basin	Cauvery	11.48	77.70
742	Uttarkashi	Fe	Uttrakhand	Uttarkashi	Ganga Basin	Ganga/Bhagirathi	30.73	78.45
743	V.S. Bridge	No metals found	Uttar Pradesh	Varanasi	Ganga Basin	Ganga	25.26	83.03
744	Valigonda	No metals found	Telangana	Yadadri Bhuvanagiri	Krishna Basin	Musi	17.37	79.03
745	Vandiperiyar	No metals found	Kerala	Idukki	WFR South of Tapi Basin	Periyar	9.57	77.09
746	Vapi	No metals found	Gujarat	Valsad	WFR south of Tapi Basin	Vapi	20.34	72.90
747	Varanasi	No metals found	Uttar Pradesh	Varanasi	Ganga Basin	Ganga	25.33	83.04
748	Varanavasi	Fe,Ni	Tamil Nadu	Ariyalur	Cauvery Basin	Cauvery/Marudai yar	11.09	79.09
749	Vautha	Cu	Gujarat	Kheda	Sabarmati Basin	Sabarmati	22.65	72.54
750	Vazhavachanur	No metals found	Tamil Nadu	Thiruvannamalai	EFR between Pennar & Cau-very Basin	Ponnaiyar	12.07	78.98
751	Verupakshapuram	No metals found	Andhra Pra-desh	Chittoor	EFR between Pennar & Cau-very Basin	Swarnamukhi	13.79	79.70
752	Vijayawada	Fe	Andhra Pra-desh	NTR	Krishna Basin	Krishna	16.30	80.37
753	Villupuram	No metals found	Tamil Nadu	Villupuram	EFR between Pennar & Cau-very Basin	Ponnaiyar	11.87	79.46

Sl. No.	Site	Metals found above limit	State/UT	District	Basin	River / Tributary	Latitude	Longitude
754	Vrindavan- Yamuna Expressway Link Road Bridge U/S of Mathura	As,Pb,Fe,Ni	Uttar Pradesh	Mathura	Ganga Basin	Ganga/Yamuna	27.57	77.71
755	Wadakbal	No metals found	Maharashtra	Solapur	Krishna Basin	Sina	17.53	75.89
756	Wadenaplly	Cu	Telangana	Suryapet	Krishna Basin	Krishna	16.79	80.07
757	Wairagarh	No metals found	Maharashtra	Gadchiroli	Godavari Basin	Godavari/Pranhita/pip/Khobragarhi	20.42	80.09
758	Warunji	No metals found	Maharashtra	Satara	Krishna Basin	Koyna	17.27	74.17
759	Watrak Nr.Vautha	No metals found	Gujarat	Kheda	Sabarmati Basin	Sabarmati/Watrak	23.32	73.41
760	Yadgir	No metals found	Karnataka	Yadgir	Krishna Basin	Krishna/Bhima	16.74	77.13
761	Yamuna Highway Road Bridge	No metals found	Uttar Pradesh	Agra	Ganga Basin	Yamuna	27.18	78.12
762	Yashwant Nagar	Fe	Himachal Pradesh	Sirmaur	Ganga Basin	Ganga/Yamuna/Giri	30.88	77.21
763	Yazali	Fe,Cu	Arunachal Pradesh	Lower Subansiri	Brahmaputra Basin	Ranganadi	27.38	93.76
764	Yelli	As,Fe	Maharashtra	Nanded	Godavari Basin	Godavari	19.04	77.45
765	Yennehole	No metals found	Karnataka	Udupi	WFR South of Tapi Basin	Swarna	13.29	74.98
766	Yingkiong	No metals found	Arunachal Pradesh	Upper Siang	Brahmaputra Basin	Siang	28.66	95.01
767	Yuksum	Fe	Sikkim	Gyalsingh	Brahmaputra Basin	Teesta/Rangit/Rathang Chu	27.37	88.21

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