STATE ENVIRONMENT PLAN

2024

WEST BENGAL

Department of Environment, Government of West Bengal

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Contents

A. Executive Summary

The State Environment Plan (SEP) 2024 for West Bengal, formulated by the Department of Environment, Government of West Bengal (GoWB) in collaboration with its Knowledge Partner, the Centre for Science and Environment (CSE), provides a comprehensive framework for environmental governance. It aligns with the National Green Tribunal (NGT) order dated 17.01.2023 (OA 360/2018) and follows the guidelines of the Central Pollution Control Board (CPCB). The plan consolidates district-level data from all 23 districts and multiple state departments, focusing on sustainable environmental management and policy execution.

Key Environmental Themes & Action Areas

1. **Waste Management**
   - Strengthening solid, plastic, e-waste, bio-medical, hazardous, and C&D waste management through improved collection, treatment, disposal, and regulatory compliance.
   - Emphasizing legacy waste remediation and promoting recycling initiatives.
2. **Water Quality Management**
   - Reducing river pollution (Ganga, Hooghly) and enhancing groundwater conservation through monitoring, contamination control, and rainwater harvesting.
3. **Wastewater Management**
   - Expanding sewage treatment capacity and enforcing stricter regulations on industrial effluent discharge.
4. **Air & Noise Pollution Control**
   - Implementing emission reduction measures for vehicles, industries, and open burning under GRAP.
   - Enhancing real-time noise monitoring, especially in urban and industrial areas.
5. **Mining & Land Use Regulation**
   - Ensuring environmental compliance in mining activities and using geospatial tools to curb illegal mining.

Implementation & Monitoring:

The District Level Committee, established under Notification No. EN/612/T-VIII-4/002/2019(Part-I), Kolkata, dated 08/04/2022, is responsible for implementing and monitoring the District Environment Plan (DEP). The committee conducts monthly review meetings and updates the progress status on the respective district websites by 31st January each year. Based on these updates, the State Environment Plan (SEP) is revised and finalized by 28th February annually.

Conclusion:

The State Environment Plan 2024 provides a structured roadmap for addressing key environmental challenges in West Bengal. It emphasizes sustainable development, inter-agency coordination and data-driven policy execution to improve air, water and waste management.

1 Introduction

Hon'ble National Green Tribunal, Principal Bench, New Delhi issued direction in OA No 710/2017 Shailesh Singh vs. Sheela Hospital & Trauma Centre and Shahjahanpur and ors. On dt. 15/07/2019 and in OA No 360/2018 Shreenath Sharma vs. Union of India & ors. on dt. 26/09/2019 to prepare District Environmental Plan. The order passed by Hon'ble NGT are as follows:

1. *Shailesh Singh vs. Sheela Hospital & Trauma Centre:*

In the matter of NGT order dated 15.07.2019 in case no. OA 710/2017, the Tribunal held that 'We find it necessary to add that in view of Constitutional provisions under Articles 243 G, 243 W, 243 ZD read with Schedules 11 and 12 and Rule 15 of the Solid Waste Management Rules, 2016, it is necessary to have a District Environment Plan to be operated by a District Committee (as a part of District Planning Committee under Article 243 ZD) with representatives from Panchayats, Local Bodies, Regional Officers, State PCB and a suitable officer representing the administration, which may in turn be chaired and monitored by the District Magistrate. Such District Environment Plans and Constitution of District Committee may be placed on the website of Districts concerned. The monthly report of monitoring by the District Magistrate may be furnished to the Chief Secretary and may be placed on the website of the district and kept on such websites for a period of one year. This may be made operative from 1.08.2019. Compliance of this direction may also be seen by the Chief Secretaries of the States/UTs. This may not only comply with mandate of law but provide an institutional mechanism for effective monitoring of environment norms.

2. *Shreenath Sharma vs. Union of India & ors:*

In accordance with the Hon'ble National Green Tribunal's directive in the matter OA No. 360/2018 (Shreenath Sharma v/s Union of India & others) Order dated: 26.09.2021, all 23 districts of the state have prepared and uploaded their District Environment Plans (DEPs) on their respective District Websites. Based on the DEPs, State Environment Plans (SEPs) was prepared and published on the state website. The status report was subsequently submitted to The Hon'ble NGT.

As per the final order dated: 17.01.2023, in the matter, DEPs and SEPs are to be updated annually (every year). The update should include gap identification, action plans and clear timelines under seven thematic areas. Seven Thematic areas are as follows:

1. Waste Management Plan
    a. Municipal Solid Waste Management
    b. Plastic Waste Management
    c. C&D Waste Management
    d. Hazardous Waste Management
    e. E-waste Management
    f. Bio-medical Waste Management
2. Water Quality Management Plan
3. Domestic Sewage Management Plan
4. Industrial Wastewater Management Plan
5. Air Quality Management Plan
6. Mining Activity Management Plan
7. Noise Pollution Management Plan

In view of the aforesaid order of the Hon'ble NGT, the DEPs of all the existing 23 districts of West Bengal state have been revised for 2024 and uploaded in the respective district websites. Based on the DEPs of all the 23 districts, the SEP has been updated in consultation with various authorities responsible for implementation of the plan.

The earlier District Environment Plans were formulated by incorporating all seven thematic areas specified in the DEP templates provided by the Central Pollution Control Board (CPCB). Additionally, districts are now required to identify specific environmental issues and vulnerable areas within their jurisdiction, such as sand mining, industrial pollution, stone crushers, brick kilns, mining, groundwater depletion and biomedical waste. Specific plans addressing these issues and mitigating the ill effects of related activities on habitats and the fragile ecosystem, with a special focus on fauna, flora and water, should be prepared.

The updated District Environment Plans are to be uploaded on respective websites by 31st January every year, while the updated State Environment Plan incorporating the DEPs and other relevant data must be finalized by 28th February each year and made available on the state website. Based on the SEPs and in coordination with any other ministry or authority, CPCB may place a consolidated plan on its website by 31st March every year.

1.1 State profile

West Bengal is in the eastern part of India, spread between 20°30' N to 27°16' N latitude and 85°50' E to 89°52' E longitude, covering an area of 88,752 km2. The state occupies about 2.7 percent of the total landmass of the country and is the thirteenth-largest state by area in India. It has common boundaries with the states

of Odisha, Jharkhand, Bihar, Sikkim and Assam and shares international borders with Bangladesh, Nepal and Bhutan. The state is divided into 23 administrative districts.

1.1.1 Topography

West Bengal spans from the Darjeeling Himalayas in the north to the Bay of Bengal in the south, with the Chhota Nagpur highlands marking its western edge. The state features diverse topography, ranging from a flat, alluvial plain to the mountainous terrain in the far north, which accounts for only one percent of its area. About six percent of the land comprises plateau fringes, including the Purulia triangle along the western border, while southern Bengal forms a significant part of the Ganga delta. West Bengal is also characterized by an intricate drainage network of the Ganga, Brahmaputra and Subarnarekha River basins. Geographically, it is divided into three distinct units, with the Ganga River splitting the state into two unequal regions: North and South Bengal.

The State has 23 administrative districts. The North Bengal with eight districts covers 21,855 km2 and renders home to 17,211,010 persons. The remaining thirteen districts of South Bengal can further be subdivided into two geographical units taking Bhagirathi-Hooghly River as the demarcating line. The western Rarh region covers an area of about 46,418 km2 and supports a population of about 42,677,166 while the eastern deltaic plain covers 20,484 km2 and the population living thereon is 31,387,939.

1.1.2 Climate

West Bengal, located in eastern India between 20°30’ N to 27°16’ N latitude and 85°50’ E to 89°52’ E longitude, experiences significant climatic variation influenced by its diverse topography and latitudinal extent. These factors shape the temperature and rainfall patterns across the plains, plateaus and Himalayan regions, each with distinct climatic characteristics. The state cycles through four seasons:

- Winter (December to February),
- Summer (March to May),
- Monsoon (June to September),
- Retreating Monsoon or Autumn (October to November).

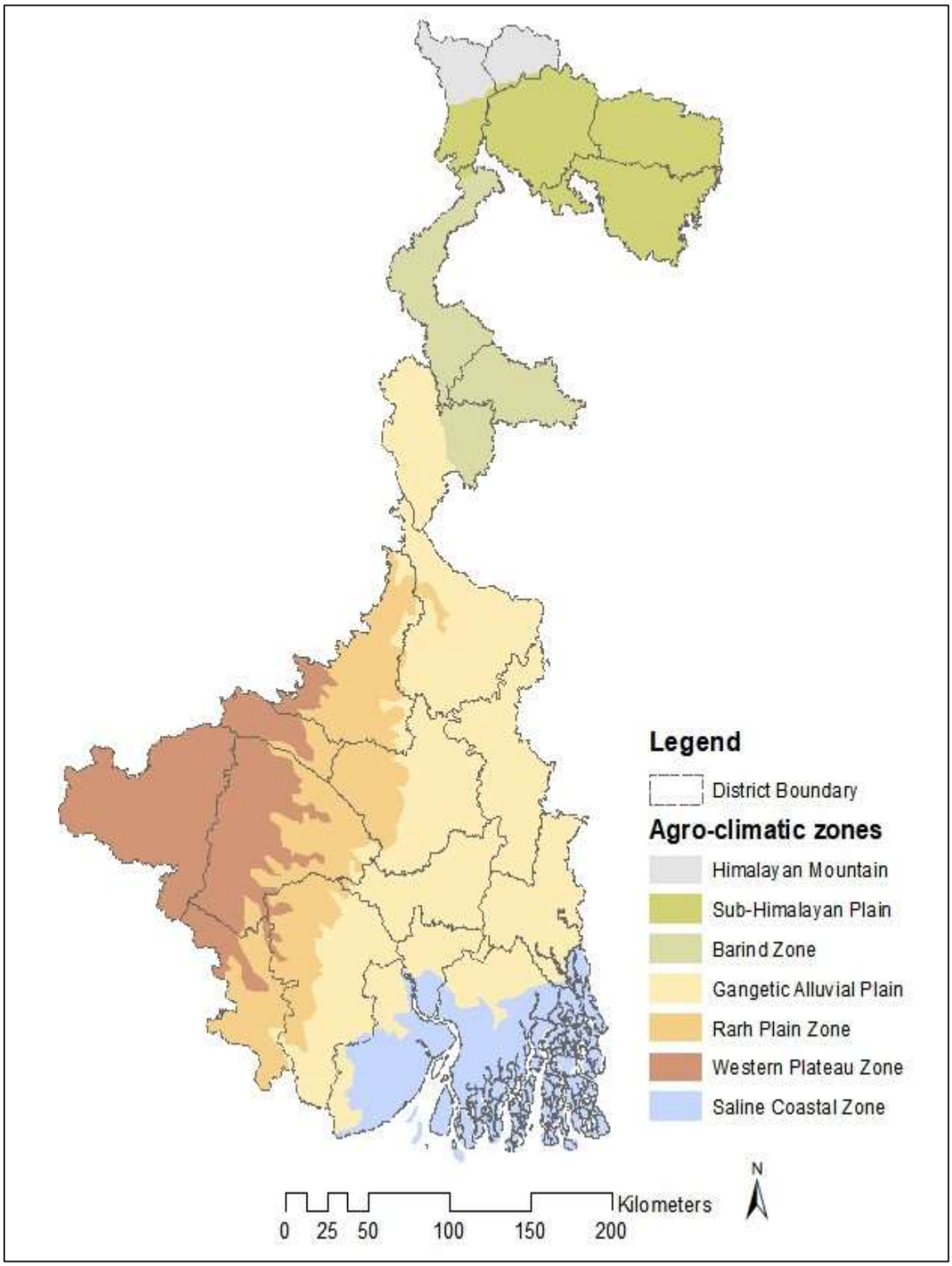
The average temperature in West Bengal ranges from a minimum of 8.4°C in the hill regions to a maximum of 37°C in the red and laterite zones. Rainfall varies significantly, from 1,100 mm in the red and laterite zones to 3,500 mm in the hilly areas. The state is divided into seven agro-climatic zones: the Himalayan Mountain region, Sub-Himalayan plains, Barind zone, Gangetic alluvial zone, Rarh plains, Western Plateau zone and Saline Coastal zone. (See: Map 1: Agroclimatic zone of West Bengal)

Since agriculture, being the largest consumer of water in West Bengal, is intricately tied to the region's agroclimatic zones. Recognizing this connection, the Department of Agriculture, Government of West Bengal, has aligned the state's three principal cropping seasons with the corresponding meteorological seasons to optimize agricultural practices and water usage.

1. **Summer (Pre-Kharif or Boro Cultivation):** This season aligns with the summer months and supports Boro cultivation, a significant cropping period primarily dependent on irrigation to sustain rice cultivation due to limited rainfall.
2. **Monsoon (Kharif Season, dominated by Aman Cultivation):** Coinciding with the monsoon months, this season benefits from heavy and consistent rainfall, which is ideal for Kharif crops like Aman paddy, a staple in the region. The abundant water availability during this period reduces dependency on irrigation.
3. **Retreating Monsoon (Rabi Season):** Following the monsoon, the retreating rains provide residual soil moisture, supporting Rabi crops. This season is crucial for cultivating crops like wheat, pulses and oilseeds, which require moderate water availability and cooler climatic conditions.

This strategic alignment of cropping cycles with meteorological seasons enhances water efficiency, ensures sustainable agriculture and optimizes productivity in West Bengal's diverse agro-climatic regions.

Map 1: Agroclimatic zone of West Bengal



1.1.3 Demography:

According to the Census of India, 2011, its population was about 91.28 million, with a high population density of 1,028 persons/km2, as against the national average of 382 persons/km2. The estimated population in 2021 was about 98.12 million and the projected population for 2031 is about 102 million. The state capital is Kolkata, which is the third-largest metropolis and seventh largest city by population in India. This is the eighth-most populous country subdivision in the world. About 31.87 percent of the total population of the state is urban.

In West Bengal, the highest population density is found in Kolkata district, followed by Howrah and North 24 Parganas (see: Map 2: District-wise population density in West Bengal, 2011). These districts are considered highly urbanized— more than half of the population in these districts lives in urban areas. Out of 23 districts of West Bengal, Kolkata recorded the highest level of urbanization, with 100 percent population in urban areas, followed by Paschim Bardhhaman. North 24 Parganas and Howrah recorded moderate levels of urbanization (50–75 percent). South 24 Parganas, Nadia, Jalpaiguri, Hooghly and Darjeeling show low levels of urbanization (25–50 percent). Fourteen districts, namely Jhargram, Bankura, Uttar Dinajpur, Cooch Behar, Purba Medinipur, Purulia, Birbhum, Malda, Paschim Medinipur, Dakshin Dinajpur, Purba Bardhaman, Murshidabad, Alipurduar and Kalimpong have very low levels of urbanization.

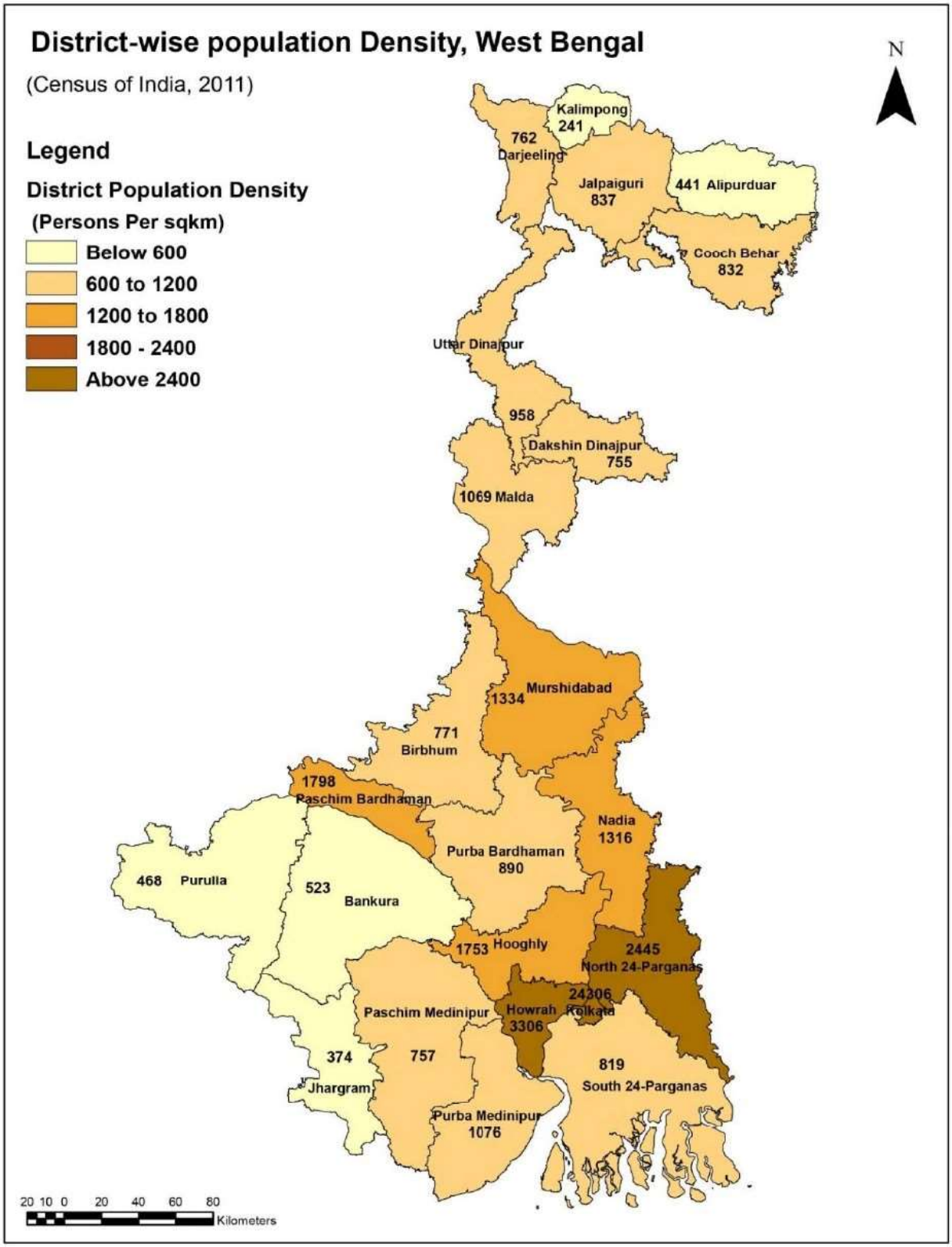
1.1.4 Economic transition

The trend in economic growth is reflected in the Economic Review of 2021–22 of the Department of Planning and Statistics, Government of West Bengal. The gross state domestic product (GSDP) maintained a growth of 12.82 percent for 2021–22, while India's GDP registered a growth of 9.18 percent. The GSDP of the state at current prices saw an increase of about three and half times in 2021–22. The contribution of the industry sector was at about 30. 37 percent.

1.1.5 Status of industry

Currently, it is estimated that there are 39,359 active industries classified into 74 types based on their activity and end-product. In addition to small- and medium-scale enterprises, the state has several major chemical and engineering industries. This includes integrated iron and steel mills, ferrous and non-ferrous metallurgical units, drugs and pharmaceuticals, petrochemical complexes, fertilizer and pesticide plants, fermentation industries, thermal power plants, textiles, manmade fibers, pulp and paper, chlor-alkali units, etc. About 10 percent of the industries fall in the red category, 31 percent in orange category and 36 percent in the green category. The rest are health care units. Coal dominates that industrial energy mix currently.

Map 2: District-wise population density in West Bengal, 2011



Note: Since more districts have been created after 2011, population data is taken from the State of Environment Report-I 2021, GoWB. Source: Created by CSE, data based on State of Environment Report-I 2021, GoWB

1.1.6 Status of transport sector

As far as the transport sector is concerned, West Bengal is well connected by roads, rail and air routes with other major cities of India. The total road length in West Bengal is about 283,865 km (as on 31st March 2019), of which surfaced road constitute about 70.47 percent of total road network. It also has extensive share of National Waterways, -- almost 15.81 percent of the total National Waterways in the country. Rapid motorization is underway. Vehicle registrations in West Bengal have been on a steady rise since 2011. However, the majority in the urban centers use public transport, walk and cycle that provides a good baseline to build the future roadmap.

1.1.7 The level of urban services

Urban services including municipal services for solid and liquid waste management, energy services and transport services are evolving and expanding in the cities of west Bengal. For instance, in 128 ULBs 97 percent of the waste is collected and 54 percent is segregated. In 89 ULBs collection efficiency is more than 95 percent. Bio-mining and processing is underway in 74 ULBs. And legacy waste remediation is ongoing in 21.9 percent of ULBs. Similar progress is underway to address scale up services for managing construction and demolition waste. This is a critical step forward to control open burning of solid waste as well as to control dust from construction and demolition waste.

It is evident that there are multiple sources of air pollution that will require a multi-sectoral approach to ensure transition to affordable clean fuels and clean technology in industry and clean energy transition in transport and households; mobility transition by scaling up mass transit, electrification of vehicles, vehicle fleet renewal, inclusive street infrastructure to promote walking and cycling and low emissions zones and strategies to reduce personal vehicle usage among others; circular economy for material recovery from waste to prevent its dumping and burning; dust management from construction and demolition, roads and open areas and greening measures; and stringent time-bound implementation strategies with improved monitoring and compliance systems.

1.2 Implementation Framework in West Bengal

This State Environment Plan (SEP) is structured in alignment with CPCB guidelines and emphasizes a coordinated approach at both state and district levels to ensure comprehensive environmental governance. Several NGT orders provide the legal framework for addressing thematic areas.

In waste management, the SEP addresses municipal solid waste, C&D waste, plastic waste and others. Municipal solid waste management is governed by OA 606/2018, while legacy waste is managed under OA 519/2019. SUDA and UDMA collect

monthly data from ULBs. Plastic waste management is regulated by EA No. 13/2019. This data reported to UDMA and WBPCB. Hazardous waste and e-waste management fall under OA 804/2017 and OA 512/2018, respectively, with oversight from WBPCB. Biomedical waste management is governed by OA 710/2017, also supervised by WBPCB.

The Water Quality Management Plan includes river water quality monitoring under OA 673/2018, with a specific focus on the Ganga River under OA 200/2014. WBPCB and UDMA monitor the river water quality. Groundwater pollution control is governed under OA 176/2015, while rainwater harvesting initiatives are addressed under OA 325/2015. Both ground water and rainwater harvesting monitored by WRIDD and I&WD. The Domestic Sewage Management Plan focuses on treating domestic wastewater under OA 138/2016, with contributions from WBPCB, SUDA, UDMA and KMDA. The Industrial Wastewater Management Plan aims to prevent the discharge of untreated effluents into water bodies as mandated by OA 593/2017. WBPCB is the responsible agency for industrial waste water discharge monitoring.

Table 1: Themes along with NGT order number and data sources

Sl no	Themes	Sub-theme	Parameters	OA Number	Data taken from
1	Waste Management	Solid Waste Management	Municipal solid waste management	606/2018	UDMA, SUDA, Department of Environment
			Legacy waste	519/2019	
		Plastic Waste Management		EA No 13/2019	UDMA and SUDA
		C&D Waste Management		-	UDMA and SUDA
		Hazardous Waste Management		804/2017	WBPCB
		E-waste Management		512/2018	WBPCB
		Bio-medical Waste Management		710/2017	WBPCB
2	Water Quality Management Plan		River Water quality	673/2018	WBPCB
	Ganga river water quality management			200/2014	WBPCB
	Ground water pollution control			176/2015	WRIDD
	Rainwater harvesting			325/2015	WRIDD, I&WD
3	Domestic Sewage Management Plan		Treatment of domestic wastewater	138/2016	WBPCB,SUDA, UDMA, KMDA
4	Industrial Wastewater Management Plan		Water pollution control by preventing discharge of untreated effluent	593/2017	WBPCB
5	Air Quality Management Plan			681/2018	WBPCB
6	Mining Activity Management Plan			360/2015	WBPCB
7	Noise Pollution Management Plan			102/2022	WBPCB

The Air Quality Management Plan, managed under OA 681/2018, prioritizes maintaining ambient air quality standards with WBPCB as the primary data source. The Mining Activity Management Plan addresses environmental impacts from mining under OA 360/2015, monitored by WBPCB. The Noise Pollution Management Plan enforces ambient noise standards under OA 102/2022, with WBPCB ensuring compliance.

Following the NGT order, the Department of Environment in coordination with the districts, collated data and inputs from districts and relevant state-level departments based on the CPCB-prescribed template to prepare the SEP. All 23 districts of the state submitted data covering seven key themes, ensuring a structured and systematic approach to addressing environmental challenges.

1.2.1 Outcome and Reporting

The SEP for West Bengal serves as a detailed synthesis of district-level plans, collating environmental data across themes to bridge the gap between current and desired compliance levels. By aligning district and state-level efforts, the SEP provides a roadmap for mitigating health risks and environmental degradation. Covering a population of over 20 million, this comprehensive framework aligns with the NGT's directives to create a sustainable and actionable environmental management strategy.

Through rigorous coordination and adherence to CPCB guidelines, West Bengal has set a precedent for integrated environmental governance, highlighting the importance of structured planning and inter-agency collaboration.

Theme 1: Waste Management

The growing population and rapid urbanization have led to a significant rise in waste generation, highlighting the urgent need for effective and sustainable waste management practices. Methane (CH_4) emissions from the anaerobic decomposition of waste in landfills and dumpsites, along with CO_2 from burning waste and other operations, contribute heavily to this problem. Minor amounts of N_2O are also released. Cities without efficient waste management systems— covering collection, transport and disposal—are particularly vulnerable.

Beyond the emissions, improper waste management directly affects public health, compromises the performance of infrastructure and can aggravate the impact of extreme weather events in cities. For example, illegal waste dumping in water bodies and drains often causes flooding during heavy rains, while dumping in green spaces reduces natural heat regulation. Additionally, waste in unregulated landfills contaminates soil and groundwater and burning waste—whether in dumpsites or open spaces—pollutes both air and water, further endangering health and the environment.

The Solid Waste Management (SWM) Rules, 2016, along with the Swachh Bharat Mission launched in 2014, acted as major drivers for improving waste collection, transportation, treatment and disposal, with the goal of creating garbage- free cities. The NGT order in O.A. No. 606/2018, States and Union Territories have been directed to submit action plans for implementing the SWM Rules, 2016. These plans address issues such as mixed waste handling, land acquisition, financial limitations, inadequate capacity and the processing of non-recyclable dry waste. Proposed solutions emphasize waste segregation at the source, decentralized waste processing, recovery efforts, collection of user fees and strategies for managing non-recyclable waste, among other key areas. (see: Table 2: Problems and solutions suggested by Ministry of Housing and Urban Affairs [MoHUA] for solid waste management)

Table 2: Problems and solutions suggested by Ministry of Housing and Urban Affairs [MoHUA] for solid waste management

S. No.	Problems faced by the States/Union Territories	Solution suggested by the MoHUA
1.	Handling mixed waste	Segregate waste at source and recover/recycle to the extent feasible at different stages. Preferred options: • 50% wet waste - compost/ biomethanization • 30% Dry waste– Recycling • 15% Dry waste– Combustible • 5% Inert waste- Landfill
2.	Land acquisition	Decentralized processing should be encouraged coupled with source segregation
3.	Financial constraints	• Collect user fee • Levy penalty for polluters • Bulk Waste Generators rules be complied
4.	Lack of capacity	• Hire services of experts • Take help of MoHUA/CPCB
5.	Non-recyclable dry waste processing	• Maximum of non-recyclable dry waste should be used in Cement Plants. • Low value plastic should be used in road construction.

Source: NGT order against O.A. No. 606/2018

The order asks States to conduct performance audits with assistance from Central Public Health and Environmental Engineering organization (CPHEEO). Parameters have been suggested for physical evaluation and compliance. These parameters include door to door collection, source segregation, waste storage facilities, transfer stations, transportation, waste processing, penalty, notification of byelaws among others (see: Table 3: Key parameters/indicators suggested for solid waste management).

Table 3: Key parameters/indicators suggested for solid waste management

S. No.	Key Parameters/Indicators	Description of Parameters/Indicators for physical evaluation
1.	Door to door collection	Segregate waste at source and recover/recycle to the extent feasible at different stages. Preferred options: • 50% wet waste - compost/ biomethanization • 30% Dry waste– Recycling • 15% Dry waste– Combustible • 5% Inert waste- Landfill
2.	Source segregation	Decentralized processing should be encouraged coupled with source segregation
3.	Litter bins and waste storage bins	• Collect user fee • Levy penalty for polluters • Bulk Waste Generators rules be complied

S. No.	Key Parameters/Indicators	Description of Parameters/Indicators for physical evaluation
4.	Transfer Stations	• Hire services of experts • Take help of MoHUA/CPCB
5.	Separate transportation	• Maximum of non-recyclable dry waste should be used in Cement Plants. • Low value plastic should be used in road construction.
6.	Public sweeping	• All public and commercial areas to have twice daily sweeping, including night sweeping and residential areas to have daily sweeping.
7.	Waste Processing • Wet Waste • Dry Waste • MRF Facility	• Separate space for segregation, storage, decentralized processing of solid waste to be demarcated • Establishing systems for home/decentralized and centralized composting • Setting up of MRF Facilities.
8.	Scientific Landfill	• Setting up common or regional sanitary landfills by all local bodies for the disposal of permitted waste under the rules • Systems for the treatment of legacy waste to be established.
9.	C&D waste	Ensure separate storage, collection and transportation of construction and demolition wastes.
10	Plastic waste	Implementation of ban on plastics below
11.	Bulk waste generators	Bulk waste generators to set up decentralized waste processing facilities as per SWM Rules, 2016.
12.	Refuse derived fuel (RDF)	Mandatory arrangements have to be made by cement plants to collect and use RDF, from the RDF plants, located within 200 kms.
13.	Preventing solid waste from entering water bodies	Installation of suitable mechanisms such as screen mesh, grill, nets, etc. in water bodies such as nallahs, drains, to arrest solid waste from entering water bodies.
14.	User fees	Waste Generators paying user fee for solid waste management, as specified in the bye-laws of the local bodies.
15.	Penalty provision	Prescribe criteria for levying of spot fine for persons who litters or fails to comply with the provisions of these rules and delegate powers to officers or local bodies to levy spot fines as per the byelaws framed.
16.	Notification of bye-laws	Frame bye-laws incorporating the provisions of MSW Rules, 2016 and ensuring timely implementation.
17.	Citizen grievance redressal	Resolution of complaints on Swachhata App within SLA.
18.	Monitoring mechanism	States/ULBs to update month wise targets/action plans on the online MIS.

Source: NGT order against O.A. No. 606/2018

The state-level adaptations like the Nirmal Bangla Mission, aligned with the Swachh Bharat Mission, have advanced door-to-door waste collection, segregation, bioremediation at dumpsites and fresh waste processing. Under these initiatives, ULBs are tasked with diverting at least 80 percent of municipal solid waste from dumpsites and achieving 100 percent remediation of legacy waste by 2026.

The NGT order asks for constitution of an Apex Monitoring Committee, Regional Monitoring Committees and State Level Committees to oversee the implementation of its directives. In response to that the Government of West Bengal has notified the creation of a Special Task Force in each district to raise awareness about the Solid Waste Management Rules, 2016, through collaboration with educational, religious and social organizations, including local Eco-clubs. The Task Force includes District Magistrates, the Superintendent of Police, Regional Officers from the West Bengal Pollution Control Board and the Chairman of the District Legal Service Authority.

Additionally, West Bengal has formed a State-Level Committee on Solid Waste Management to ensure effective implementation of the 2016 rules. This committee comprises representatives from key departments—Environment, Health and Family Welfare, Panchayat and Rural Development, Urban Development and Municipal Affairs—as well as the CPCB and WBPCB and is chaired by a former High Court Judge. Monitoring and enforcement of the solid waste management rules will be coordinated by the respective ULB Chairpersons and Municipal Corporation Commissioners.

2.1 Status of Solid Waste Management

In West Bengal, 30 percent of the population lives in urban areas and the remaining in rural areas. The rural areas do not have organized solid waste management infrastructure or services. However, a few schemes have been initiated in Gram Panchayats under the Nirmal Bangla Mission.

West Bengal has 128 ULBs including seven municipal corporations and others vary from small to large scale Municipalities. The autonomous hill districts of Darjeeling and Kalimpong have five ULBs, namely Darjeeling, Siliguri, Kurseong, Mirik Kalimpong and is an eco-sensitive geography. These ULBs along with a few in plains that are places of religious significance – Bolpur, Tarakeshwar, Nabadwip, Krishnanagar, etc. – witness high tourist footfall and have high floating population.

Waste Management Rules 2016 supersede the Municipal Solid Waste (Management and Handling) Rules 2000. The new rules take within the ambit every local authority, including the village panchayats of census towns and urban agglomerations. These authorities are responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid waste and implement the provisions of the new rules.

Due to wide geographic variation in the state, areas like Darjeeling and the

Sundarbans face significant challenges in waste management. In Darjeeling, the hilly terrain and dispersed population make waste collection and transportation difficult, with narrow roads, heavy rainfall and steep slopes leading to waste accumulation and pollution. The seasonal influx of tourists further strains the system, compounded by limited waste processing facilities.

In Sundarbans, the low-lying, flood-prone landscape and frequent flooding wash waste into rivers, while the region's complex network of islands and waterways complicates efficient waste transport. Manual collection methods persist and limited awareness, combined with the need for eco-sensitive practices to protect biodiversity, adds to the challenge. These sensitive are given special efforts to manage waste effectively and protect the environment.

2.1.1 Volume of Municipal Solid Waste

Waste generation is influenced by socio-economic factors, population density, culture and climate. As household incomes rise, access to a wider range of consumer goods also increases, leading to a faster accumulation of solid waste.

As of 2024, 128 ULBs in 23 districts of West Bengal generate a total of 13,216 tonnes of municipal solid waste (MSW) daily, according to the SUDA. The Kolkata Municipal Corporation produces the highest volume, at 4,500 tonnes per day (TPD), followed by Howrah Municipal Corporation with 710 TPD and Asansol Municipal Corporation with 700 TPD. Other notable contributors include South Dum Dum Municipality (359 TPD), Siliguri Municipal Corporation (358 TPD), Bidhannagar Municipal Corporation (350 TPD), Rajpur-Sonarpur Municipality (348.5 TPD)and Durgapur Municipal Corporation (304 TPD). On average, the waste generated across all ULBs is 103.25 TPD, with 20 of the 128 ULBs surpassing this average. (See: Map 3: Total solid waste generated at ULB level, 2024)

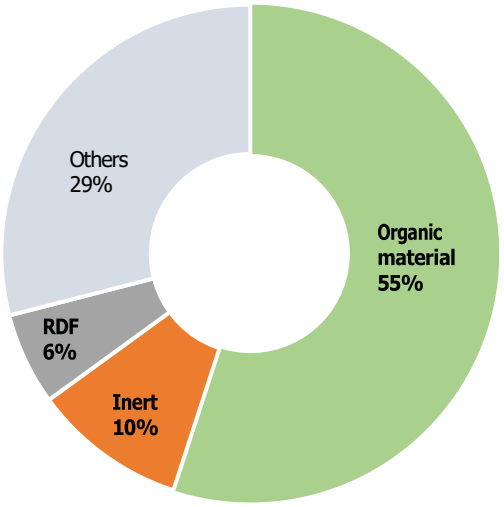
On average, per capita waste generation in West Bengal is 441.69 grams per day. The highest rate is observed in the Kolkata Municipal Corporation, which generates 1,000.74 grams per day, followed by South Dum Dum at 890.12 grams per capita daily. Most ULBs produce between 300 and 700 grams per capita per day, with Class I towns (populations exceeding 100,000) typically at the upper end of this range. Interestingly, nine ULBs generate less than 300 grams per capita per day, with Bongaon Municipality recording the lowest at just 57.36 grams per day, despite having a population over 100,000 (See: *Map 4: Per capita solid waste generated at ULB level, 2024*).

2.1.2 Characteristics of Municipal Solid Waste

MSW in West Bengal comprises of organic, inorganic recyclables and inorganic non-recyclable materials, mostly heterogenous in nature. Around 55 percent of the MSW is organic, 10 percent is inert or ash, 6 percent is represented by RDF and remaining 29 percent belongs to the miscellaneous category that includes paper, plastic,

clothes, glass, rubber, wood, metals and sanitary waste etc. (See: Graph 1: Composition of municipal solid waste in West Bengal)

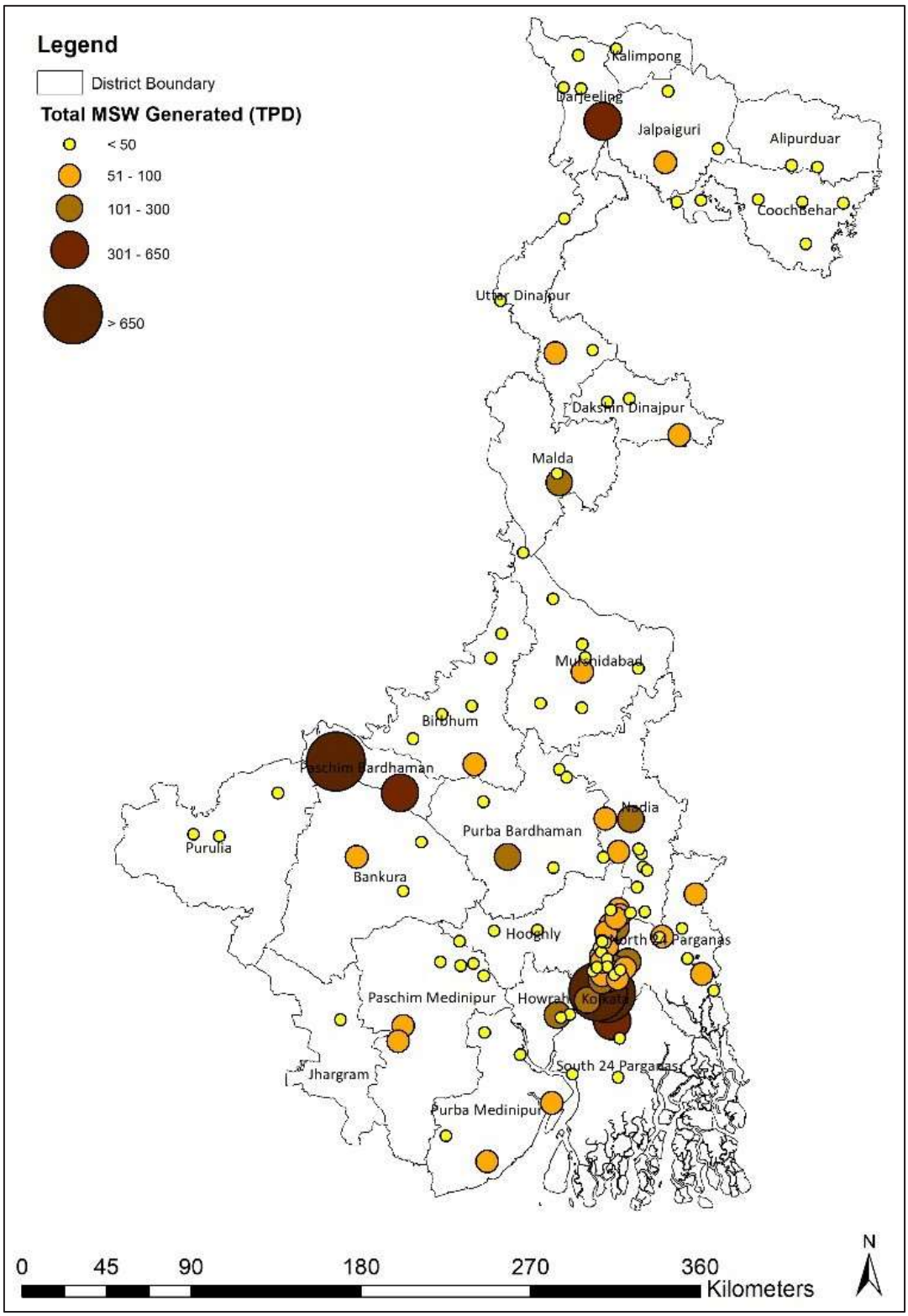
Graph 1: Composition of municipal solid waste in West Bengal, 2024



Source: SUDA

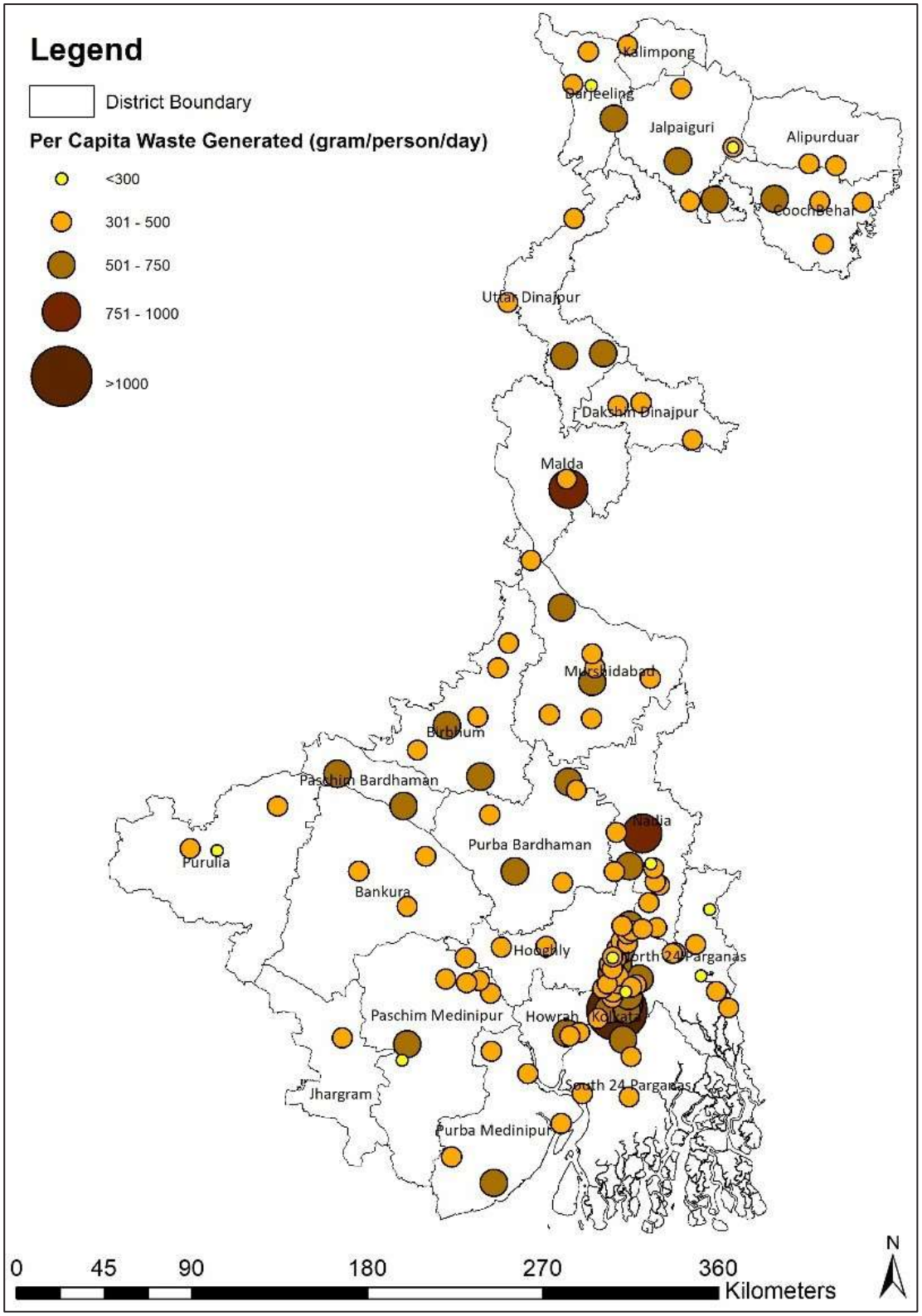
Characteristics of waste determine the treatment method and subsequent disposal. Since there is scarcity of land in rapidly urbanizing areas, minimizing requirement for sanitary landfills should take focus for solid waste management in the state. To enable this, being informed on the composition and characteristics of waste bears great significance. It becomes highly important to keep a local or ULB level inventory of characteristics of waste to enable effective waste management.

Map 3: Total solid waste generated at ULB level, 2024



Source: Data from SUDA; Generated by CSE

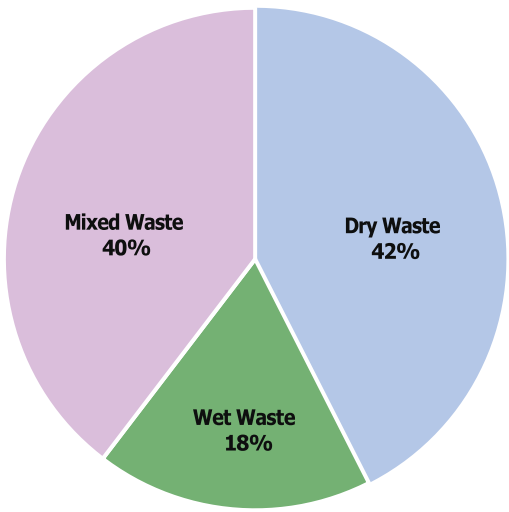
Map 4: Per capita solid waste generated at ULB level, 2024



Source: Data from SUDA; Generated by CSE

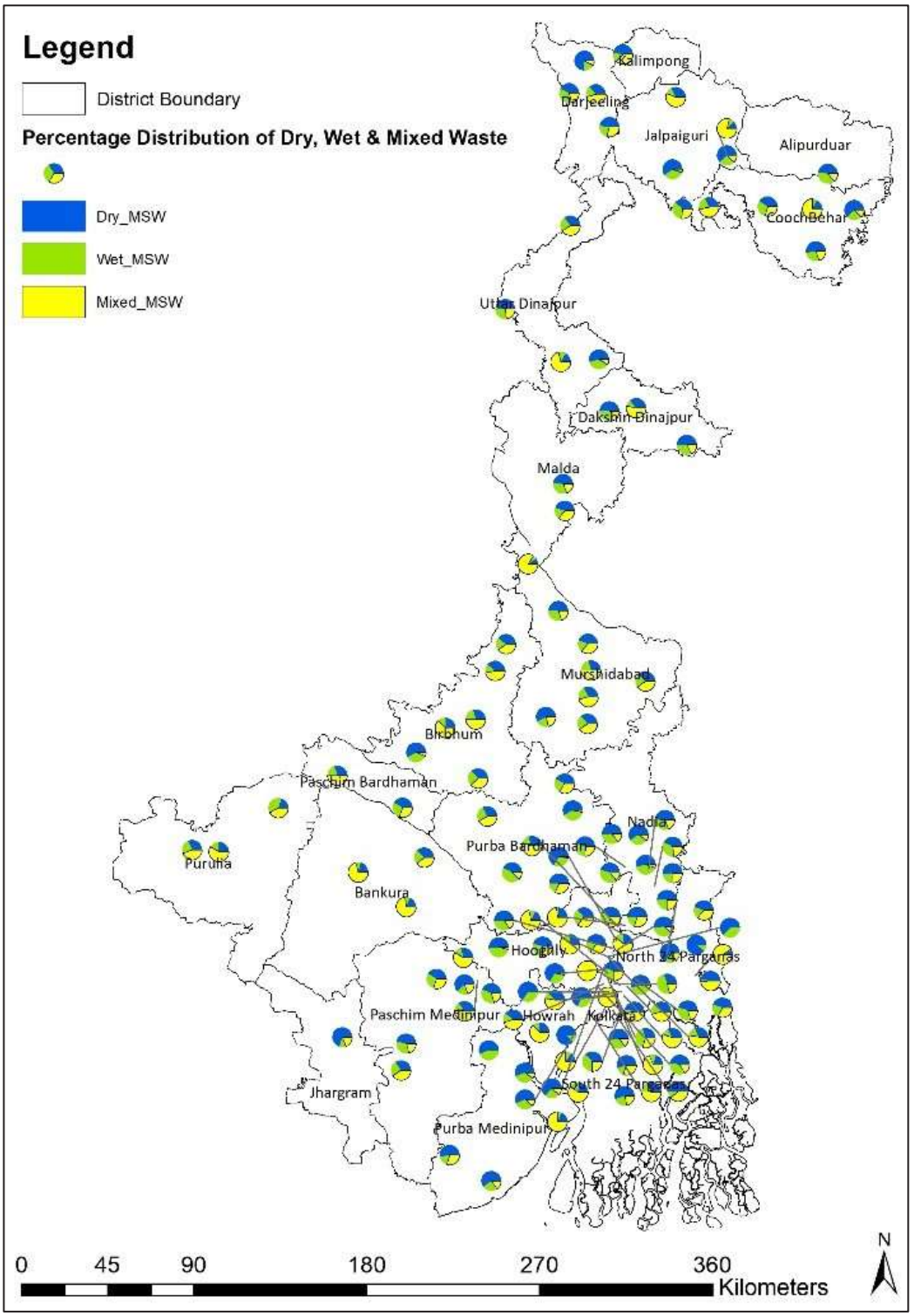
Data reported by 128 ULBs of the 23 district the dry waste constitutes the largest share of the waste stream in most ULBs, typically ranging from 40 percent to 70 percent of the total waste (See: Graph 2: Composition of solid waste in West Bengal. For example, in larger municipalities such as Kolkata Municipal Corporation, dry waste makes up over 50 percent of the total waste, totaling 2,300 tonnes out of 4,500 tonnes per day. Similarly, in Siliguri Municipal Corporation and South Dum Dum, dry waste accounts for approximately 47-50 percent of the total waste. This trend indicates that dry waste consistently represents the largest portion of waste in the majority of ULBs, with a few exceptions where mixed or wet waste is more prevalent. In municipalities like Howrah and Panihati show a higher concentration of mixed waste, with Panihati consisting solely of mixed waste and Howrah exhibiting a significantly greater proportion of mixed waste compared to both dry and wet waste. Similarly, ULBs like Khardah and Dhuliyan display a more substantial presence of wet and mixed waste, respectively, diverging from the typical dominance of dry waste seen in other areas. (See: Map 5: Percentage distribution of dry, wet and mixed waste, 2024)

Graph 2: Composition of solid waste in West Bengal, 2024



Source: SUDA

Map 5: Percentage distribution of dry, wet and mixed waste, 2024



Source: Data from SUDA; Generated by CSE

2.1.3 Operations and Infrastructure

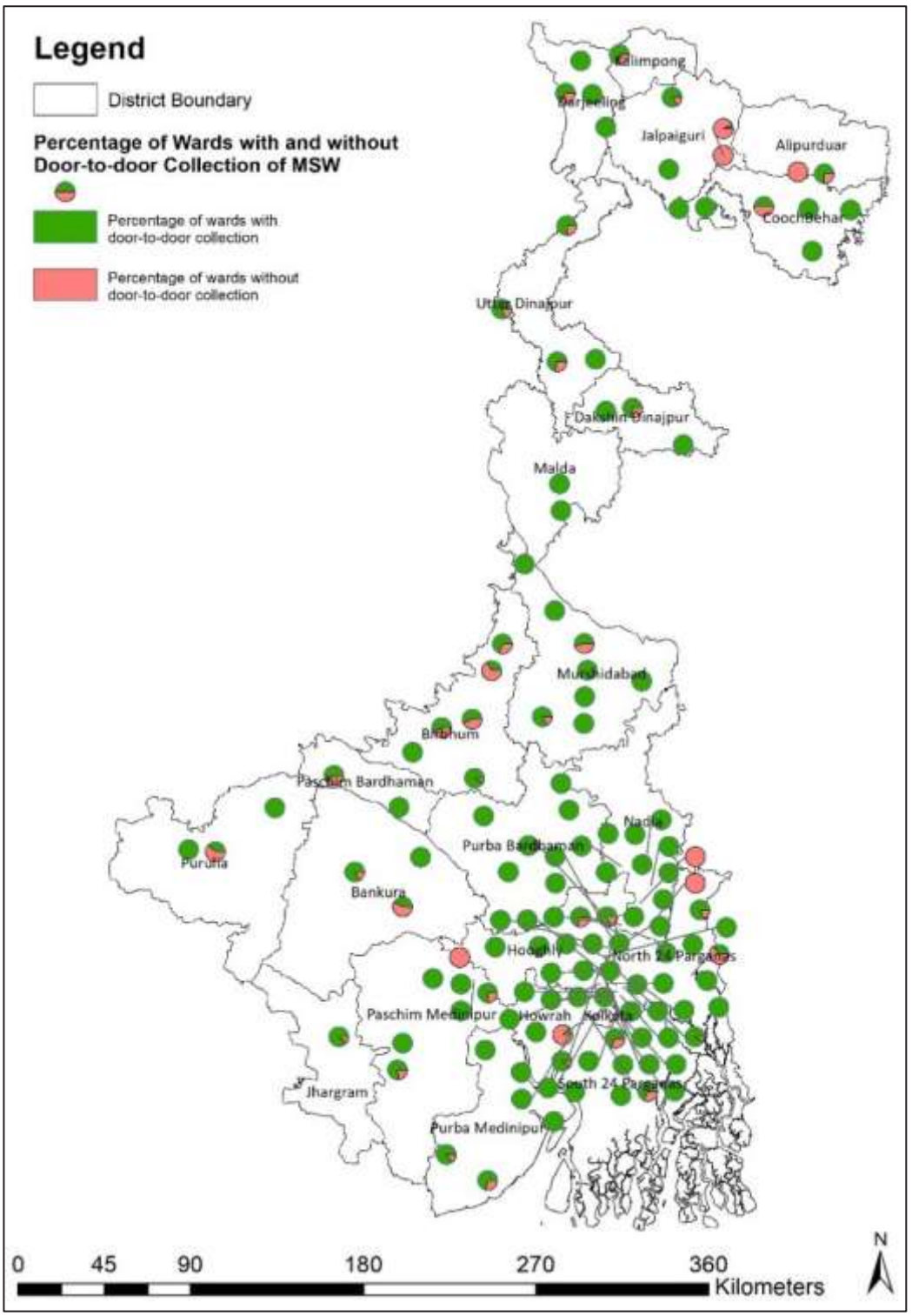
While ULBs carry out street sweeping, waste collection, transportation and disposal, much of the process remains disorganized. According to the state policy report, collected waste is often dumped unscientifically in low-lying or vacant areas, posing a serious threat to natural resources. Leachates from this waste contaminate water bodies, groundwater reserves and soil. Materials like plastics, e-waste, ceramics and metal scraps, when left unattended at dump sites, chemically alter the land, irreversibly changing the soil's pH. This is particularly concerning for a state with eco-sensitive regions like hills, river plains and wetlands. To ensure sustainable waste management in West Bengal, household- level segregation, door-to-door collection and transportation of segregated waste, proper treatment of waste streams and minimal disposal at sanitary landfill sites are essential.

2.1.4 Waste Collection

West Bengal has been working to improve its solid waste collection and transportation as part of its Nirmal Bangla Mission. Under the mission, the state has employed Nirmal Bandhus and Nirmal Saathis to enable implementation of solid waste management rules 2016. Nirmal Bandhus collect waste from door- to-door and are supervised by Nirmal Saathi. Nearly 250–350 households are covered by one Nirmal Bandhu and one Nirmal Saathi supervises up to 6 Nirmal Bandhus. Nirmal Saathis report to the Ward Supervisor which further reports to the Sanitary Inspector. The appointed Nirmal Saathis are women who are also a part of self-help groups formed and organized under the West Bengal government's Anandadhaara Mission. This practice is a good example to demonstrate linking of two missions and achieving their goals.

Around 92 percent of the total wards (around 2906) in West Bengal have a complete door-to-door waste collection service. Larger municipalities like Kolkata Municipal Corporation and Bidhannagar have also achieved 100 percent coverage, indicating strong waste management systems in place. However, many municipalities, like Asansol (62 out of 106 wards), Bishnupur (8 out of 19 wards) and Rampurhat (6 out of 18 wards), only partially cover their areas, suggesting room for improvement. Additionally, some ULBs, such as Chakdaha, Falakata, Mainaguri and Haringhata, deviate from the general trend by reporting little to no coverage, highlighting significant gaps in their waste collection services (See: Map 6: Door-to-Door collection of MSW in ULBs, 2024).

Map 6: Door-to-Door collection of MSW in ULBs, 2024



Source: Data from SUDA; Generated by CSE

2.1.5 Collection efficiency

The average efficiency across all ULBs is approximately 94.27 percent. A significant majority of 94 out of 128 ULBs have 100 percent collection efficiency. On the other hand, five ULBs fall below the average, highlighting areas where improvements could be made to enhance collection efficiency and bring their performance closer to the standards set by the leading ULBs (See: Map 7: Collection efficiency for solid waste generated in ULBs, 2024).

2.1.6 Transportation of Waste

107 ULBs, representing about 84 percent, have implemented fully segregated waste transport systems, demonstrating a strong commitment to infrastructure development and optimized waste management. Additionally, 3.9 percent of ULBs have partial segregation, indicating they are in a transitional phase toward fully segregated transport system. However, 12 percent of ULBs still lack segregated transport, highlighting areas for improvement in urban planning (see: *Map 8: Segregated waste transportation by ULBs, 2024*).

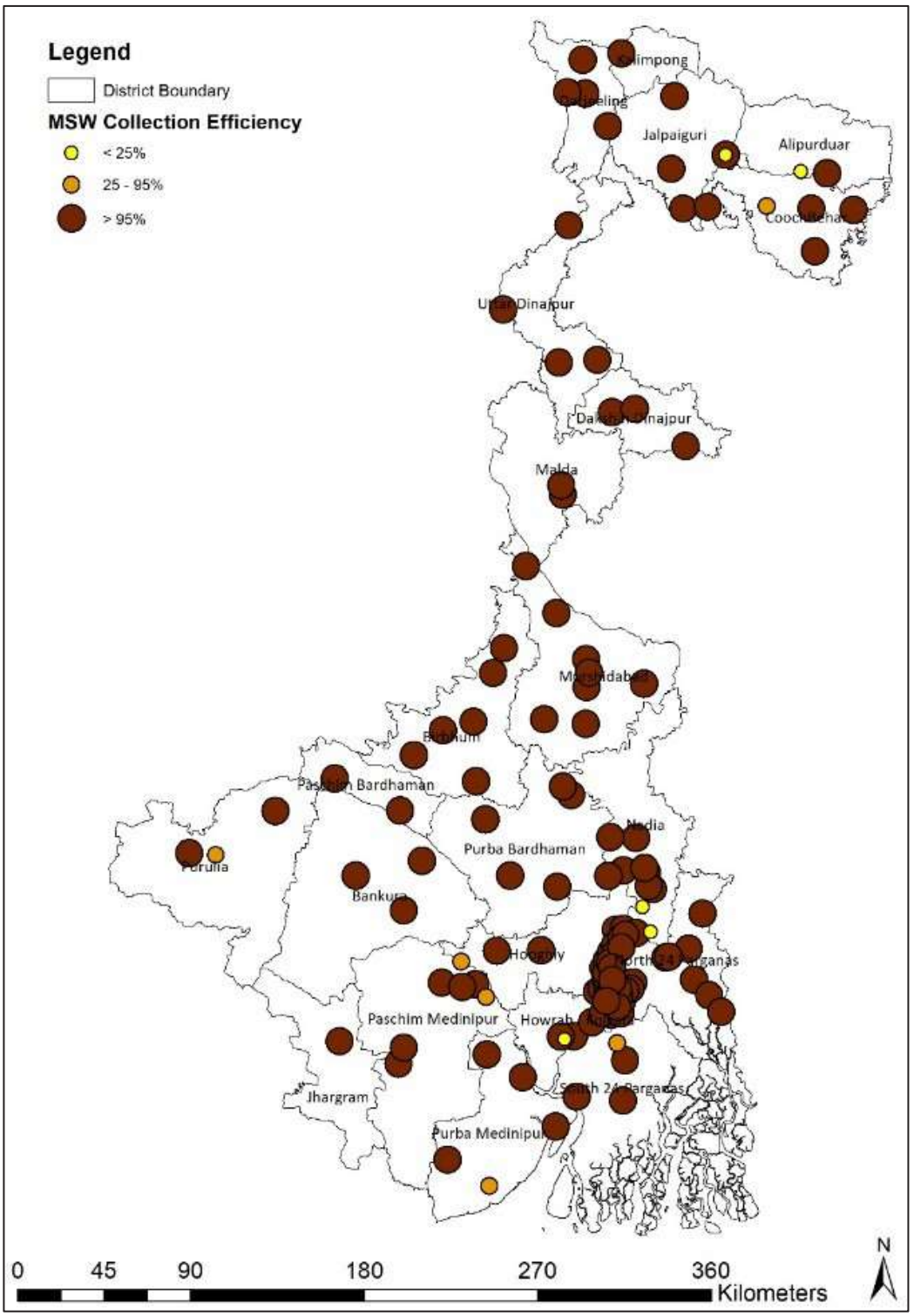
According to West Bengal's solid waste policy, all ULBs have either paddled tricycle (PTC) or stationary compactors for proper transportation and disposal at the dumping sites. A few (large) ULBs have been provided with battery operated hydraulic tipper for collection in areas with narrow roads.

In the absence of municipal services to collect waste, there is a practice of households employing private individuals to collect and dispose of waste informally. These individuals dump the collected waste at vacant land parcels at their discretion. This means that not only municipal services need to be scaled up to reach every household but that is also a need for awareness campaigns to segregate waste at household levels. This helps in enabling transportation infrastructure to collect and transport the waste from households in a segregated manner.

2.1.7 Treatment and Disposal

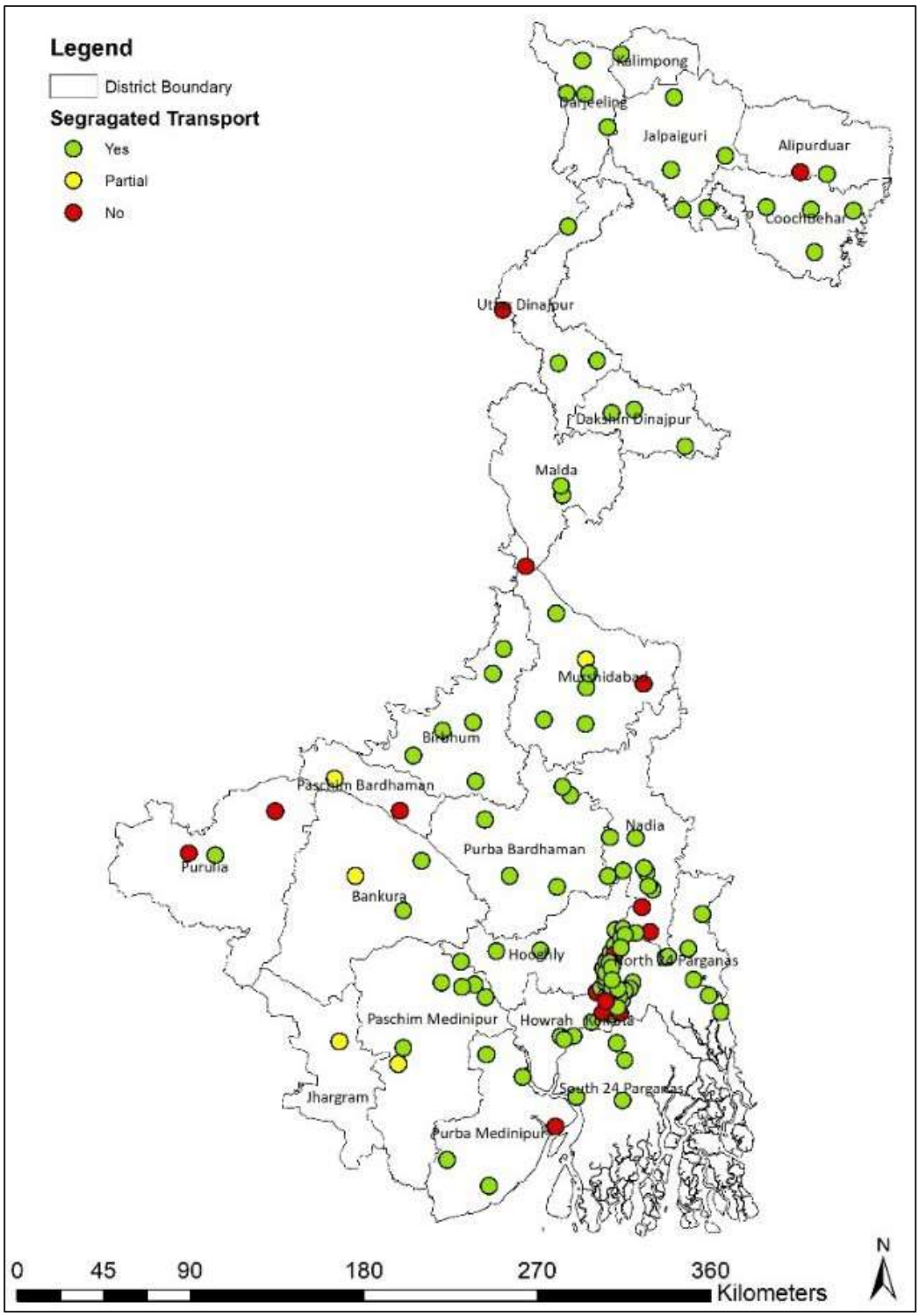
Collected waste transfer to designated transfer stations or waste collection depots then from depot to dumpsites. A total of 4975 waste collection depots are in 128 ULBs of 23 districts. The primary mode of waste collection is through paddled tricycles (PTCs). Some ULBs equip PTCs with four units of 40-litre blue bins and four units of 40-litre green bins to facilitate the segregated waste collection, giving each PTC a total capacity of roughly 320 liters. PTCs then transfer the collected waste to secondary collection vehicles, or waste collection depots. Overall, waste is transported to dumpsites using fuel-operated tippers, hopper tippers and tractors, with fuel-operated tippers being the main

Map 7: Collection efficiency for solid waste generated in ULBs, 2024



Source: Data from SUDA; Generated by CSE

Map 8: Segregated waste transportation by ULBs, 2024



Source: Data from SUDA; Generated by CSE

vehicles for secondary collection. These tippers typically have capacities ranging from 3,000 to 4,000 liters.

There are 123 waste dumpsites across 118 of the 128 ULBs in West Bengal. Dhapa, the largest dumpsite in the Kolkata Metropolitan Area (KMA), holds nearly 60 lakh tonnes of legacy waste over 60 hectares, according to the State of Environment report of West Bengal 2021. The Pramodnagar dumpsite in North Dum Dum serves five ULBs: Dumdum, South Dumdum, North Dum Dum, New Barrackpore and Baranagar, demonstrating the cluster approach for regional waste management facilities. Likewise, Baidyabati, Chapdany, Konnagar, Rishra, Sreerampore and Uttarpara municipalities use the Baidyabati Regional Waste Management Centre (RWMC), with Uttarpara being the farthest ULB in this cluster.

Several ULBs have multiple dumpsites within their city limits. Asansol Municipal Corporation leads with five dumpsites, the highest among ULBs. Naihati municipality operates three separate dumping grounds, covering a total area of 23.94 acres. Similarly, Jhalda and Purulia municipalities also maintain three dumpsites each. Additionally, 82 ULBs have one dumpsite, highlighting the extensive waste management infrastructure across the state.

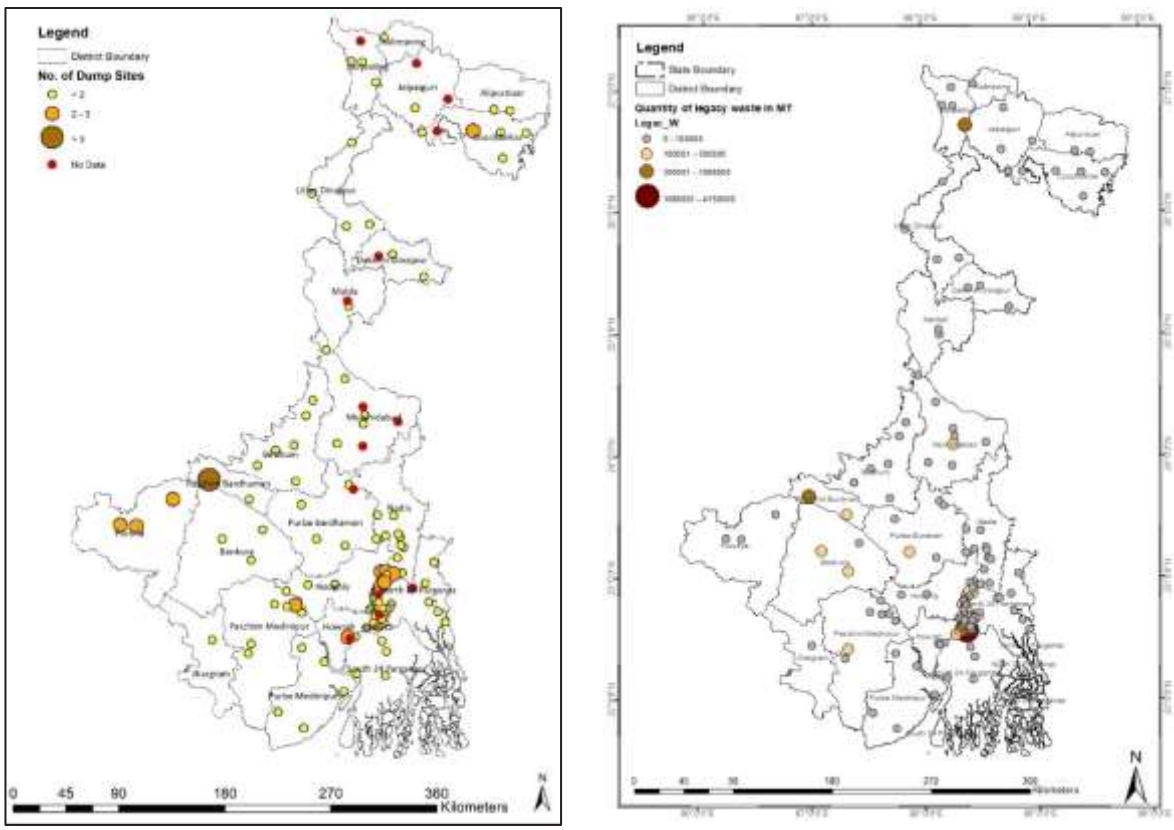
Kolkata bears the highest burden of legacy waste, amounting to around 41.5 lakh tonnes across two dumpsites, constituting approximately 37 percent of the total legacy waste of the state (see: Map 9: Total number of dump sites in ULBs, 2024 and Quantity of legacy waste (2023)). Followed by Asansol Municipal Corporation with 10.88 lakh tonnes spread across five dumpsites and Howrah Municipal Corporation with 9.61 lakh tonnes.

2.1.7.1 Waste processing

Out of the 128 municipalities in West Bengal, 74 are engaged in waste processing before disposing of solid waste in sanitary landfills. Six municipalities, including Krishnagar, Haldia, Uttarpara Kotrung, Baidyabati and Alipurduar, have achieved 100 percent waste processing. On average, about 27percent of waste is processed across these municipalities. However, 54 ULBs have yet to begin their waste processing activities.

The most adopted waste processing method is windrow composting, currently used by 66 municipalities to process a total of 2,392.5 TPD of solid waste. Some municipalities combine windrow composting with other techniques—five municipalities use it alongside bio methanation to process 300 TPD and two municipalities' pair it with biogas to process 11 TPD. Additionally, Maheshtala

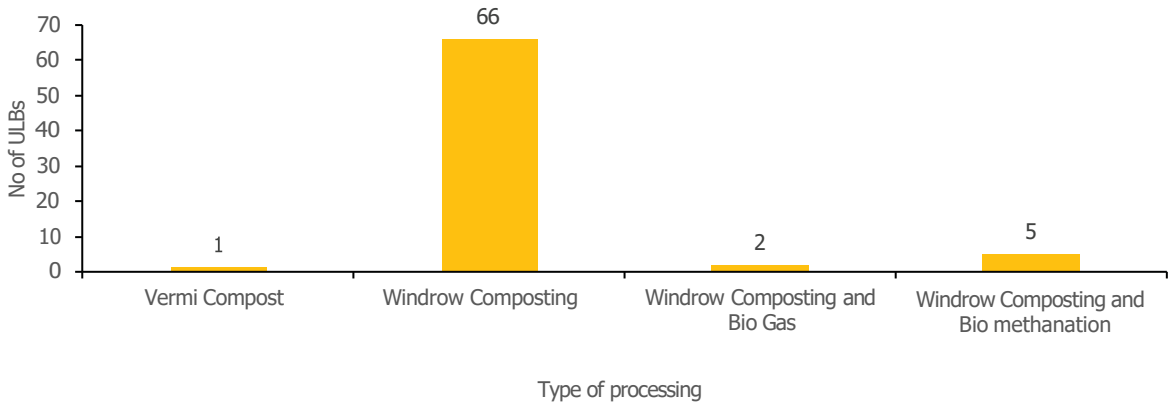
Map 9: Total number of dump sites in ULBs, 2024 and Quantity of legacy waste (2023)



Source: Data from SUDA; Generated by CSE

municipality is the only municipality utilizing vermi-composting for solid waste processing (See: Graph 3: Number of Municipalities in West Bengal adopting different methods of solid waste processing, 2024).

Graph 3: Number of Municipalities in West Bengal adopting different methods of solid waste processing, 2024



Source: SUDA

Apart from that, as data shared by SUDA, December 2023, among the 128 ULBs, about 74 have initiated the bio-mining process to address the legacy waste, with a focus on remediating 46.63 lakh tonnes.

As of December 2023, West Bengal has successfully remediated 24.41 lakh tonnes (21.9 percent) of legacy waste. The remediation efforts have led to the disposal of approximately 18.61 lakh tonnes of waste, comprising 1.41 lakh tonnes of RDF, 6.59 lakh tonnes of Inert material and 10.64 lakh tonnes of G.E. The RDF generated through the bio-mining process is being sent to cement factories in nearby states for reuse (See: Table 4: ULBs with their existing treatment capacity for MSW, 2024).

Table 4: ULBs with their existing treatment capacity for MSW, 2024

S. No.	Name of ULB	Quantity of Waste Processed (TPD)	Percentage of Waste Processed	Waste Processing Unit
1	Baranagar	77.36	46.32	Windrow Composting and Bio methanation
2	Dum Dum	28.77	46.32	Windrow Composting and Bio methanation
3	New Barrackpore Municipality	12.74	46.32	Windrow Composting and Bio methanation
4	North Dum Dum	14.82	46.32	Windrow Composting and Bio methanation
5	South Dumdum	166.31	46.32	Windrow Composting and Bio methanation
6	Jainagar-Mazilpore	6.00	66.67	Windrow Composting and Bio Gas
7	Rajpur-Sonarpur	5.00	1.43	Windrow Composting and Bio Gas
8	Alipurduar	21.00	100	Windrow Composting
9	Arambagh	7.00	24.34	Windrow Composting
10	Ashoknagar-Kalyangarh	35.00	72.92	Windrow Composting
11	Baduria	4.00	67	Windrow Composting
12	Baidyabati	50.00	100	Windrow Composting
13	Bally	16.00	11.43	Windrow Composting
14	Balurghat	25.00	33.33	Windrow Composting
15	Bankura	4.00	6.56	Windrow Composting
16	Bansberia	10.00	25	Windrow Composting
17	Barrackpore	15.00	30	Windrow Composting
18	Baruipur	6.00	24.49	Windrow Composting
19	Basirhat	53.00	94.64	Windrow Composting
20	Bhadreswar	12.00	37.5	Windrow Composting

S. No.	Name of ULB	Quantity of Waste Processed (TPD)	Percentage of Waste Processed	Waste Processing Unit
21	Birnagar	8.00	81.47	Windrow Composting
22	Bolpur	17.00	30.92	Windrow Composting
23	Bongaon	31.00	50	Windrow Composting
24	Budge-Budge	25.00	83.33	Windrow Composting
25	Buniyadpur	7.00	58.33	Windrow Composting
26	Champdany	19.00	100	Windrow Composting
27	Chandernagore	25.00	34.99	Windrow Composting
28	Dalkhola	4.00	23.13	Windrow Composting
29	Diamond Harbour	4.00	20.48	Windrow Composting
30	Durgapur	25.00	8.22	Windrow Composting
31	Gangarampur	14.00	50	Windrow Composting
32	Garulia	12.00	33.55	Windrow Composting
33	Gobardanga	4.00	21.46	Windrow Composting
34	Haldia	80.00	100	Windrow Composting
35	Haldibari	2.50	48.08	Windrow Composting
36	Halisahar	21.00	40.38	Windrow Composting
37	Hooghly Chinsurah	16.00	21.33	Windrow Composting
38	Howrah MC	10.00	1.41	Windrow Composting
39	Islampur	12.00	55.22	Windrow Composting
40	Jangipur	25.00	52.08	Windrow Composting
41	Kalna	6.00	26.09	Windrow Composting
42	Kalyani	16.00	26.67	Windrow Composting
43	Kanchrapara	12.00	22.29	Windrow Composting
44	Kharagpur	25.00	30.49	Windrow Composting
45	Khardah	14.00	30.15	Windrow Composting
46	Kolkata Municipal Corporation	609.00	13.53	Windrow Composting
47	Konnagar	25.00	98.04	Windrow Composting
48	Krishnagar	120.00	100	Windrow Composting
49	Madhyamgram	16.00	17.78	Windrow Composting
50	Mathabhanga	8.00	56.06	Windrow Composting
51	Mekliganj	4.00	85.11	Windrow Composting
52	Memari	5.00	31.25	Windrow Composting
53	Murshidabad	12.00	60	Windrow Composting
54	Nabadwip	16.00	26.67	Windrow Composting
55	Naihati	20.00	18.69	Windrow Composting

S. No.	Name of ULB	Quantity of Waste Processed (TPD)	Percentage of Waste Processed	Waste Processing Unit
56	Nalhati	8.00	53.33	Windrow Composting
57	Panskura	8.00	44.44	Windrow Composting
58	Raiganj	16.00	16.84	Windrow Composting
59	Rampurhat	18.00	64.29	Windrow Composting
60	Ranaghat	20.00	80	Windrow Composting
61	Rishra	45.00	83.33	Windrow Composting
62	Sainthia	12.00	63.16	Windrow Composting
63	Serampore	70.00	73.68	Windrow Composting
64	Siliguri MC	200.00	55.87	Windrow Composting
65	Suri	11.00	29.73	Windrow Composting
66	Taherpur	4.10	82	Windrow Composting
67	Taki	8.40	60	Windrow Composting
68	Tamralipta	12.00	48.78	Windrow Composting
69	Tarakeswar	3.50	26.6	Windrow Composting
70	Titagarh	9.00	18.87	Windrow Composting
71	Tufanganj	6.00	75	Windrow Composting
72	Uluberia	17.00	14.17	Windrow Composting
73	Uttarpara Kotrung	72.00	100	Windrow Composting
74	Maheshtala	14.00	6.67	Vermi Compost

Source: SUDA

Figure 1: Windrow beds in Chandannagore covered due to rains, 2023

Source: Chandannagore Municipality

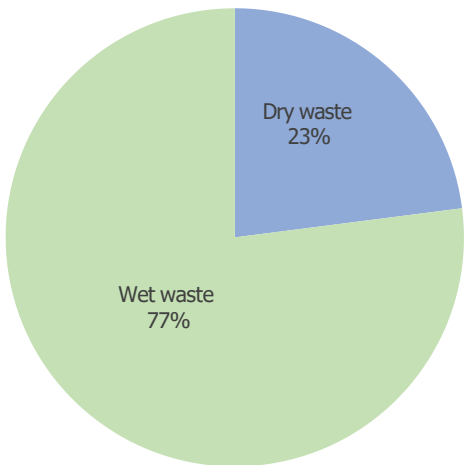
Figure 2: Composting at the dumpsite in Madhyamgram, 2023

Source: Madhyamgram Municipality

2.1.8 Waste Management in rural part of the state

In West Bengal, Kolkata is the only entirely urban district, while the remaining 22 districts include rural areas. These 22 districts collectively encompass around 38,193 villages, which together generate approximately 363.79 thousand kilograms (363 TPD) of waste daily. Of this, 77 percent is wet waste and 23 percent is dry waste (See: Graph 4: Share of wet and dry waste). Around 98 percent of the generated waste, amounting to 357 thousand kg, is collected, showcasing the state's commendable waste collection efficiency.

Graph 4: Share of wet and dry waste

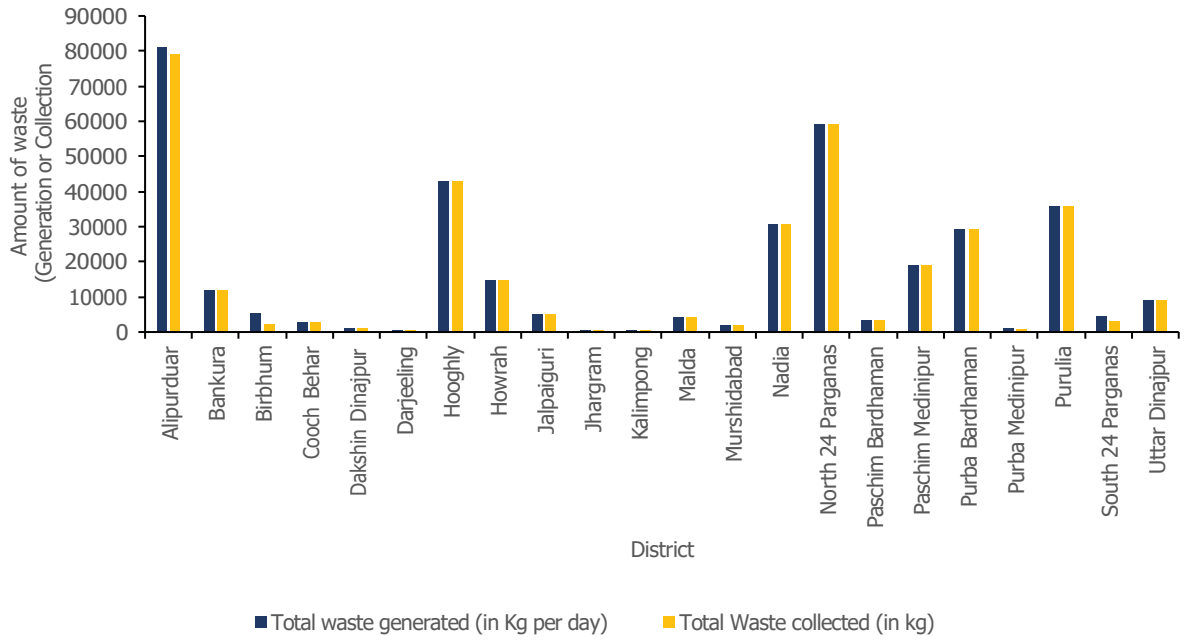


Source: Panchayat & Rural Development Department, GoWB

A district-level analysis of West Bengal reveals significant variations in waste management efficiency. Districts like Bankura, Cooch Behar, Hooghly and North 24 Parganas achieve 100 percent waste collection efficiency, reflecting well-established systems at the Gram Panchayat (GP) level, supported by proper planning, infrastructure and active community involvementDistricts like Kalimpong (43 percent) and South 24 Parganas (72 percent) have opportunities for growth, with ongoing improvements in infrastructure, geographic features, and public awareness. (See: Graph 5: District wise solid waste generation and collection in rural areas of the state).

Waste collection in rural areas is primarily carried out at the household level using trolleys. This is supported by a fleet of 8,330 vehicles, including trolleys, mini trucks and dumpers. Larger districts, such as Hooghly and South 24 Parganas, operate over 500 vehicles each, ensuring efficient and reliable waste transport and segregation. Meanwhile, smaller districts like Kalimpong are progressively building their resources. All districts follow a segregated waste collection and transportation system to maintain organized waste management.

Graph 5: District wise solid waste generation and collection in rural areas of the state

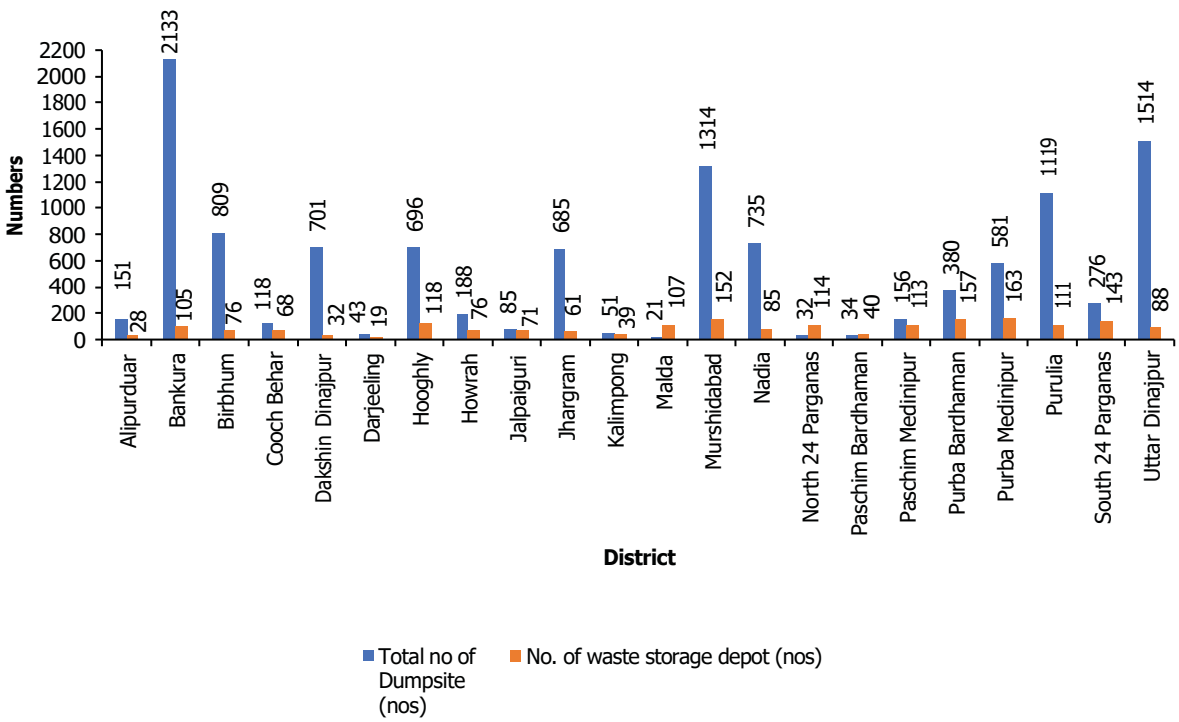


Source: Panchayat & Rural Development Department, GoWB

The waste storage infrastructure varies significantly across districts in terms of dumpsites and waste storage depots. Districts like Bankura (2133 dumpsites, 105 depots) and Murshidabad (1314 dumpsites, 152 depots) exhibit high dumpsite numbers, reflecting both large waste volumes and challenges in waste management. In contrast, districts such as Malda (21 dumpsites, 107 depots) and Darjeeling (43 dumpsites, 19 depots) have fewer dumpsites, indicating either lower waste generation or lack of management systems (See: Graph 6: District wise rural dumpsites and waste storage depots). This distribution highlights the need for targeted improvements in areas with high waste volumes while recognizing effective models in other regions.

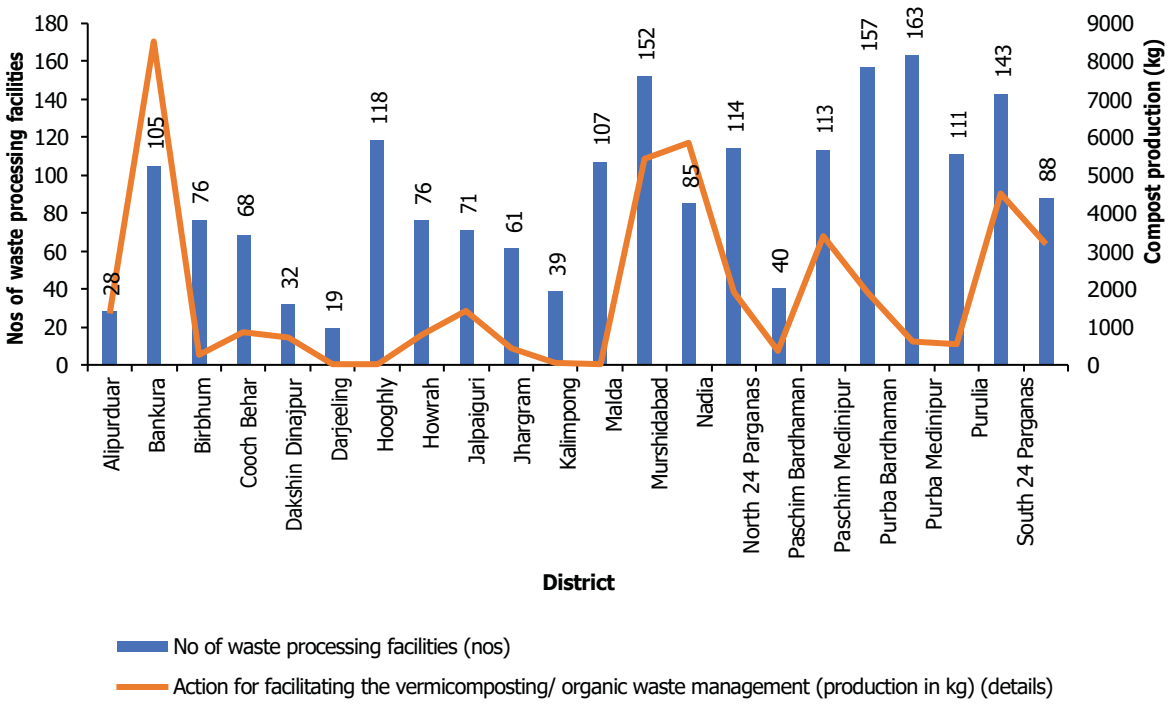
The collected waste is processed at 1,966 waste management facilities across all 22 districts, with Purba Medinipur (163 facilities) leading, followed by Purba Bardhaman (157) and Murshidabad (153). Through these waste processing efforts, a total of 42,220 kg of compost is produced via vermicomposting (See: Graph 7: *No of waste processing facilities (nos)* and production of compost, 2023).

Graph 6: District wise rural dumpsites and waste storage depots



Source: Panchayat & Rural Development Department, GoWB

Graph 7: No of waste processing facilities (nos) and production of compost, 2023



Source: Panchayat & Rural Development Department, GoWB

Additionally, a total of 17,860 awareness programs and workshops are conducted annually to sensitize the public against burning and dumping activities. While significant progress has been made, there remains an opportunity to strengthen enforcement and implement more comprehensive strategies to address challenges like illegal dumping in water bodies, low-lying areas and open burning.

2.2 Plastic Waste

For effective implementation of the Plastic Waste Management Rules, 2016 (as amended) across the State following the MoEF&CC, GoI Notification, the Department of Environment, GoWB had issued Notification vide No. EN/1209/3C-22/2019 dated 27.06.2022 against Banned Plastic Carry Bags (thickness less than 120 microns w.e.f. 31.12.2022) & Single Use Plastic (SUP) items.

However, the uncontrolled plastic waste dumping in open areas, posing severe environmental hazards and public health risks. The state aims for "Towards Zero

Plastic Waste," focusing on changing public behavior as the core of its plastic waste management strategy. The approach also emphasizes reducing plastic use, promoting recycling and advancing packaging solutions with non-plastic, eco-friendly materials in the supply chain.

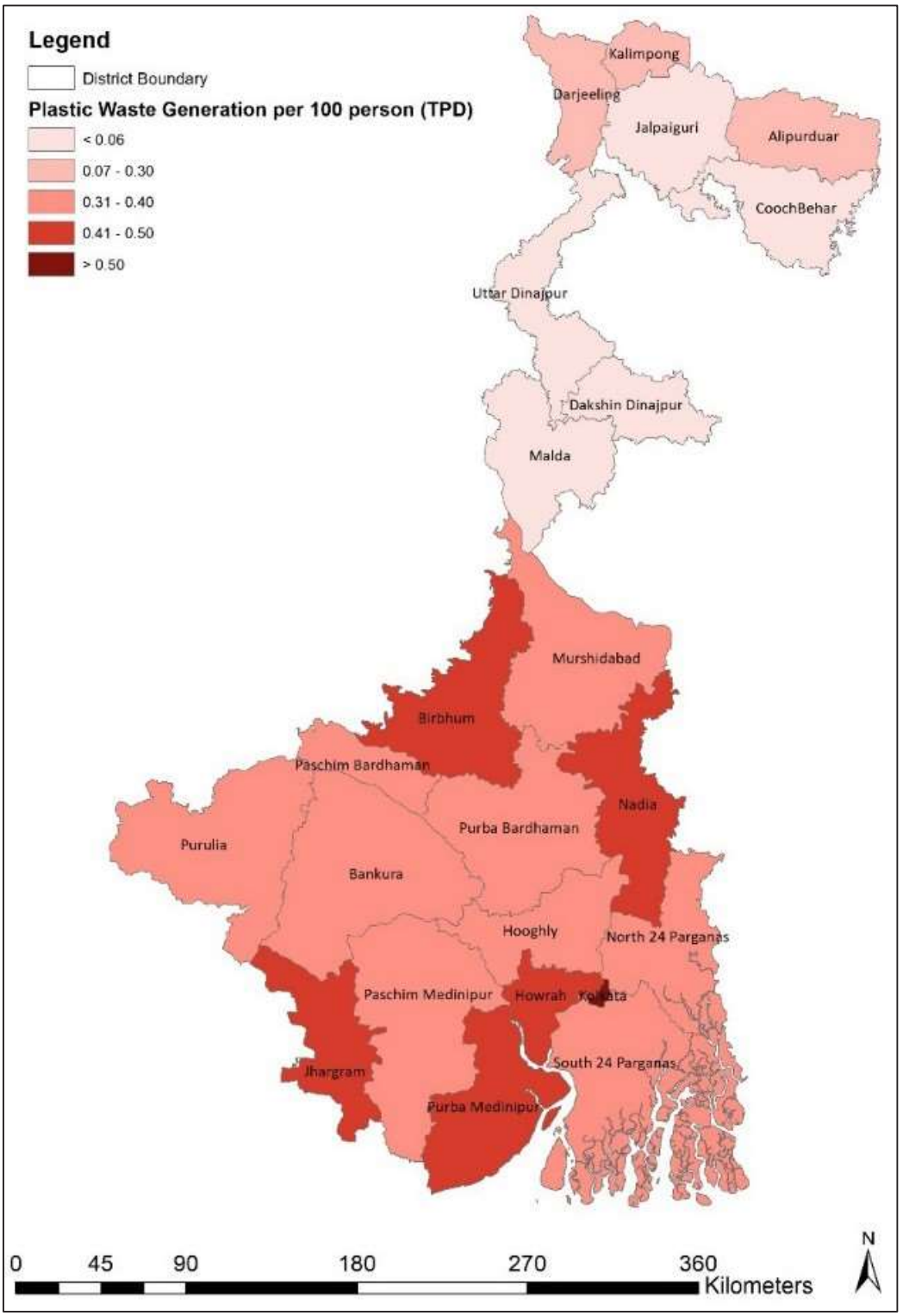
The main types of plastic that comes across in our daily lives are carry bags, bottles, packaging films, wrapping materials, fluid containers, toys, disposable crockery and cutlery, cables, pipes, floorings and other household and engineering applications. These conventional (petro-based) plastics are non-biodegradable and remain in the environment for hundreds of years. Unscientific disposal of plastics leads to accumulation of plastic waste into storm-water drains, low- lying areas, riverbanks, seacoasts, which adds to the climate vulnerability. When unsegregated plastics reach a neighborhood waste collection point, these are often burned openly, which emits toxic gases like carbon monoxide, hydrochloric acid, amines, nitrides, benzenes, dioxins and furans. The same happens at landfill sites when plastics get caught in landfill. This is a serious deterrent to the environment and public health.

West Bengal Pollution Control Board is working to implement Extended Producer's Responsibility (EPR) with Indian Plastic Federation and SUDA. UD& MA Department of GoWB has prepared State Policy for collection, segregation & disposal of plastic waste. The West Bengal Plastic Carry Bags and Garbage Control Bill prohibits manufacture, transport, storage and use of plastics made of recycled plastics. WBPCB has banned the entry, use and sale of plastic carry bags in heritage and tourist places. Carry bags of thickness that are less than 75 microns are banned and WBPCB has released a book on plastic pollution (in Bengali) for public awareness on 5 June, 2023.

As per the WBPCB, the state's 128 ULBs generated around 2,94,789 tonnes of plastic waste in FY 2022-2023. The state also has two plastic manufacturing units. According to SUDA, in 2021, the Kolkata Municipal Corporation (KMC) was the largest contributor, with per capita plastic waste generation at 68 grams per day, followed by Jhargram (48 grams/person/day), Howrah (47 grams/person/day)and Birbhum (46 grams/person/day)(See: Map 10: District wise plastic waste generation in West Bengal). The state's average per capita plastic waste generation in 2021 was 10 kg, over three times the national average.

In 2021, KMC recorded a high per capita plastic waste generation of 24 kg, well above the state's average. To address this challenge, KMC has set up 39 dry waste collection centers specifically for plastic waste. The state supports this effort

Map 10: District wise plastic waste generation in West Bengal



Source: Data from WBPCB; Map generated by CSE

with 14 plastic recycling units. KMC has also established a 2 TPD Plastic Waste Management Plant at Dhapa and plans to commission a 100 TPD Material Recovery Facility (MRF) along with a 10 TPD plastic processing plant within this year.

Furthermore, municipalities like Serampore and Konnagar have partnered with NEPRA Environmental Solutions Pvt. Ltd. in Ahmedabad, Gujarat, to co-process plastic waste. Similarly, Uttarpara Kotrung Municipality collaborates with Clear Clouds Enviro Pvt. Ltd. for plastic disposal. Additionally, multiple waste management agencies work to collect Multi-Layered Plastic (MLP) waste on behalf of producers and scrap dealers, with most of this waste being used for co-processing.

The Board has taken initiatives to conduct training/workshops through offline and online involving CPCB, SUDA and ULBs for redressal of complaints on manufacture, stock, sell and storage of Single Use Plastic (SUP)/ restricted items of plastic lodged by people in mobile app as well as in the portal. The Board has issued directions to Manufacturers, Producer, Importers and Brand Owners (PIBOs), Plastic Waste Processors (PWP) to obtain registration.

Figure 3: Raising awareness to stop the use of single-use plastic.

Source: Dishaearth.org

2.3 Construction and Demolition Waste

While traditionally C&D waste has been collected mixed with the municipal solid waste, C&D waste management rules 2016 mandate generators to segregate C&D waste into at least four fractions: concrete, soil, steel, wood and plastics, bricks and mortar. The rules also provide for generator to hand over the C&D waste to the ULB and pay relevant charges among others. The rules provide for cities to prepare their C&D waste bye-laws and generators to submit C&D waste management plan while seeking building permissions. This section captures largely the interventions related to C&D waste made by KMC as the other ULBs are in process to initiate mechanisms for C&D waste management.

2.3.1 Policy and mandate

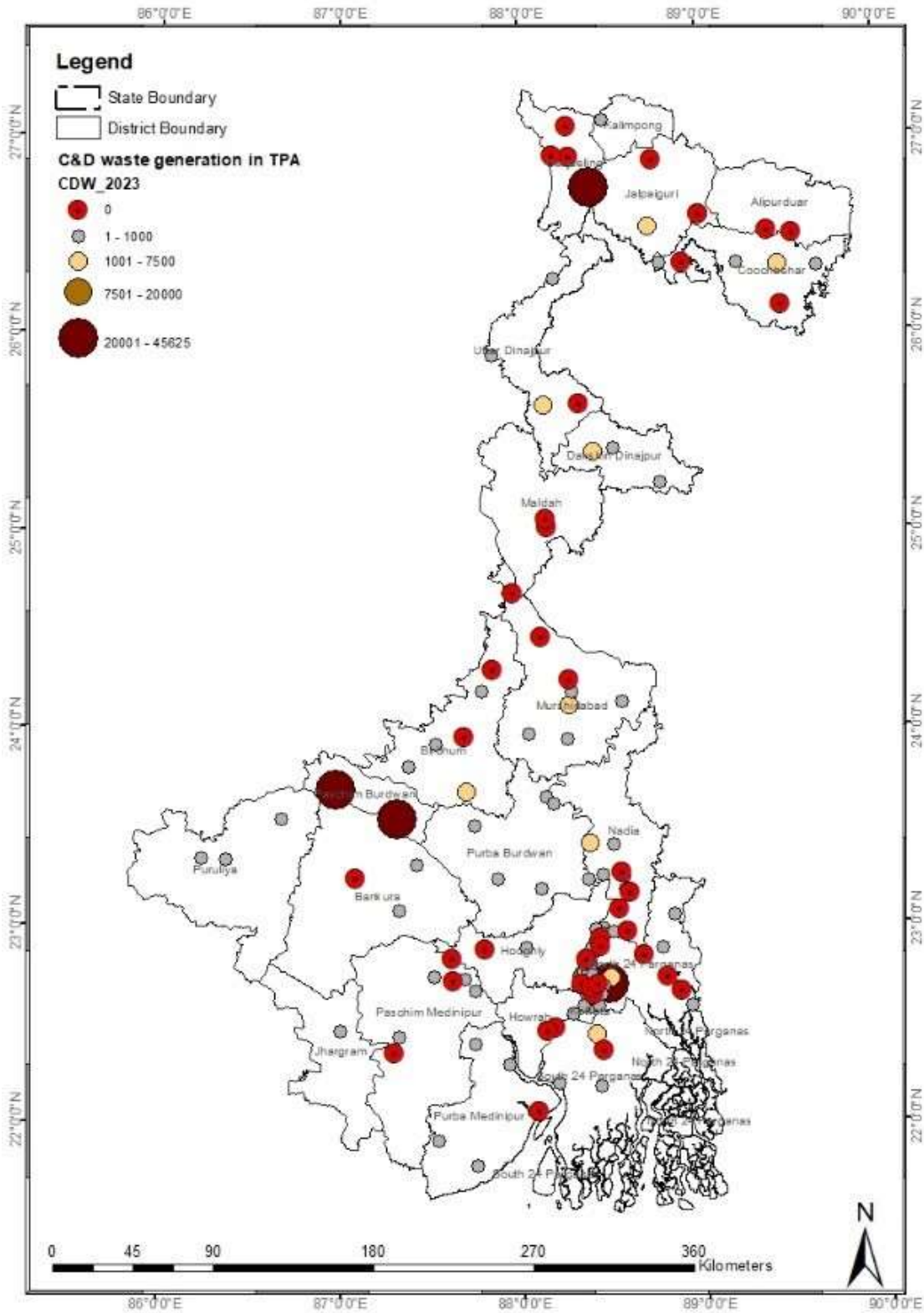
The West Bengal government, in collaboration with SUDA, is in the process of developing Model C&D waste Bylaws for the state. In 2022, West Bengal had already introduced a C&D waste policy, encouraging ULBs to create their own C&D waste bye-laws and establish collection systems. The policy sets ambitious targets: 50 percent collection of generated C&D waste within two years of notification, 80 percent within the following two years and 100 percent within the subsequent year. While Kolkata has already implemented solid waste bye-laws with provisions for C&D waste, other ULBs are in the process of drafting their own waste bye-laws.

2.3.2 C&D waste generation

In 2023, the ULBs in West Bengal generated approximately 1.78 lakh tonnes per annum of Construction and Demolition (C&D) waste, as reported by 101 ULBs. Of this, approximately 0.69 lakh tonnes per annum have been collected by 47 ULBs, while the remaining ULBs are actively developing their collection strategies Top of Form. The Major generator is Asansol Municipal Corporation (125 TPD), followed by Madhyamgram Municipality (78.28 TPD) and Siliguri Municipal Corporation (63.02 TPD). Five ULBs have initiated the recycling of their C&D waste, accounting for around 0.0062 lakh tonnes per annum, constituting only 0.35 percent of the total waste generated. In current practice, collected C&D waste are transported to landfill sites. Additionally, approximately 5.90 percent of the C&D waste is repurposed as material for filling roadbeds instead of traditional mud filling, reported by 13 ULBs. (See: Map 11: Construction and Demolition Waste in ULB's, 2024)Top of Form

According to KMC solid waste bye-laws, a fine of Rs 5,000 will be levied upon all generators for not storing and delivering C&D waste in segregated manner as per schedule B of KMC solid waste bye-laws 2020. In case of disposal of C&D waste and other waste in water body, roads and pavements, a fine of Rs 5,000 will be levied for first time, followed by Rs 7,500 for second violation and Rs 10,000 for every repeated violation. The user fee and fine.

Map 11: Construction and Demolition Waste in ULB's, 2024



Source: Data from SUDA; Generated by CSE

In 2023, a C&D waste recycling plant was established in Patharghata, in Newtown Rajarhat, with a total capacity of 1,600 TPD. Of this, 500 TPD is allocated for Kolkata, while the remaining capacity serves neighboring ULBs like Bidhannagar, Dumdum, South Dumdum and Howrah. This plant is one of the largest C&D recycling facilities in India. Notably, 20,000 tonnes of C&D waste were used to construct a ramp using Honeycomb Gravel Stabilizer Grid Plastic technology. To streamline waste management, KMC has deployed dedicated vehicles to transport C&D waste from collection points to the processing plant. Additionally, The SUDA is in the process of setting up of Construction & Demolition wastes processing facilities in different non-attainment cities and Siliguri in West Bengal.[1]

2.4 E-Waste

E-waste in India predominantly consists of large household appliances such as refrigerators, LED and LCD televisions, washing machines and air conditioners. Additionally, it includes IT and telecom equipment like personal computers, laptops, mobile phones and associated accessories, as well as consumer electronics like televisions, music systems and similar devices as Schedule-1. While these items are not hazardous in their original state, they become harmful when dismantled or processed. [2,3,4] The hazardous materials present, such as heavy metals (lead, mercury, cadmium), flame retardants and other toxic substances, pose significant risks to both human health and the environment once the waste is broken down. This makes e-waste particularly problematic when processed informally, as unregulated dismantling exposes workers and communities to dangerous pollutants.

According to the State of Environment (SoE) report, e-waste typically consists of 50 percent metals, primarily iron and steel, 21 percent plastics and 13 percent non-ferrous metals, including components like copper, silver and gold. The remainder is composed of other elements such as glass, circuit boards and hazardous materials. While the metals and plastics in e-waste can be valuable if recycled properly, the toxic substances must be carefully managed to prevent their release into the environment.

Recycling e-waste properly offers several benefits. It helps recover valuable materials, reduces the need for mining new resources, minimizes environmental pollution and ensures that hazardous materials are disposed of safely. However, state faces a significant challenge in creating awareness among consumers and incentivizing the transition from informal to formal recycling processes.

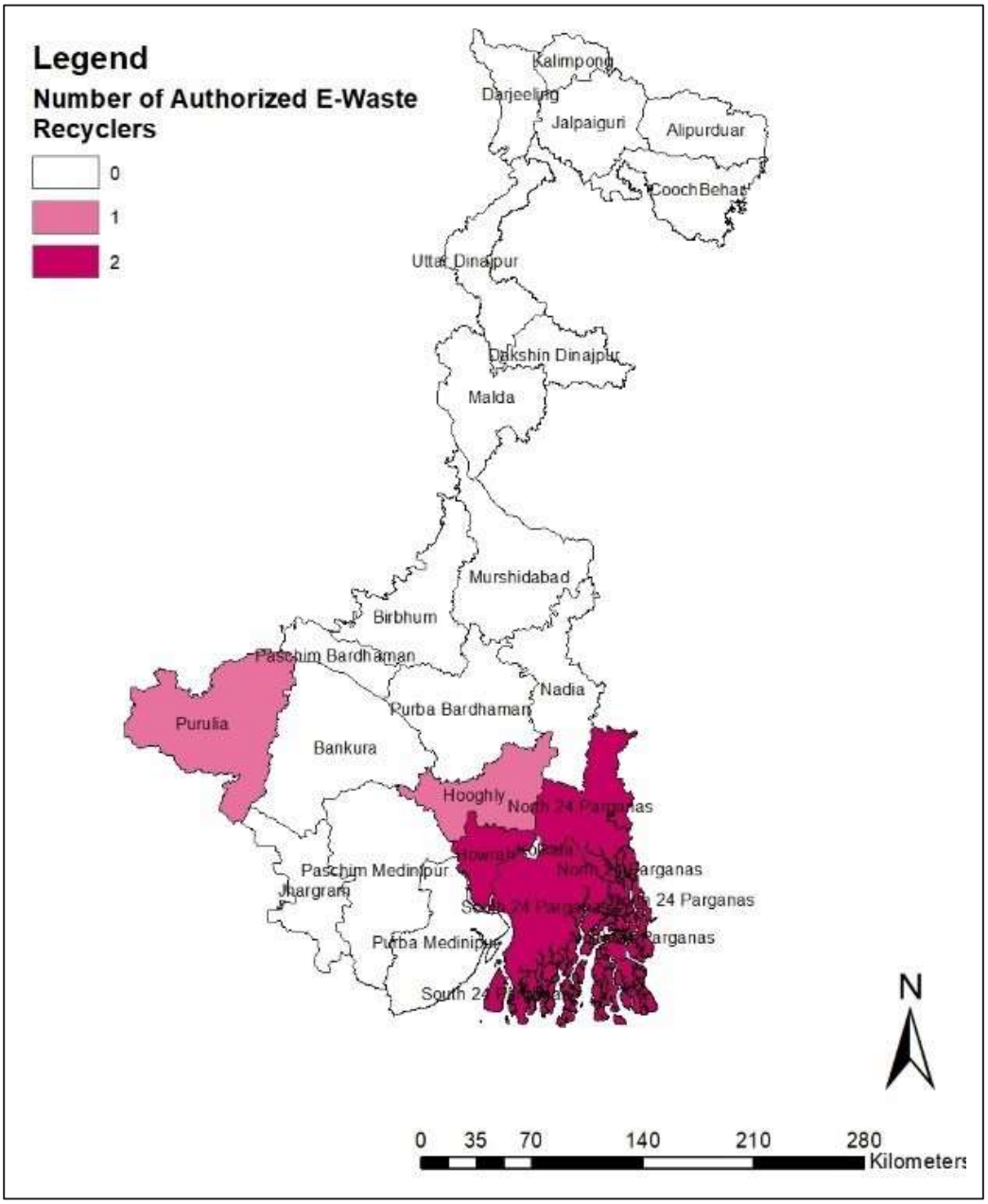
West Bengal has made progress in e-waste management, with five districts—Hooghly, Howrah, Purulia, South 24 Parganas and North 24 Parganas—hosting a total of eight authorized e-waste recycling plants (See: Map 12: District wise number of authorized E-wase recyclers in West Bengal). Those are helps to process a total of 29,946 tonnes per annum e-waste in the state.

Figure 4: E-Waste Bin in Kolkata[5]

Source: West Bengal Electronics Industry Development Corporation Limited

For effective implementation of the E-waste Management Rules, 2016 (as amended), the Board has taken different initiatives across the State along with the Department of Information Technology & Electronic, Govt. of West Bengal and West Bengal Electronics Industry Development Corporation Limited (WEBEL). A model integrated E-waste Management Facility is being set up by WEBEL with financial assistance from the WBPCB for collection-segregation-dismantling and recycling of e-waste in West Bengal.

Map 12: District wise number of authorized E-wase recyclers in West Bengal



Source: West Bengal Pollution Control Board

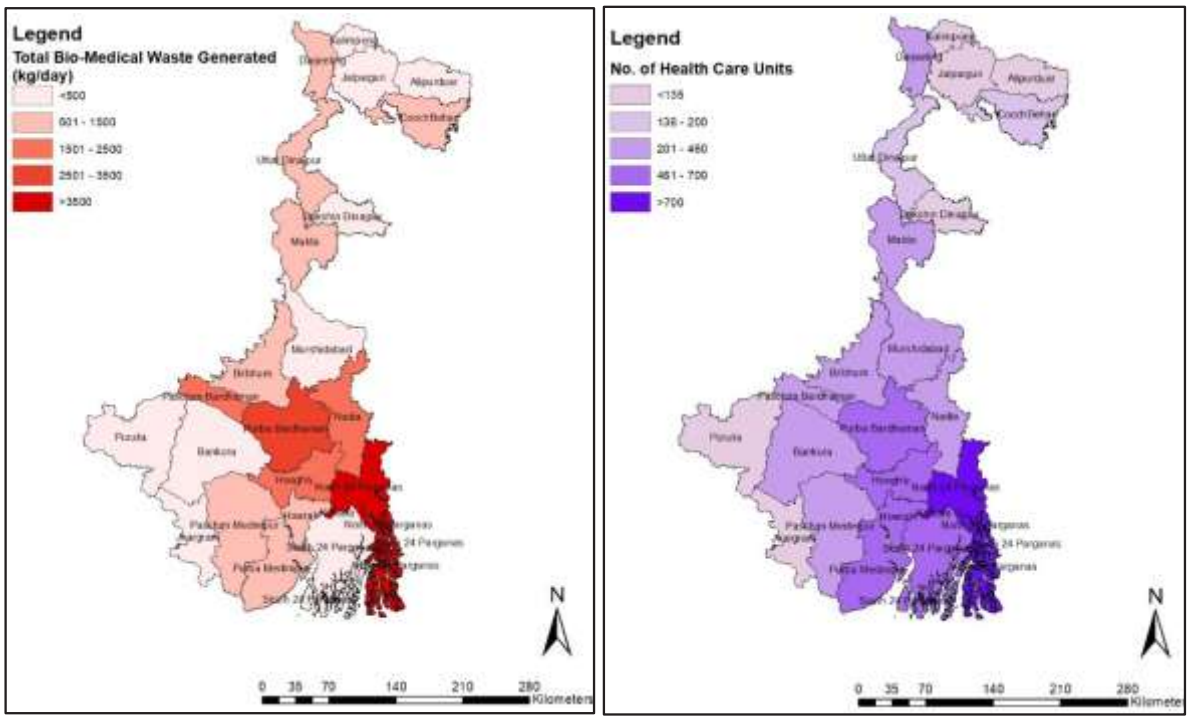
2.5 Bio-Medical Waste

According to CPCB, West Bengal ranked 5th in bio-medical waste (BMW) generation among Indian states in 2014. As of 2024, the WBPCB reports that the state's 23 districts collectively have 9,712 healthcare units, generating approximately 38,886.14 kg of bio-medical waste per day.

2.5.1 Generation of Bio-medical Waste

Kolkata, with the highest number of healthcare units (1,631), produces the most bio-medical waste at 9,107.38 kg/day, followed by North 24 Parganas with 1,179 units generating 6,646.01 kg/day. Purba Bardhaman, with 534 units, generates 3,481.89 kg/day. This data reflects that districts with more healthcare facilities tend to produce larger amounts of waste due to higher patient volumes and medical procedures (See: Map 13: District wise bio-medical waste generation (Left); number of health care units (right) in West Bengal).

Map 13: District wise bio-medical waste generation (Left); number of health care units (right) in West Bengal



Source: West Bengal Pollution Control Board

2.5.2 Treatment of Bio-medical Waste

Of the total bio-medical waste (BMW) generated, approximately 26,862.47 kg/ day is incinerated, while 12,023.67 kg/day is treated through autoclaving. Several districts, such as Purba Medinipur (incinerating 1,284.49 kg/day and autoclaving 7.76 kg/day), Paschim Medinipur (incinerating 1,228.49 kg/day and autoclaving 5.78 kg/day), Murshidabad (incinerating 321.42 kg/day and autoclaving 54.47 kg/day)and Jhargram (incinerating 373.57 kg/day and autoclaving 1.59 kg/day), show a strong preference for incineration, likely due to the ease of operation and the availability of infrastructure.

However, districts like Kolkata (incinerating 4,381.61 kg/day and autoclaving 4,725.77 kg/day) and North 24 Parganas (incinerating 5,005.41 kg/day and autoclaving 1,640.6 kg/day) take a more balanced approach, using both incineration and autoclaving, which reflects the availability of diverse waste treatment facilities.

South 24 Parganas (incinerating 1,390.18 kg/day and autoclaving 1,475.93 kg/day) and Howrah (incinerating 643.3 kg/day and autoclaving 554.69 kg/day) stand out as exceptions, where autoclaving is used almost as much as, or even more than, incineration. These districts are leading in adopting safer and more sustainable methods, shifting towards autoclaving, which is environmentally preferable for certain types of bio-medical waste (See: Map 14: District-wise share of treatment technologies for treating).

2.6 Hazardous Waste

Hazardous waste includes materials that pose substantial risks to human health and the environment due to their toxic, corrosive, flammable, or reactive nature. Proper disposal and management are essential to minimize these risks.

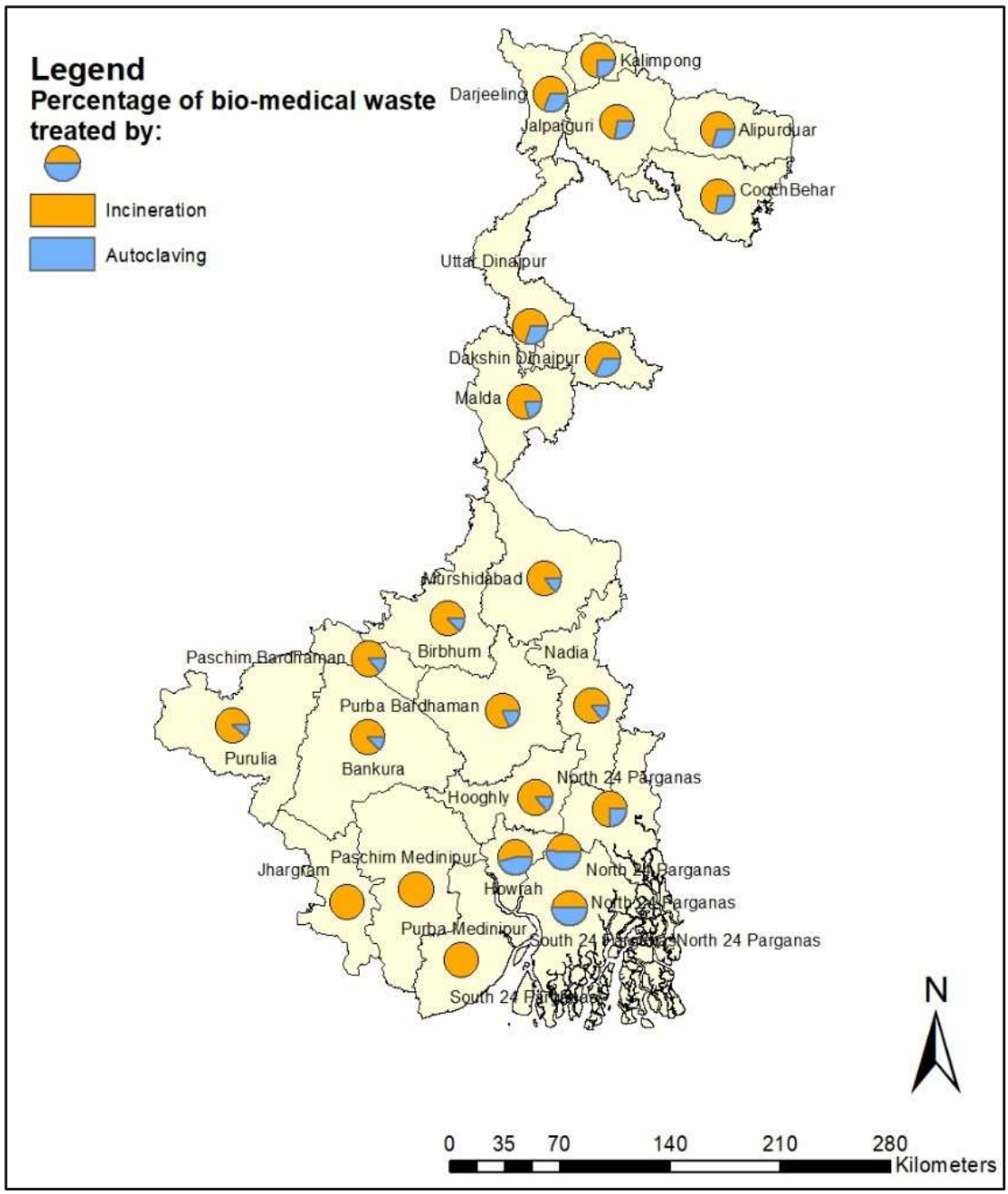
2.6.1 Generation of Hazardous waste

According to the WBPCB, the state generated 2.42 lakh tonnes of hazardous waste in FY 2022-23. The major contributors to this hazardous waste are districts like Paschim Bardhaman, Purba Medinipur, Paschim Medinipur, Howrah and Hooghly. Paschim Bardhaman is the largest generator, accounting for around 35 percent of the total hazardous waste with 82,517 tonnes per year, followed by Purba Medinipur (57,879.46 MT/year) and Paschim Medinipur (32,084.87 MT/year), largely due to the proximity of these districts to the port and the state's industrial corridor.

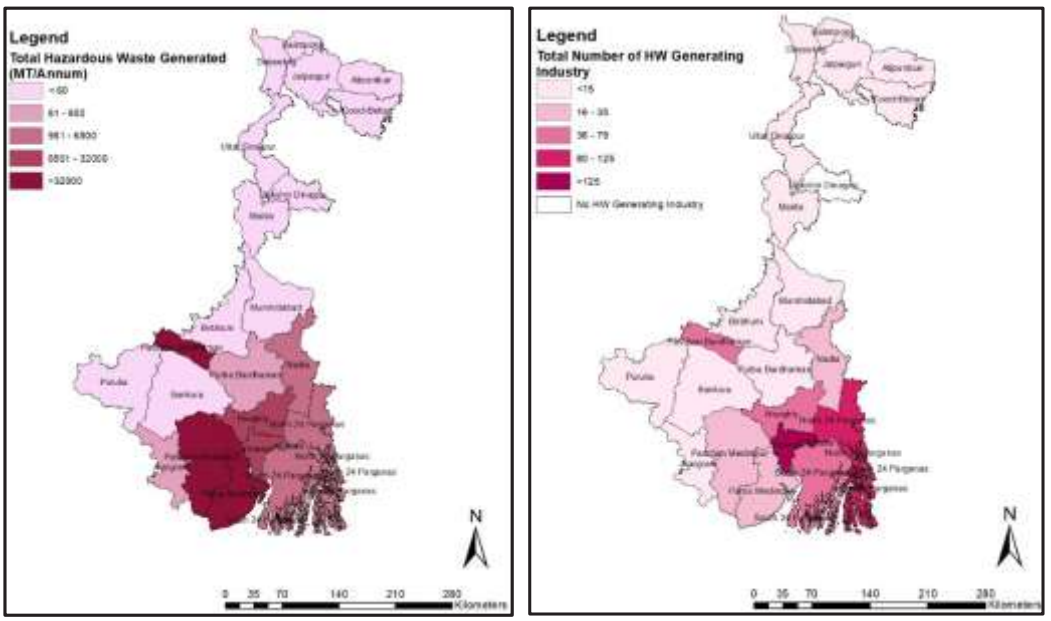
Howrah (24,889.94 MT/year) and Hooghly (21,448.08 MT/year) are also significant contributors, driven by the presence of hazardous waste-generating industries—199 units in Howrah and 56 in Hooghly. Kolkata has 197 hazardous waste-generating units, followed by North 24 Parganas with 121 units and South 24 Parganas with 69 units.

In contrast, some districts like Birbhum, Cooch Behar, Uttar Dinajpur, Dakshin Dinajpur, Alipurduar and Kalimpong reported no hazardous waste generation, likely due to their more rural economies or lack of major industrial activities. This difference highlights the uneven distribution of industrial development and waste generation across the state (See: Map 15: District wise quantity of hazardous waste generation (left); Number of hazardous wastes generating industries (right)).

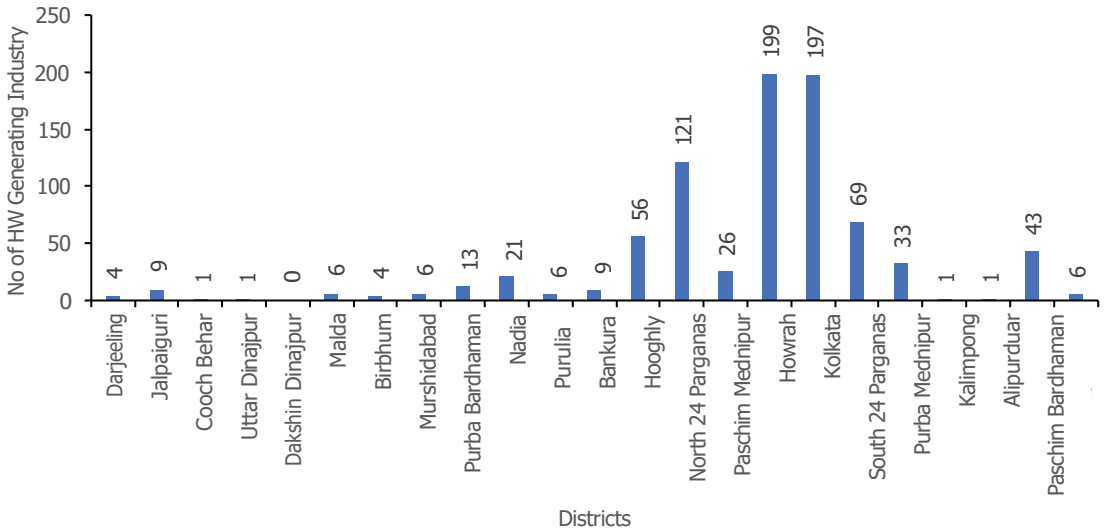
Map 14: District-wise share of treatment technologies for treating



Map 15: District wise quantity of hazardous waste generation (left); Number of hazardous wastes generating industries (right) in West Bengal



Graph 8: Number of Hazardous Waste generating industry

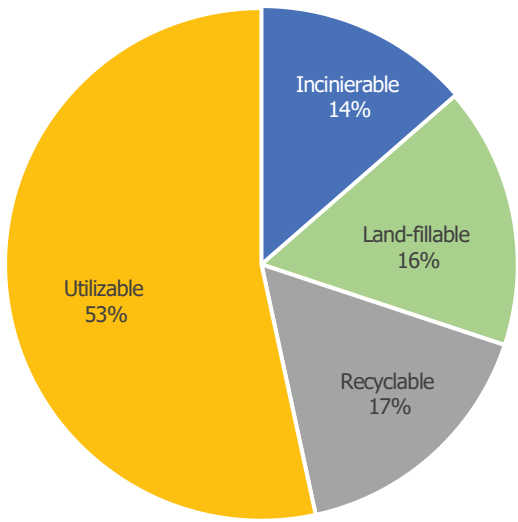


Source: West Bengal Pollution Control Board

2.6.2 Distribution of hazardous waste based on treatment characteristics

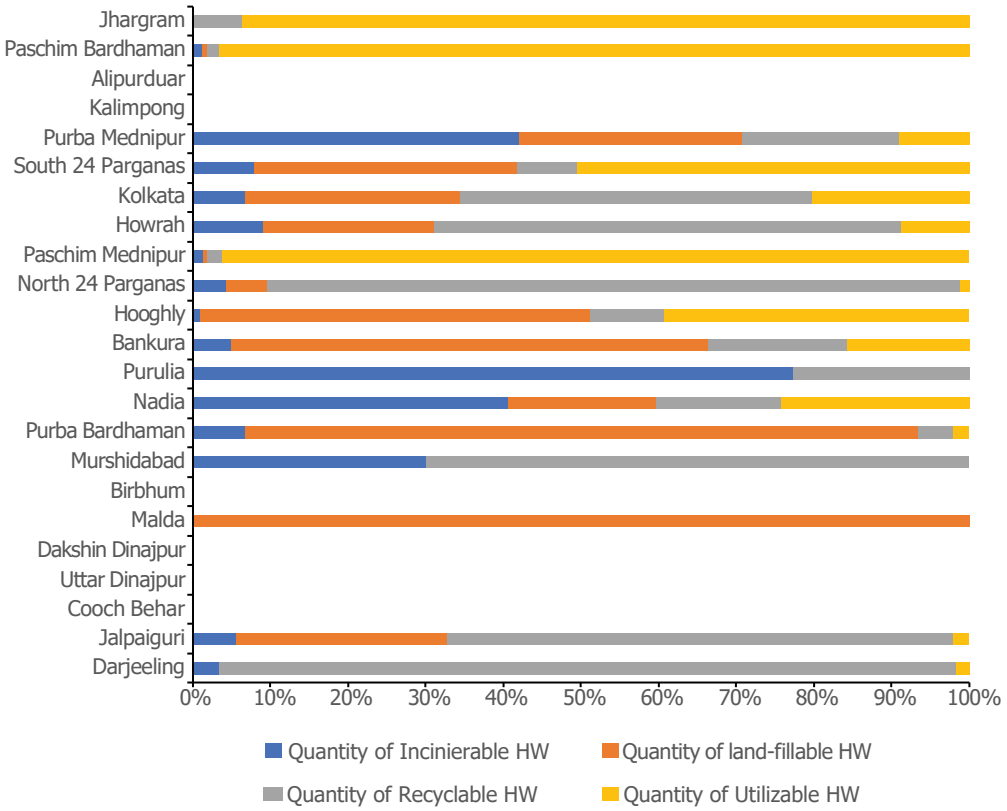
In West Bengal, hazardous waste is treated through three primary methods: incineration, recycling and landfilling. Approximately 55 *percent* of the hazardous waste generated is re utilizable, while 17 *percent* is recyclable. Conversely, 14 *percent* is processed through incineration and 17 *percent* is sent to landfills. Paschim Bardhaman and Paschim Medinipur demonstrate a strong commitment to reutilization, with over 96 *percent* of their generated waste being reused. In contrast, despite having a high generation rate, Purba Medinipur, which accounts for 24 *percent* of the state's total hazardous waste, primarily processes its waste through incineration, with 42 *percent* of the district's waste being incinerated. Interestingly, Darjeeling district, which generates very little hazardous waste, recycles about 95 *percent* of its waste. Meanwhile, Malda district completely landfilled its hazardous waste, followed closely by Purba Bardhaman, where 86.7 *percent* of the waste was landfilled (See: Map 16: Distribution of hazardous waste based on treatment characteristics and Graph 10: Share of HW waste).

Graph 9: Hazardous wastes generated during F.Y. 2022-23



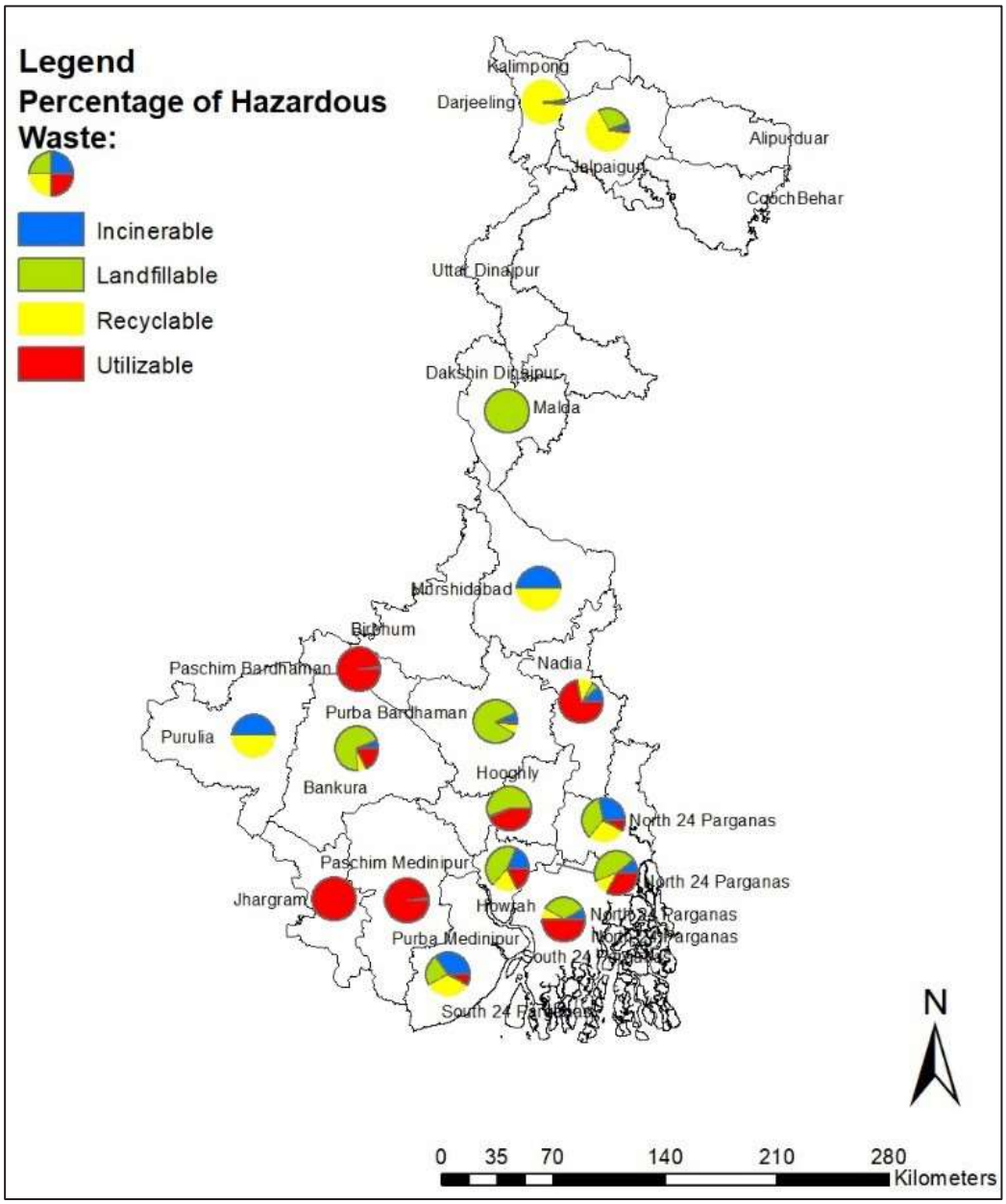
Source: West Bengal Pollution Control Board

Graph 10: Share of HW waste



Source: West Bengal Pollution Control Board

Map 16: Distribution of hazardous waste based on treatment characteristics



Source: West Bengal Pollution Control Board

Theme 2: Water Quality Management Plan

Urban development has led to the modification of rivers through channelization and impoundment to support industry and commerce. However, growing populations along riverbanks have introduced challenges like open defecation and untreated domestic waste being discharged directly into rivers.

Downstream stretches face further pollution from industrial discharges, stormwater and agricultural runoff, especially during monsoons, while drains from urban and industrial areas worsen contamination. Regular water quality monitoring is crucial to assess pollution impacts and ensure the health and sustainability of these vital ecosystems.

The increasing number of critically polluted river stretches has underscored the urgent need for effective water quality management. In response, the National Green Tribunal (NGT), through its order in Original Application No. 673/2018 dated December 6, 2019, directed states to develop, revise and implement comprehensive action plans to restore these degraded river ecosystems.6[6]

The NGT has issued an order for the constitution of a River Rejuvenation Committee (RRC) and a Special Environment Surveillance Task Force (SESTF). This order mandates 100 percent treatment of sewage by March 31, 2020, through in-situ remediation and the initiation of STP setups. It also requires ensuring that all drains and other sewage sources are connected to STPs, with penalties for non-compliance as outlined in the order dated August 22, 2019. The timeline for completing all action plan steps, including setting up and commissioning STPs, extends until March 31, 2021.

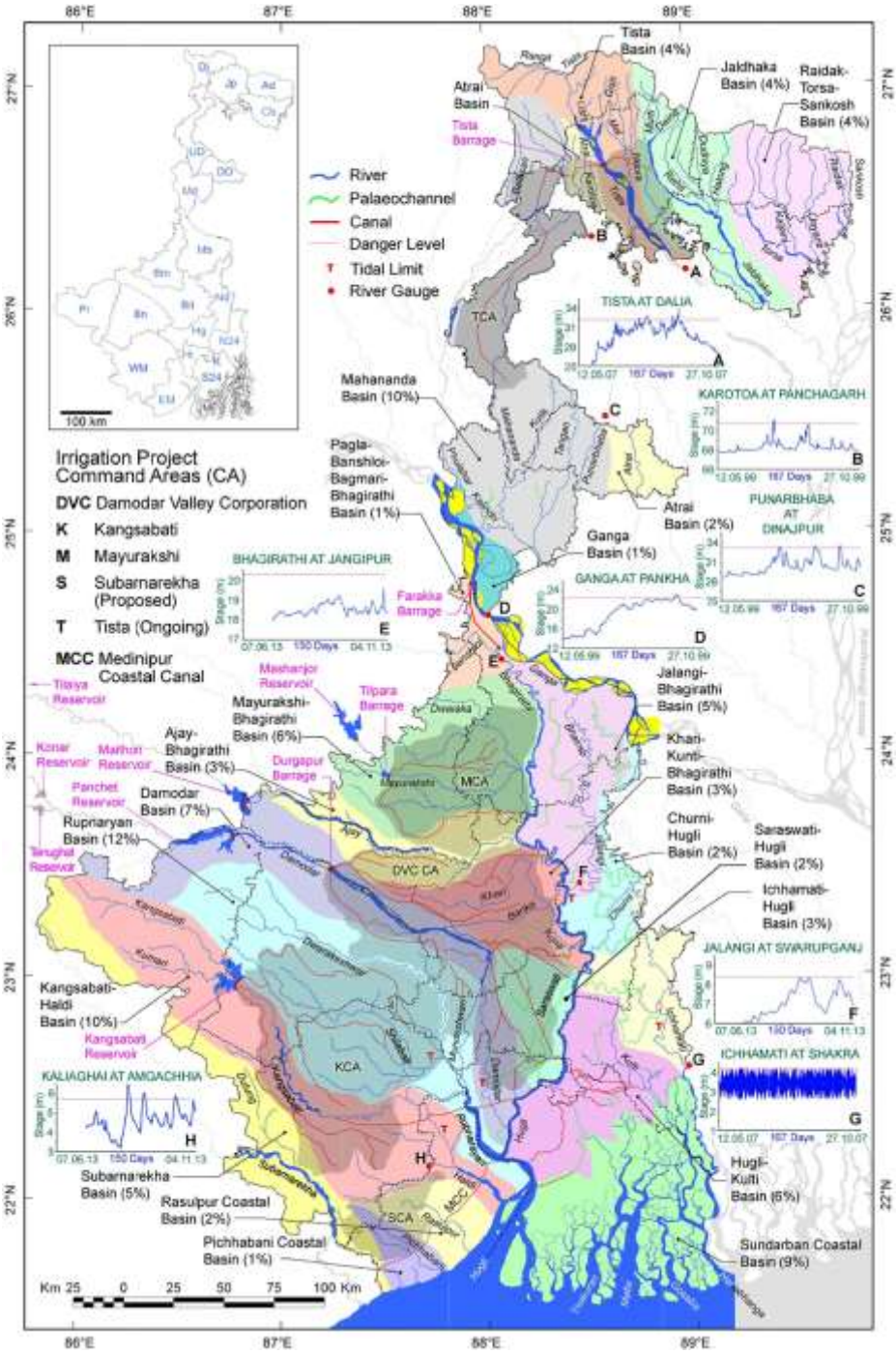
Monitoring will be overseen by the Chief Secretaries of States/UTs and, at the national level, by the Secretary, Ministry of Jal Shakti, with the National Mission for Clean Ganga (NMCG) and CPCB. NMCG will serve as the nodal agency for compliance and submit reports to NGT starting from April 1, 2020.

3.1 River system of the state

West Bengal has a well-distributed network of rivers and rivulets, as it is located at the tail-end of the Ganga basin. The state has 7.5 percent of the nation's water

resources.[7] About six out of 22 drainage basins in West Bengal fall entirely within its boundary (see: Map 17: Drainage basin of West Bengal). Apart from Hooghly and the Teesta, all other rivers are largely rain-fed. The state has three major river basins: 81 percent falls under the Ganga basin, 12 percent under the Brahmaputra basin and 4 percent under the Subarnarekha basin. There are also two smaller coastal basins that make up 3 percent of the state's geography.[8] In addition

Map 17: Drainage basin of West Bengal



Source: West Bengal Pollution Control Board

to its dense network of waterbodies, West Bengal has a 721 km long coastline. According to the State of Environment 2021 of the Government of West Bengal, the total annual water resources of the state are 129.32 billion cubic meters (bcm). The annual extractable groundwater resource is 23.90 bcm (as of 2023), which is about 17 percent of total water resources.[9]

3.1.1 River water quality

As per a Pollution Control Board 2022 report 13 stretches of different rivers in West Bengal has identified as 'polluted' as of 2022 (See: Table 5: The Polluted River Stretches in West Bengal in 2022). The list of 'polluted rivers' includes the Hooghly, Damodar, Barakar, Dwaraka, Mathabhanga-Churni, Jalangi, Mahananda, Teesta, Rupnarayan and Bidyadhari.[10] Within those, one river falls under priority I (BOD exceeding 30 mg/L) and two under priority II (BOD 20–30 mg/L), signifying urgent pollution remediation needs. Urban, industrial and agricultural effluents have degraded water quality, rendering rivers unsuitable for bathing per CPCB standards (See: Map 18: Polluted River Stretches in West Bengal in 2022).

Table 5: The Polluted River Stretches in West Bengal in 2022

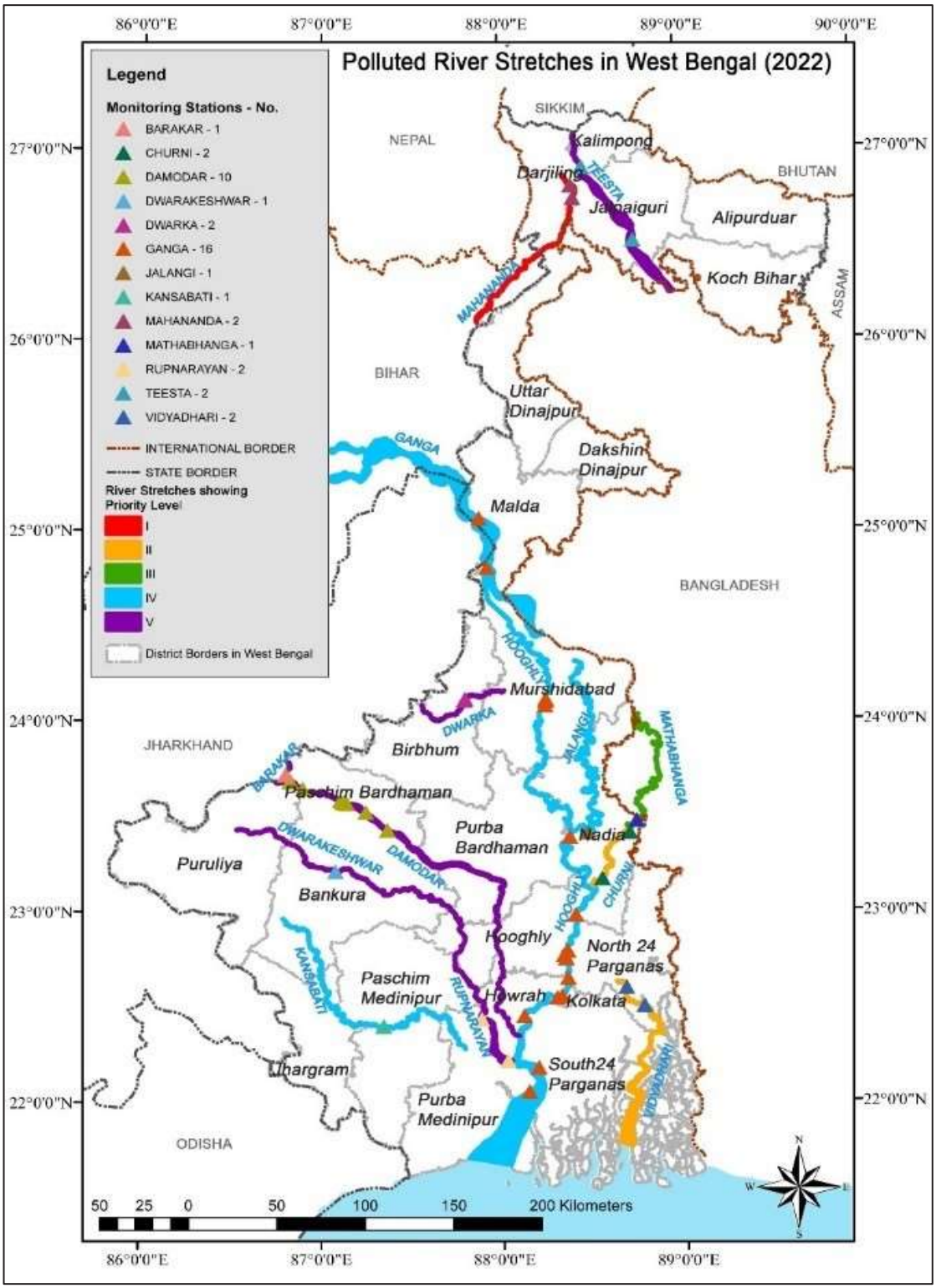
Sl no	River	Executing Agency	2022 Priority
1	Vidyadhari	PHED	II
2	Mahananda	SJDA	I
3	Churni	KMDA	II
4	Dwarka	PHED	V
5	Ganga	KMDA	IV
6	Damodar	ADDA	V
7	Jalangi	MED	IV
8	Kansai	MED	IV
9	Mathabhanga	PHED	III
10	Barakar	ADDA	V
11	Dwarkeswar	MED	V
12	Rupnarayan	MED	V
13	Teesta	SJDA	V

Source: Urban Development and Municipal Affairs, GoWB

3.1.2 Water Quality Monitoring Stations

The 2022-2023 Annual Report of the WBPCB states that water quality monitoring in West Bengal is carried out at 140 stations under the National Water Quality Monitoring Programme (NWMP), in compliance with OA 673/2018 and OA 200/2014, with a specific focus on Ganga River pollution. These include 72 surface water monitoring stations, comprising 55 for rivers, 14 for ponds/lakes, 2 for canals,

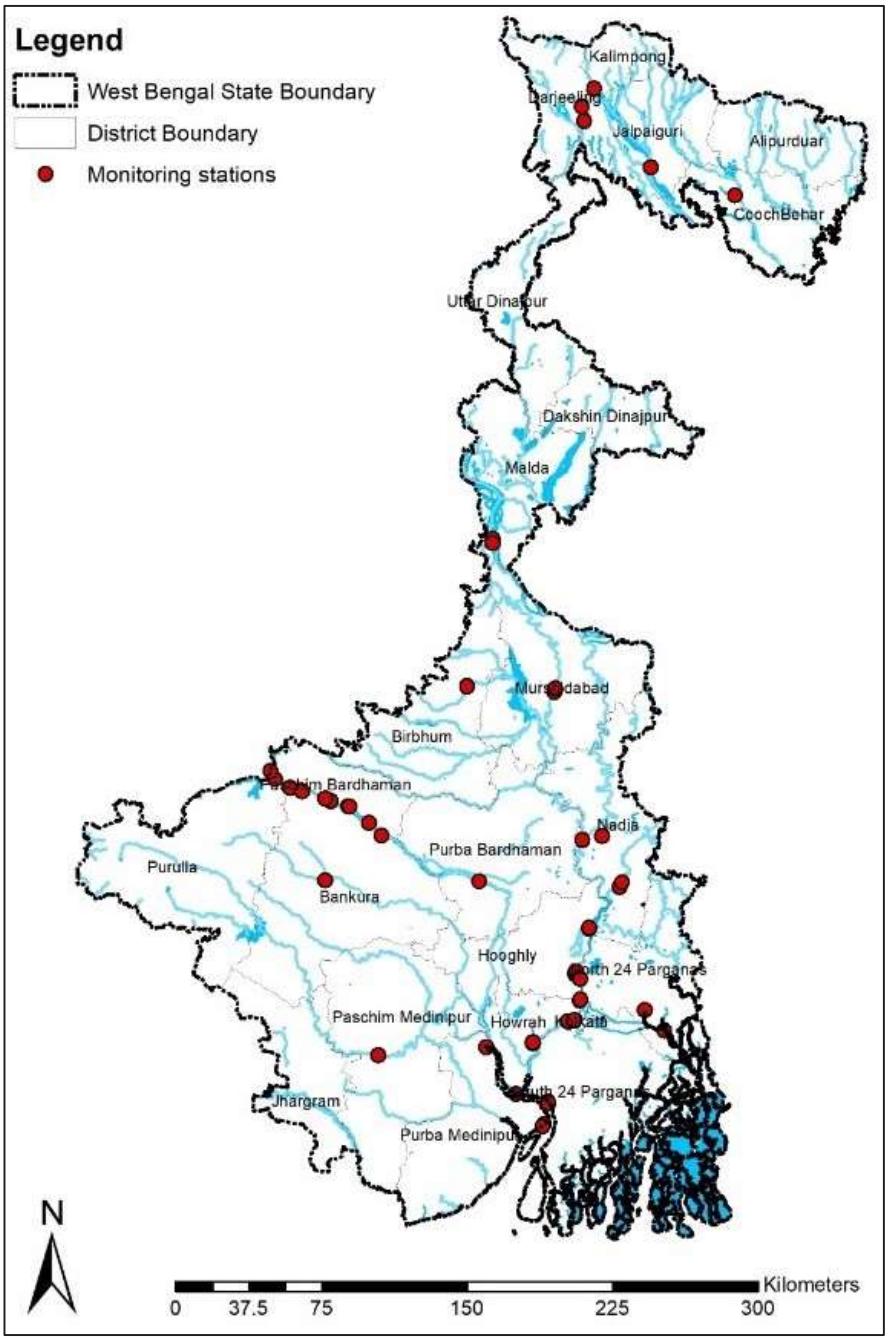
Map 18: Polluted River Stretches in West Bengal in 2022



Source: West Bengal Pollution Control Board

and 1 marine station, alongside 68 groundwater monitoring stations. Additionally, 15 locations along the Ganga River are monitored under both the National Mission for Clean Ganga (NMCG) and NWMP initiatives (see: Map 19: Location of river water quality monitoring station). WBPCB collects water sample from NWMP stations are collected monthly, while samples from Ganga stations under the NMCG are collected fortnightly. Groundwater samples are collected biannually.

Map 19: Location of river water quality monitoring station



Source: West Bengal Pollution Control Board and India Rivers Week 2016

3.1.3 Pollution load in rivers

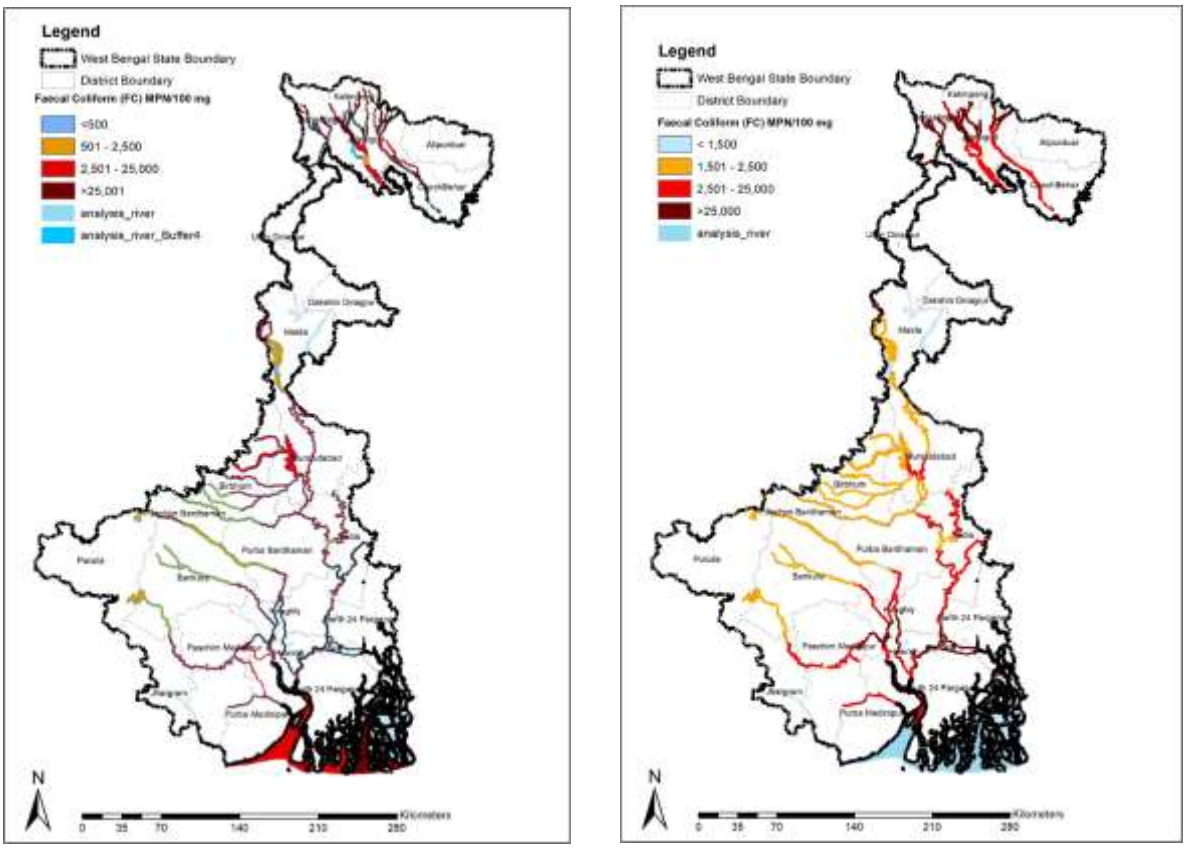
West Bengal Pollution Control Board in collaboration with the Central Pollution Control Board, under the National Water Monitoring Programme (NWMP), conducts regular monitoring of water quality of all major rivers of the State. WBPCB collects water sample from NWMP stations are collected monthly, while samples from Ganga stations under the NMCG are collected fortnightly. These samples are analyzed for a range of parameters, including physico-chemical indicators such as pH, total suspended solids, dissolved oxygen, biochemical oxygen demand (BOD), chemical oxygen demand (COD)and ammonia, nitrate, as well as bacteriological parameters like total coliform and fecal coliform. This comprehensive approach aims to ensure effective monitoring and management of water quality across the state.

According to WBPCB's 2022 report, the Hooghly River's average BOD level is 2.57 mg/land the annual average DO level is 6.34 mg/l, meeting CPCB's bathing water quality standards. However, faecal coliforms and faecal streptococci levels exceeded permissible limits, indicating potential sewage overflow or discharge of waste from various sources. These making it unfit for bathing, recreational and drinking purposes without proper disinfection. Micropollutants such as trace metals, pesticides, etc. were found within limit in the Bhagirathi-Hooghly River system.

The major concern of water quality of river Ganga is BOD concentration occasionally marginally above the criteria value (3.0 mg/l) and presence of high level of Faecal Coliform bacteria, then criteria value was observed almost in all stations through the study period whereas reduction trend was noticed in upstream of the river (Farakka, Khagra, Nabadip and Tribeni). (See: Map 20: Faecal Coliform (FC) MPN/100 mg in Pre-Monsoon and Post Monsoon) The Dissolved Oxygen levels are however, good in river water throughout the period indicating that the river water is suitable for aquatic life.

The BOD level of river Damodar was found to be generally below the maximum criteria value except occasional exceedance at a few locations. The level of DO at ten locations of river Damodar were found well above the minimum criteria level which indicated the aquatic condition was satisfactory for aquatic flora and fauna. The Damodar River has an annual faecal coliform level of 32.2 x 10^2 MPN/100 ml, exceeding permissible limits, suggesting untreated sewage overflow. Major rivers like Barakar, Silabati, Rupnarayan, Kasai and Vidyadhari also surpass permissible faecal coliform levels, posing risks of waterborne diseases.

Map 20: Faecal Coliform (FC) MPN/100 mg in Pre-Monsoon and Post Monsoon



Source: Data provided by WBPCB; map generated by CSE

3.1.4 Water pollution control in rivers and waterbodies

In West Bengal, as part of the Namami Ganga Programme, the WBSPMG is focused on protecting the water quality of the Hooghly River. The state monitors 53 river locations under the National Water Quality Monitoring Programme (NWMP). There are 33 Sewage Treatment Plants (STPs) with a total capacity of 717.72 million liters per day (MLD). Four STPs with a combined capacity of 190.7 MLD are currently being renovated, while ten new plants are under construction. Additionally, 18 more STPs are planned to ensure proper sewage treatment before discharge into rivers.[11]

The River Rejuvenation Committee of West Bengal has prepared an action plan for Rejuvenation of River Ganga in 2020 with the target of making water fit at least for bathing purposes (i.e. BOD< 3 mg/l and FC < 500 MPN/100 ml). Within this framework, there is a programme to preserve the water quality of West Bengal's 25 rivers. This should be leveraged for creating riparian buffers along riverbanks.

The West Bengal Pollution Control Board reports that in addition to the government owned STPs, there are 153 private STPs with a total capacity of 54.27 MLD, mainly in hospitals, housing complexes and commercial areas. According to the 2020 action plan, the Hooghly River annually receives 1084 MLD of sewage, with 1012 MLD treated before discharge and 1117.5 MLD of industrial effluent from ETPs.[12] The implementation of water treatment measures has improved the Ganga River's water quality from Farakka to Diamond Harbour to Priority V, as observed from June to December 2022 and highlighted in the 2nd National Ganga Council Meeting on December 30, 2022.[13]

Need upstream and downstream monitoring of water quality to assess actual impacts on a range of parameters including pH, TDS, total nitrogen, ammonia, heavy metals and mercury etc. This is needed to ensure that the water quality standards are met. Also assess aquatic ecosystems and monitor invasive and exotic species.

Alternative treatment technology

To address river pollution, West Bengal has implemented alternative treatment technologies, as reported by the WBPCB. For instance, the Jangipur drain, which flows into the Ganga, has been equipped with a bio/phyto remediation process, with a treatment capacity of 0.2 MLD. Periodic chemical dosing is carried out and test results suggest that the current treatment process may achieve the desired water quality. Similarly, the Sreenathpur drain at Churni has been fitted with the same technology, with a treatment capacity of 2.79 MLD. Work is also underway to implement this technology for the Basko canal feeding into Churni. Additionally, nine rivers are planned to receive in-situ alternative treatment technologies at identified polluting drains.

On pollution caused by idol immersion during religious festivals, the Government of West Bengal has notified the West Bengal Prevention and Control of Water Pollution (procedure for Immersion of Idol after Pujas) Rules in September 2018. These rules mandate Puja Committees to regulate the physical and chemical characteristics of puja idols. The ULBs and district authorities are mandated to perform a series of duties from planning of immersion points to collection of debris post-immersion and disposal at the sanitary landfills. Levying immersion fees from the puja committees and spot fines on non-compliance to the rules are also part of the duties of the ULBs and district authorities.[14]

The WBSEP 2021 report indicates that districts such as Kalimpong, Uttar Dinajpur, Alipurduar, Paschim Burdwan, Purba Burdwan, Hooghly, Jhargram,

Purba Medinipur and South 24 Parganas have successfully controlled riverside open defecation. Additionally, Darjeeling, Cooch Bihar, Nadia and Bankura districts have implemented measures to partially control open defecation.

3.1.5 Coastal Water Quality at Digha

State Board monitored to assess the coastal water quality of Digha (India) in the north western coast of the Bay of Bengal. Digha is a meso-tidal coastal plain located between two major estuarine systems, i.e. Subarnarekha and Hooghly located respectively on the western and eastern side of the West Bengal along the northeast coast of India. Board started the monitoring of the coastal water quality from January 2021.

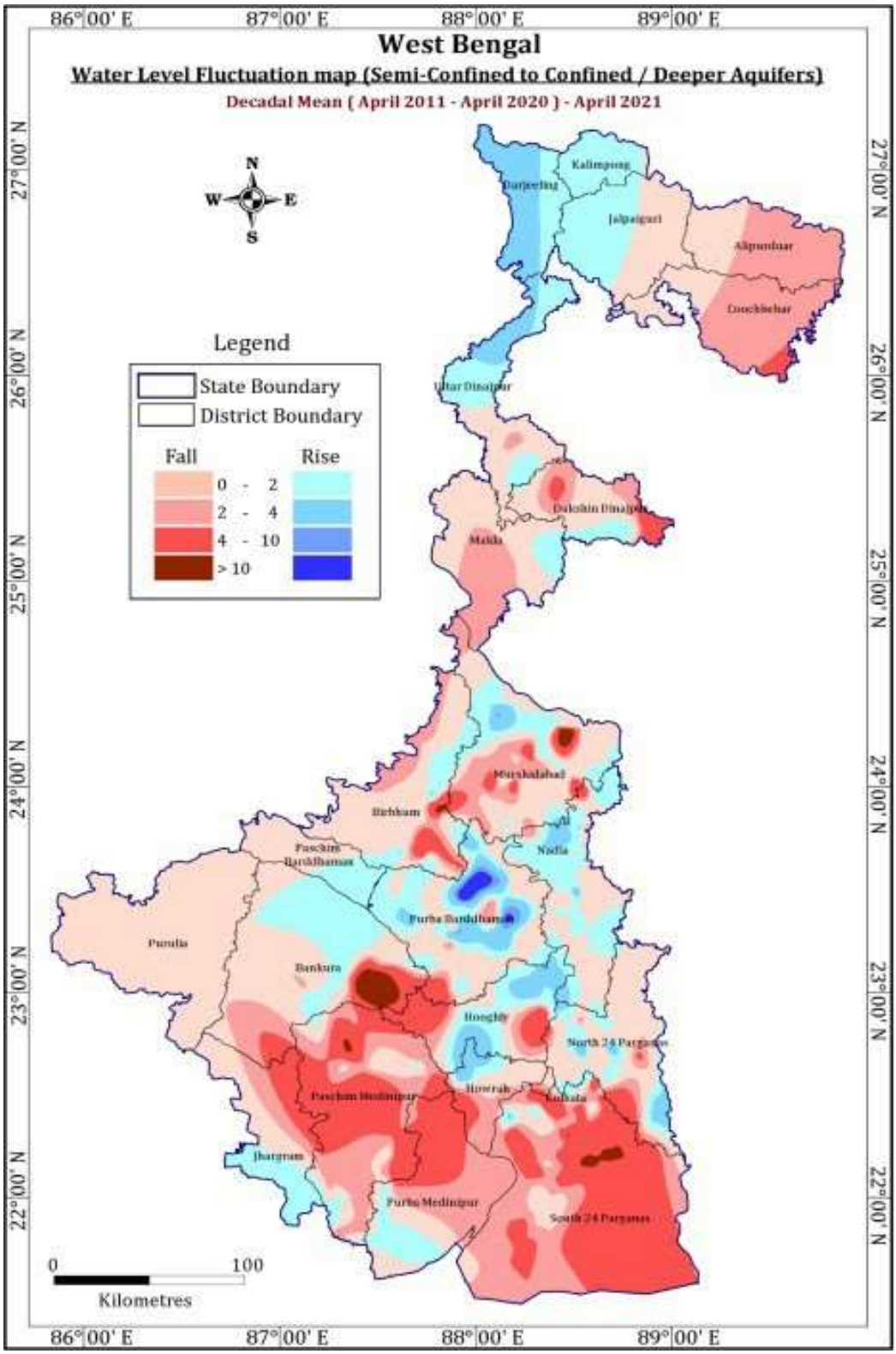
The DO was found to be well above the water quality criteria 4.0mg/l, indicating that the water quality is suitable for aquatic life. The BOD value is well within the criteria value throughout the study period (3.0 mg/l). Faecal coliform counts above the criteria value through out study period.

3.2 Groundwater

In West Bengal, groundwater is mostly extracted for minor irrigation purpose and it covers 2.44 percent of total irrigated area. The average decadal pre monsoon (April 2011–April 2022) water-levels fluctuation occurred within the range of 0–2 meters. Around 5.8 percent the state shows a rise of 2–4 meters and 2.6 percent shows a rise of more than 4 meters. On the other hand, 11.1 percent of the total aquifers demonstrated a decline of 2–4 meterman 10.9 percent experienced a decline of more than 4 meters. Over the past decade, southern districts, including both coastal and laterite zones, experienced a decline in groundwater levels exceeding 4 mbgl. Some parts of Bankura, Murshidabad and South 24 Parganas district have experienced decline of more than 10 mbgl in groundwater levels.[15] This could be attributed to expansion of groundwater irrigation through deep tube wells, shallow tube wells and dug wells (see Map 21: Decadal water-level fluctuations from April 2011 to April 2021).

Ground water quality of the State is monitored in 68 locations twice in a year (April & October). All parameters (Physico – Chemical Parameters, Biological, Metal & Pesticides) are monitored in the month of April & in October. All the parameters are monitored in the station situated near the River Ganga. The data are available at Board's website www.wbpcb.gov.in. Across the State it was found that ground water was free from heavy metal pollutant & pesticides. Occasional presence of Arsenic, Iron, Faecal Coliform could be observed.[16]

Map 21: Decadal water-level fluctuations from April 2011 to April 2021

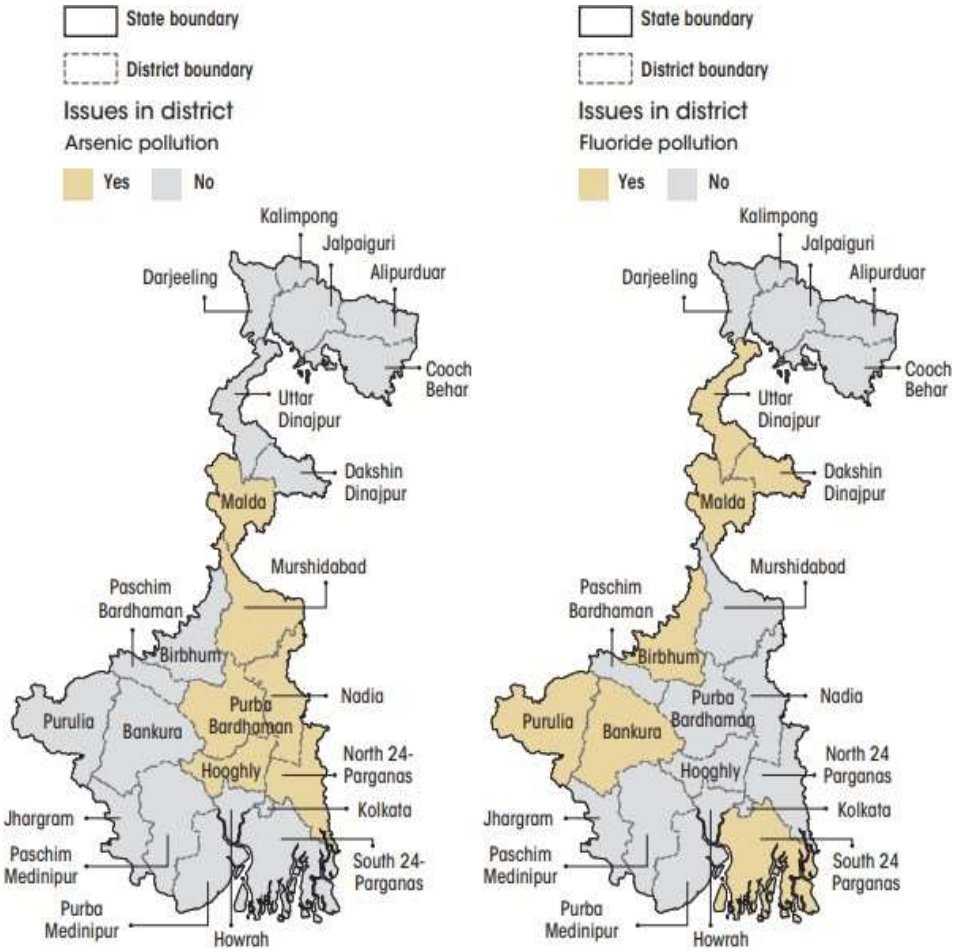


Source: CGWB report 2022

3.2.1 Contamination in groundwater

According to the Water Resource Department, 81 blocks in eight districts and 49 blocks in seven districts of West Bengal suffer from arsenic and fluoride contamination in groundwater, respectively. The IPCC AR 6 report warns that climate change exacerbates the presence of arsenic in groundwater, potentially reducing rice production by 39 percent by 2100. This poses a serious threat to food security, especially in low-income countries where rice is a staple crop[17]. Additionally, drought conditions increase salt levels like chloride and fluorides, contaminating drinking water and heightening water insecurity in drought-prone region (see: Map 22: Ground Water Quality (left: arsenic pollution; right: fluoride pollution)).

Map 22: Ground Water Quality (left: arsenic pollution; right: fluoride pollution)



Note: According to PHED, 83 blocks in eight districts are affected by arsenic, 43 blocks in seven districts are affected by fluoride and 53 blocks in four districts are affected by salinity. Presence of geogenic contaminants is found in groundwater extracted from shallow handpump tubewells (arsenic contamination)/deep hand pump tubewells (fluoride contamination).

Source: Water Resources Investigation and Development, GoWB

Groundwater in West Bengal shows significant Total Dissolved Solids (TDS) variation, often exceeding the 500 mg/L drinking limit (BIS: 2012). High TDS can affect taste, water corrosiveness and crop productivity, leading to increased

fertilizer use and GHG emissions. In 2011, TDS exceeded limits in various districts, including North and South 24 Parganas, Purulia, Bankura, Howrah, Kolkata and Midnapur. By 2019, TDS surpassed limits primarily in Howrah, Kolkata and 24 Parganas. Total hardness increased in some districts like Hooghly and South 24 Parganas from 2011 to 2019, while chloride levels remained within permissible limits in all districts. This leads to higher use of fertilizer in agriculture and higher GHG emission from crop land (see: Table 6: Groundwater quality).

Table 6: Groundwater quality

Parameter Districts	TDS (Total Dissolved Solids) (ppm)		Chloride (ppm)		Total Hardness, CaCO3 (ppm)		pH	
	2011	2019	2011	2019	2011	2019	2011	2019
Bankura	645.2	420.48	165.33	100.77	285.58	235.33	6.52	8.01
Birbhum (Pre 2017)	348	369	49	78	196	165	7.81	7.29
Bardhaman (2020)		405	26.94	63	190	259	7.49	7.39
Cooch Behar	172.81	178.07	28	30.86	114.25	97.35	7.65	7.62
Dakshin Dinajpur	201.27	301.52	25	32.42	158.36	125.71	7.28	8.06
Darjeeling	138.64	159.02	31.62	29.23	72.09	72.23	6.63	7.45
Hooghly	406.27	371.15	43.07	57.89	200.52	236.06	7.87	7.56
Howrah	616.6	716.43	116.7	165.55	262.4	291.5	7.7	7.52
Jalpaiguri	145.19		23.18		88.84		7.02	
Kolkata	1230.61	972.42	330.45	306.19	434.09	405.71	7.79	7.83
Maldah	278.74	368	32.8	51.9	241.79	231	7.34	7.68
Murshidabad	499.18	384.74	41.25	44.88	227.18	166.09	7.6	7.63
Nadia	480.37	493.12	60.48		273.97	229.36	7.93	7.36
North 24 Parganas	633.6	569.49	128.67	116.38	242.26	219.15	7.56	7.93
Paschim Medinipur	185.34	200.84	37.47	81.2	95.57	127.65	6.74	7.84
Purba Medinipur	407.14	479.41	110.86	116.8	212.34	155	7.07	8.01
Purulia (Pre 2019)	665.55	407.95	145.48	105.79	276.29	236.63	6.63	8
South 24 Parganas	874.4	948.17	297.7	318.36	368.69	243.79	7.68	7.82
Uttar Dinajpur	113.18	194.28	29.86	39.42	73.94	82.71	7.45	7.42

Source: Water Resources Investigation and Development, Govt. WB

denotes maximum levels

3.2.2 Groundwater Monitoring Network

The state government has already established a groundwater-level monitoring network consisting of approximately 2,000 groundwater monitoring wells. This network includes 523 real-time groundwater monitoring wells equipped with Digital Water Level Recorders (DWLR) and Telemetry Systems. These advanced technologies facilitate accurate and timely monitoring of groundwater resources. This network needs to be expanded and strengthened for real-time monitoring.

3.3 Conserving rain water

Diverse set of approaches have been adopted to conserve and augment fresh water through decentralized and distributed water management systems across climatic zones of the state. These include rainwater harvesting techniques, rejuvenation of waterbodies and soil moisture conservation techniques.

3.3.1 Rejuvenating water bodies to augment surface water availability

This is an extensive rainwater harvesting programme in the state targeting revival of neglected ponds and the creation of new ones in targeted land. This facilitates large-scale area-wide rainwater harvesting that also controls surface runoff effectively and improves overall availability of water resources.

This reduction in runoff also helps to mitigate erosion, flooding, waterbody contamination while increasing water-holding capacity. This also lessens the reliance on groundwater and surface water sources for irrigation during dry spell and substitutes domestic use. This also enables development of pisciculture, offering an additional source of income for the local communities.[18]

As part of Jal Dharo Jal Bharo and Jal Tirtha initiatives, a total of 314,522 waterbodies and retention structures have been either created or restored. A total of 86,232 equivalent tanks have been constructed by WRI&DD and 228,225 waterbodies created or renovated along with the P&RD Department. The WRI&DD has created or restored 65 ponds under MGNREGA (see: Table 7: Waterbodies created or renovated by WRIDD and P&RD). The southern regions of the state have a significant number of tanks, which are utilized to collect rainwater and offer irrigation services during the dry season.[19]

To support this, a mass awareness campaign has been launched in Kolkata areas and different districts of the state to create awareness. For the awareness campaign a documentary film Jal Dharo Jal Bharo was prepared by SWID in six languages (Bengali, English, Hindi, Nepali, Urdu and Ol Chiki or Santali

Language)

Table 7: Waterbodies created or renovated by WRIDD and P&RD

Financial year	Waterbody created/ renovated in convergence with P&RD	Equivalent tank created/retention structure by WRIDD	MGNREGA pond by WRIDD
2011–12	23,983	16,903	0
2012–13	27,596	11,717	0
2013–14	26,525	3,697	0
2014–15	14,443	2,746	0
2015–16	18,565	11,363	0
2016–17	26,557	11,776	65
2017–18	30,887	6,335	0
2018–19	38,600	5,724	0
2019–20	21,069	15,971	0
Total	228,225	86,232	65

Source: Water Resources Investigation and Development, GoWB

Figure 5: Reservoir construction under Jal Tirtha in West Bengal

Source: Water Resources Investigation and Development, GoWB

3.3.2 Rainwater harvesting in Darjeeling hills

Substantial progress has been made in promoting rainwater harvesting in the niche ecosystem of Darjeeling hills. In 2016, NABARD and Darjeeling municipality had initiated a project to develop rainwater harvesting infrastructure to improve water supply and sustain micro-ecosystem of the region.[20] The project aimed to collect 5,607 liters of rainwater per household categorized as Below Poverty Line (BPL), considering an average rooftop area of 20 square meters for each household. To achieve this goal, the project aimed to construct rooftop- based water storage structures with a capacity of 1,000 liters per household for 3,000 households.

Additionally, community water storage structures with a capacity of 10,000 liters each were planned for 200 BPL households. Any surplus rainwater collected beyond the storage tank's capacity would be directed to local drains as surface water runoff. Each household was to be equipped with a gravity filter to purify stored water for domestic usage.

Theme 3: Domestic Sewage Management

West Bengal generates 7,696 MLD of sewage in its urban areas, a significant challenge given the increasing urban population and industrial activity. To address this, the state has established a sewer network spanning 7,726.53 kilometers, facilitating the conveyance of wastewater to nearby sewage treatment plants (STPs) in urban regions.

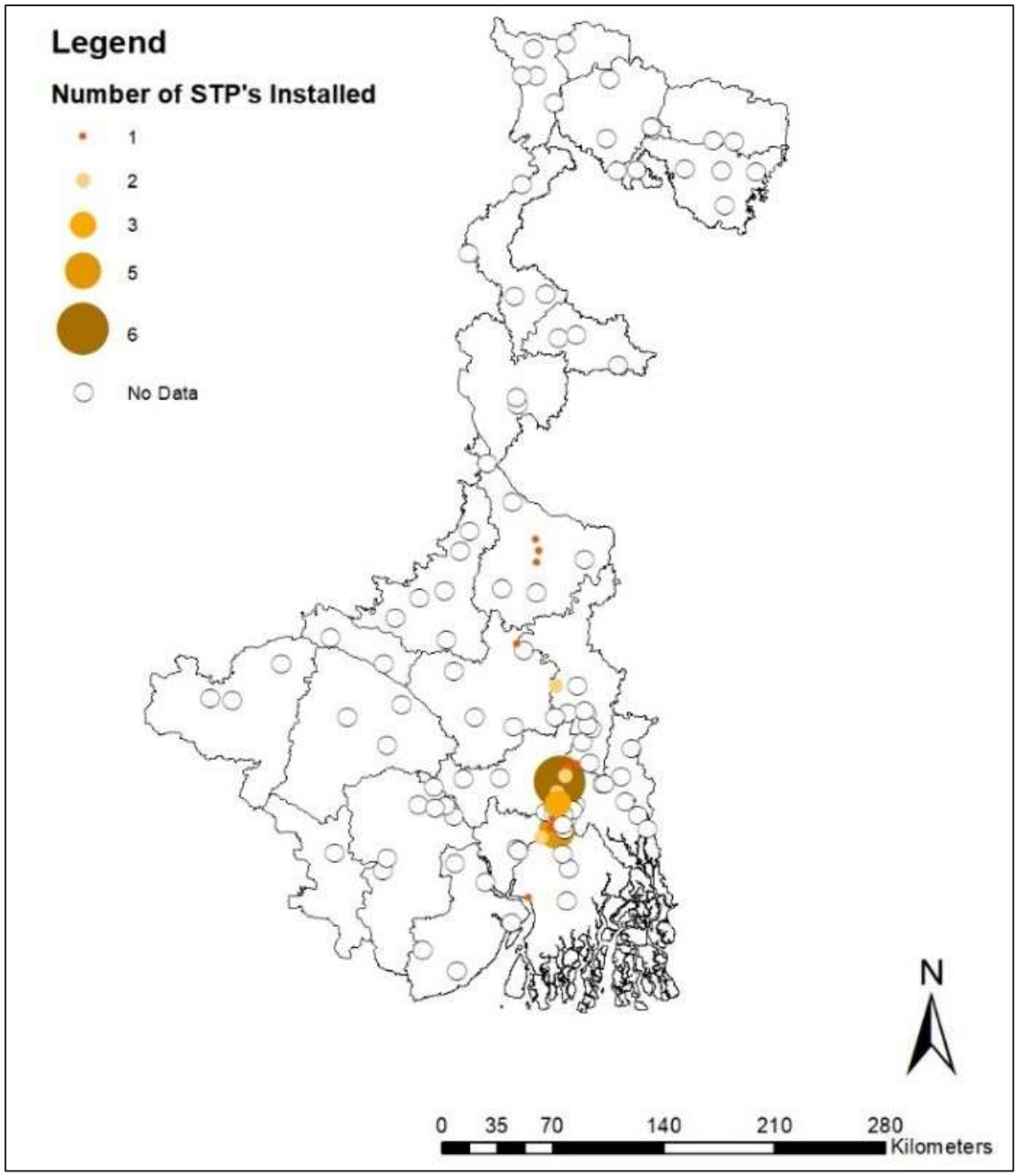
4.1 Installed sewage treatment capacity

As of 2024, West Bengal's total installed sewage treatment capacity across 128 ULBs stands at 715.67 MLD, according to the WBPCB. However, only 377.81 MLD of this capacity is operational, while 337.86 MLD remains non-operational due to technical and infrastructural challenges. To address the shortfall, an additional 18.60 MLD of treatment capacity has been proposed for construction.

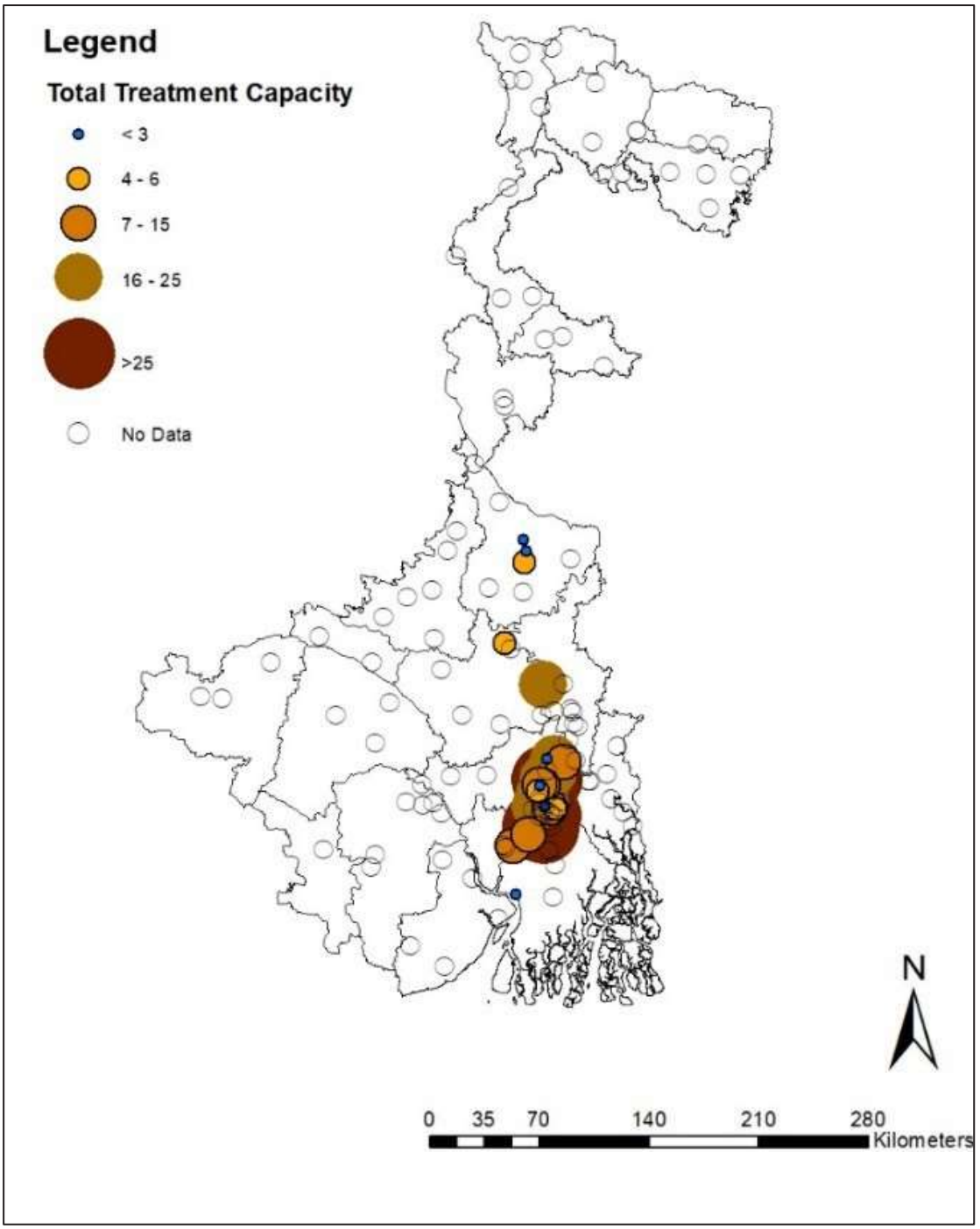
According to the data reported by the districts, class II (town with population 50,000 to 99,999) and larger towns in Kolkata district are generating about 1400 MLD of domestic sewage. Major urban centers such as Kolkata Municipal Corporation, Howrah and Baranagar lead in sewage treatment infrastructure, with Kolkata having the highest capacity at 179 MLD, followed by Howrah at 65 MLD and Baranagar at 60 MLD. In contrast, smaller ULBs like Jiaganj-Azimganj and Bansberia operate with minimal capacities of 0.69 MLD and 0.3 MLD, respectively. Some ULBs, including Titagarh and Kalyani, maintain a relatively balanced approach, managing sizable treatment capacities with only one or two sewage treatment plants (STPs) (See: Map 23: ULB wise total number of STP's installed in West Bengal and Map 24: ULB wise total sewage treatment capacity in West Bengal).

However, a significant concern is that 96 ULBs lack any sewage treatment plants, leaving large volumes of wastewater untreated. This disparity underscores the need for targeted interventions to expand sewage treatment infrastructure, rehabilitate non-functional plants and ensure equitable wastewater management across all ULBs in the state.

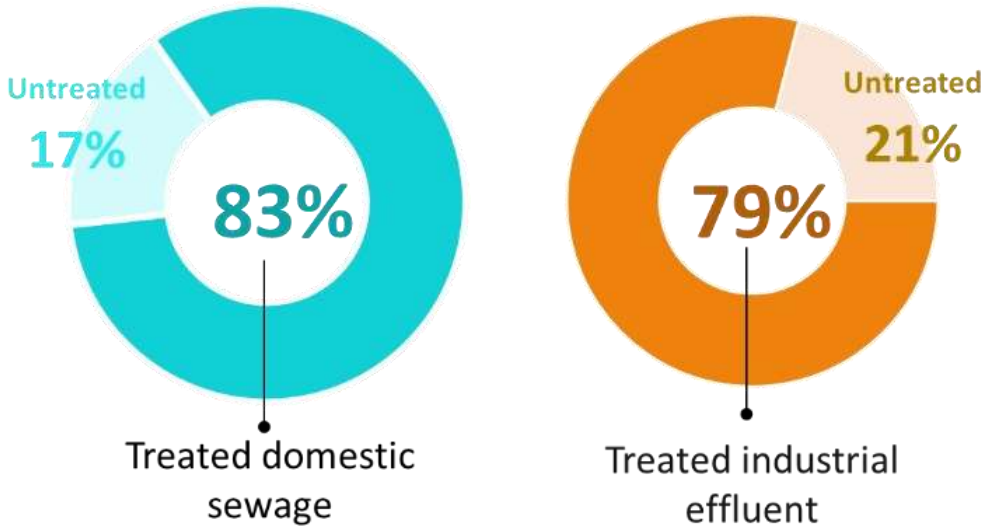
Map 23: ULB wise total number of STP's installed in West Bengal



Map 24: ULB wise total sewage treatment capacity in West Bengal



Graph 11: Treatment of domestic and industrial wastewater



Source: Urban Development and Municipal Affairs, GoWB

Even with full operationalization of the existing and proposed STP capacities, West Bengal would still face a substantial treatment deficit of 6,961 MLD. This gap underscores the urgent need for expanding sewage treatment infrastructure, optimizing existing facilities and implementing robust strategies to manage wastewater sustainably. Without immediate interventions, untreated sewage will continue to strain water resources and exacerbate environmental challenges in the state.

Theme 4: Industrial Wastewater Management

West Bengal, a resource-rich state, has a long-standing legacy of industrial development, particularly concentrated in South Bengal along the River Hooghly and the Bay of Bengal's port areas. This region hosts diverse industries, including jute mills, cotton ginning and weaving units, textile and silk weaving mills, iron and steel foundries, paper and paperboard factories and chemical plants. These industries have significantly boosted the state's economy but have also adversely affected the environment, particularly through wastewater pollution.

Industries along the River Hooghly often discharge untreated or inadequately treated wastewater into waterbodies, leading to severe ecological damage. Effluents from textile mills, jute factories, paper mills and chemical plants carry toxic chemicals, heavy metals, dyes and suspended solids that degrade water quality, harm aquatic ecosystems and pose significant health risks to local communities reliant on the river for their livelihoods.

West Bengal's industrial landscape is heavily dominated by manufacturing and engineering industries, which form the backbone of its economy. These are closely followed by agro-based industries, reflecting the state's agricultural strength. Contributing 6.1 percent to India's total food grain production[21], West Bengal plays a pivotal role in ensuring the country's food security. Furthermore, the state is a leading producer of jute and leather, accounting for 79.6 percent of India's total jute production and 25 percent of the nation's leather exports.[22]

The prominence of jute and leather industries underscores West Bengal's industrial significance; however, these sectors are highly water-intensive and generate substantial wastewater. Jute processing involves extensive water use for retting and washing, while leather tanning requires vast amounts of water for cleaning, soaking and chemical treatments. Both industries discharge wastewater laden with toxic chemicals, dyes, heavy metals and organic pollutants, which, if inadequately treated, can pose severe risks to local water bodies and ecosystems. Balancing economic growth with sustainable wastewater management remains a critical challenge for the state.

5.1 Status of Industry

The Government of West Bengal has initiated timebound steps to modernize existing infrastructure facilities and to create new clusters and growth centers in certain focused sectors like Biotechnology, Cement, Chemicals, Food Processing, Gems & Jewelry, Iron & Steel, Information Technology Manufacturing and Textiles in addition to 59 multiproduct industrial par.

Apart from manufacturing and engineering industries, West Bengal is also a key producer of petroleum and petrochemicals. Natural gas production in West Bengal in the year 2018-19 reached 710.46 million cubic meters. West Bengal is also a flourishing exporter of leather products.

The WBPCB maintains a detailed inventory of industries classified into five pollution-based categories: 'Red,' 'Orange,' 'Green,' 'White 'and 'Exempted', as per CPCB guidelines. 'Red' industries represent the highest pollution potential, while 'Green' industries are the least polluting and 'White' industries have negligible environmental impact.

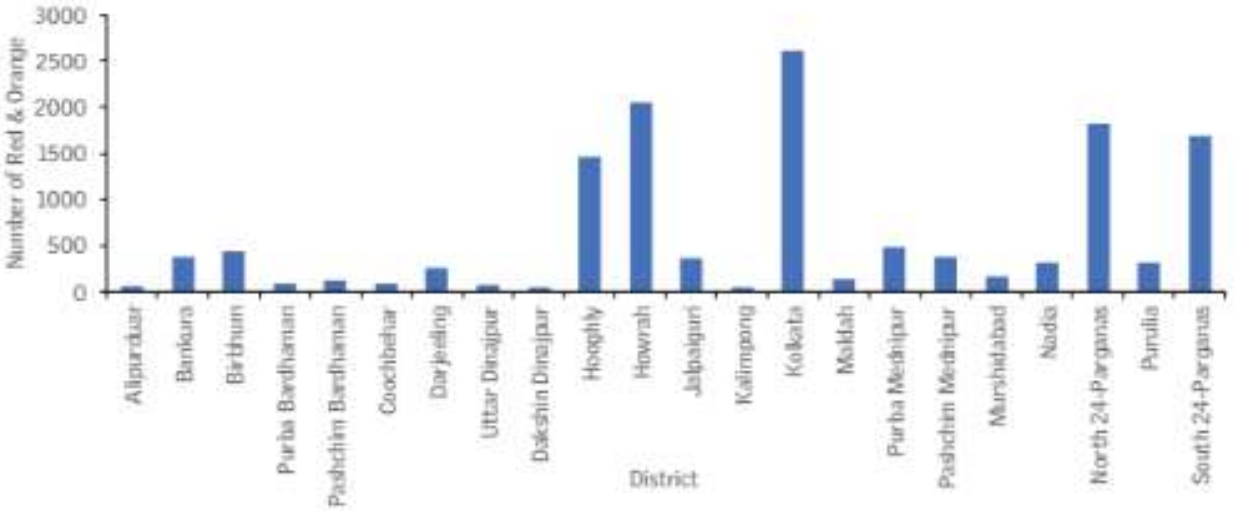
According to WBPCB, West Bengal hosts 44,331 industries across 23 districts, with 9 percent classified as 'Red' and 25 percent as 'Orange,' both being significant contributors to toxic wastewater discharge. These industries are predominantly concentrated in the southwestern region, the Haldia port area, the Kolkata Metropolitan Area and the Durgapur–Asansol colliery belt. (see: Graph 12 Size-wise and category-wise distribution of industries registered and Graph 13: District-wise distribution share of category of industries in West Bengal).

The CPCB has classified 17 industry types as highly polluting due to their substantial effluent discharge into rivers and lakes. In West Bengal, around 160 industries fall under this classification. (see: Graph 14: District-wise distribution of 17 category industries in West Bengal)

According to CPCB, Grossly Polluting Industries (GPI) are the industries that discharge effluents into a water course and (a) handle hazardous substances, or (b) whose untreated effluent has BOD load of 100 kg per day or more, or (c) a combination of (a) and (b). Currently there are 54 identified GPIs in West Bengal.

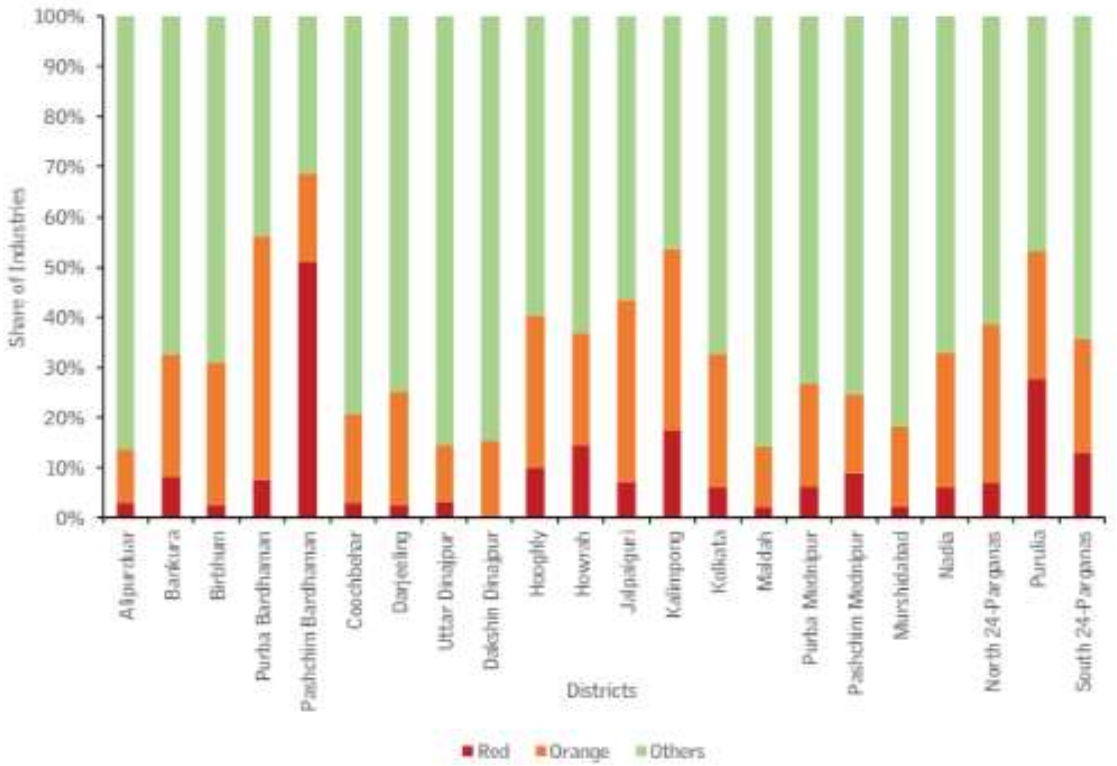
GPIs were redefined as Seriously Polluting Industries (SPI) by the NGT recently. These are the industries discharging effluents into a water course and the CPCB has classified 33 sectors of industries as SPI sectors. There are 376 SPIs in West Bengal currently. All the GPIs and SPIs are connected to Effluent Treatment

Graph 12: Size-wise and category-wise distribution of Industries registered



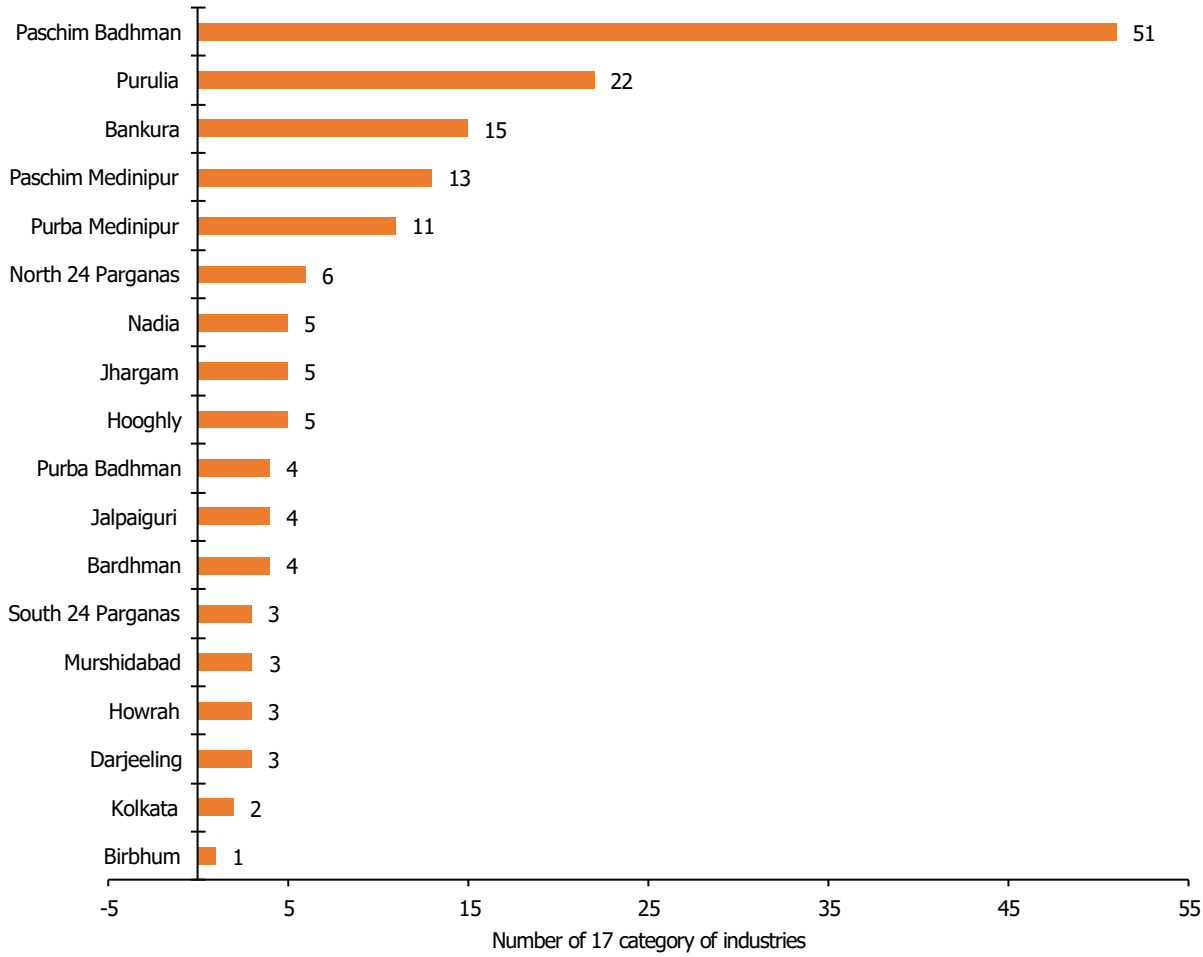
Source: West Bengal Pollution Control Board

Graph 13: District wise distribution share of category of industries in West Bengal



Source: 2021, State of Environment, West Bengal and data shared by West Bengal Pollution Control Board

Graph 14: District-wise distribution of 17 category industries in West Bengal



Source: Based on the data provided by WBPCB

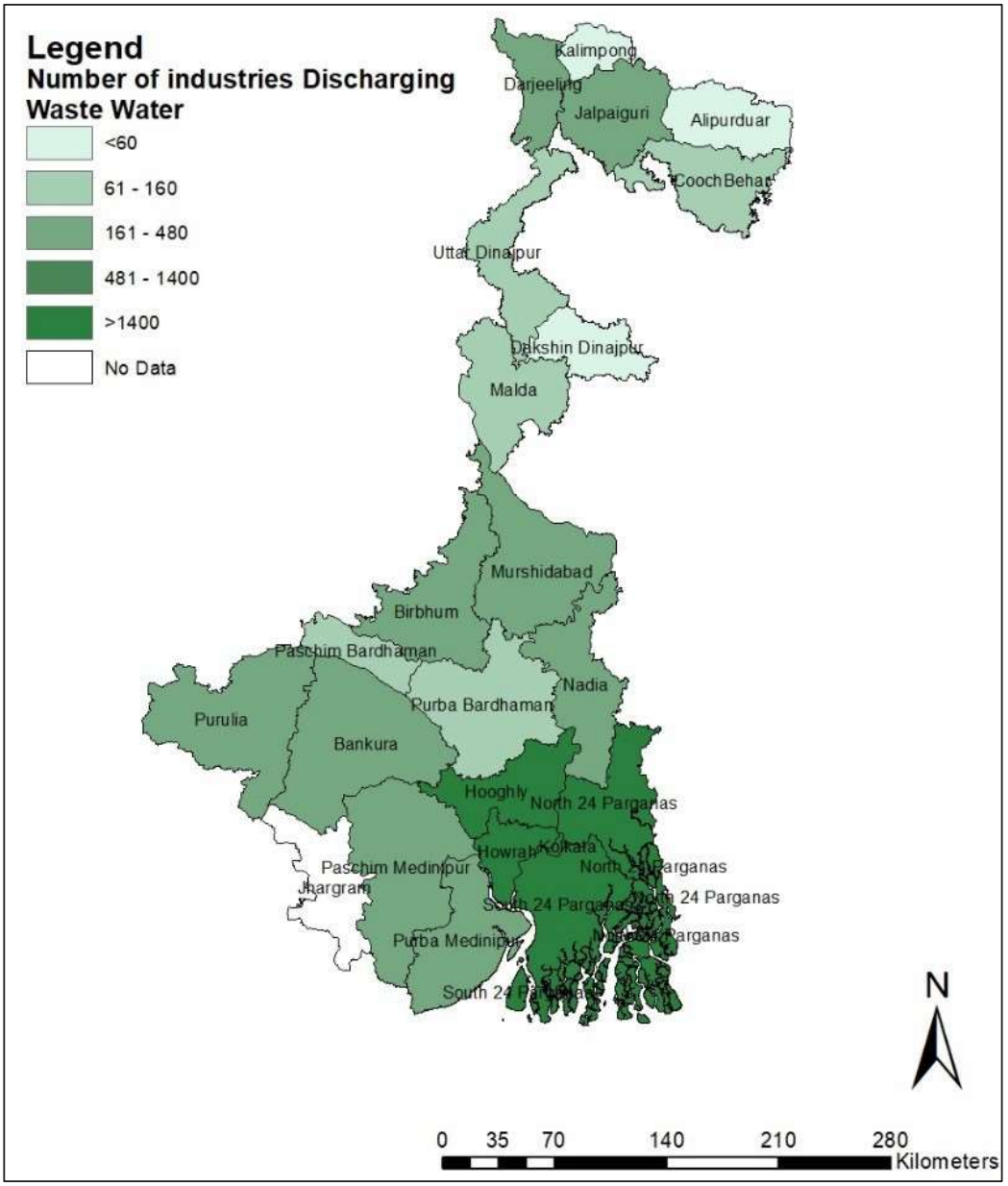
Note: This is a dynamic list which changes over time depending on several parameters

Plants (ETP). This highlights ongoing efforts to mitigate pollution from these highly polluting sectors.

5.1.1 Number of waste water discharging industries

Industrial wastewater management poses a significant challenge for West Bengal, driven by the state's dense industrial concentration. According to the data reported by the districts, a total of 13,328 industries across 23 districts discharge wastewater. The highest concentrations in Kolkata (2,606), Howrah (2,055), North 24 Parganas (1,820)and South 24 Parganas (1,685) (see: Map 25: District wise number of industries discharging waste water). These districts are home to industries such as leather processing in Kolkata and jute, fiber and agro- based industries in surrounding areas, contributing substantially to wastewater generation.

Map 25: District wise number of industries discharging waste water



The Bantala Leather Complex in Kolkata hosts 345 tanneries. The Complex has a capacity to process 1000 kg/day of raw hides and skins using 35 MLD of water. All tanneries collectively discharging 19.9 MLD of wastewater. This wastewater is treated by four CETP modules, each with a capacity of 5 MLD, totaling 20 MLD. Plans are underway to expand the CETP capacity (20 MLD) further. The treated effluent is discharged to the Karaidanga Storm Water Flow (SWF) canal. The chromium-bearing effluent is separately treated and chromium is recovered for reuse in the process

Across West Bengal, the total installed treatment capacity of all Effluent Treatment Plants (ETPs) stands at 1,360.60 MLD. Despite these efforts, the effective management of industrial effluents remains a critical challenge, underscoring the need for enhanced monitoring, stricter enforcement and infrastructure upgrades.

Purba Medinipur (478), driven by port-based industries and Birbhum (443), fueled by mineral-based operations, reflect substantial industrial activity, contributing to the pollution burden on local water bodies and rivers. The concentration of industries in these key hubs underscores the strain on wastewater treatment infrastructure and highlights the pressing need for robust industrial effluent management to safeguard water resources and mitigate environmental impacts.

5.2 Initiatives for Transition to Cleaner Fuels and Technologies

The Government of West Bengal, through notification no. EN/1527/TVIII-6/01/20209 dated November 13, 2020, has prohibited the use of pet coke and furnace oil as industrial fuels in specific areas, including KMC, Howrah Municipal Corporation (HMC), Barrackpore Municipality, former Asansol Municipal Corporation, former Raniganj Municipality, Durgapur Municipal Corporation, Haldia Municipal Corporation, select parts of Howrah and Asansol, Bandel and Siliguri Municipal Corporation.

To promote cleaner alternatives, the notification has approved the use of less polluting fuels such as LPG, LNG, PNG, CBM/CNG, naphtha, propane, gasoline, hydrogen, methane, biogas, high-speed diesel (HSD), light diesel oil (LDO), low-sulphur heavy stock, RDF and other fuels with minimal pollution potential.

The transition to the above-mentioned replacement fuels or installation systems for recovery of 90 percent of SO2 was to be done within 18 months in specified areas. For the rest of West Bengal, this was to be done within 24 months from the

date of the published notification. Coal Bed Methane (CBM) is also used in most of the industries of Durgapur and Asansol.

Natural gas serves as a transitional alternative in West Bengal's shift to cleaner fuels, with Gas Authority of India Limited (GAIL) spearheading infrastructure projects which include natural gas pipeline, city gas distribution and a fertilizer plant based on coal gasification. GAIL through its subsidiary Bengal Gas Company Limited has set up CNG stations and plans to expand them.

Several other steps in terms of comprehensive consent mechanisms before establishment and surveillance and monitoring are being adopted in the state to address the menace of pollution caused by industries. The non-compliant industries are subjected to regulatory actions.

Theme 5: Mining Activity Management

West Bengal ranks as the third-largest state in India for mineral production, contributing approximately one-fifth of the country's total output. Coal is the dominant mineral, accounting for 99% of the state's production. Among minor mineral resources, the state holds a significant share, with 57% of the country's apatite, 14% of china clay and 14% of fireclay reserves, as reported by the State of Environment (SoE) and the Indian Minerals Yearbook 2014. Additionally, resources such as feldspar, fireclay and silica sand have experienced a rising trend in production, according to the State Statistical Handbook 2014 (see Graph 6: Trends in production of minerals of West Bengal). Birbhum district has been a key producer of fireclay, particularly in the year 2013-14, contributing substantially to the state's output. However, the extraction of fireclay, which involves mining topsoil, presents a significant environmental threat by depleting fertile land. This practice accelerates soil erosion, deforestation, land degradation and potentially contributes to desertification, posing long-term ecological risks. During the year 2019-20 production of Coal, Natural Gas and Sulphur was reported from West Bengal. The value of minor mineral's production was estimated at 146 crores for the year 2019-20.[23]

6.1 MINING INVENTORY OF MAJOR MINERALS

Coal mining is predominantly concentrated in the Raniganj-Asansol belt, which remains a key area for the state's coal production. Among minor resources, it holds 57 percent apatite, 14 percent china clay and 14 percent fireclay resources of the country according Indian Minerals Yearbook 2020.

According to Coal Directory of India, 2019-20, West Bengal's estimated coal reserve are 31.69 billion tonnes, with significant coal fields located at Raniganj, Barjora and Birbhum (see: Table 2020). The state's coal production reached 5.33 million tonnes during the 2015-16 period.

The Deocha-Pachami Coal Block, located in the south-western part of the Birbhum Coalfield, is the largest coal mine in India. Spanning approximately 10 sq km, it holds an estimated 2,100 million tonnes of coal reserves, with a potential investment of Rs. 20,000 crore (approximately US$ 3 billion).

Table 8: Reserves/Resources of Coal in West Bengal, 2020

(In million tonnes)				
Coalfield	**Identified**	**Indicated**	**Inferred**	**Total**
Raniganj	14018	7103.37	3703.69	24825.06
Barjora	200.79	-	-	200.79
Birbhum	-	5743.5	901.34	6644.84
Darjeeling	-	-	15	15
Total				31685.69

Source: Coal Directory of India, 2019-20.

According to Indian Minerals Yearbook 2020, several minerals are found across various districts of West Bengal. Purulia district contains barytes, copper, gold, kyanite, pyrite and titanium; Bankura and Purulia districts have felspar; Darjeeling holds lead-zinc; Bankura, Birbhum and Purulia districts contain granite; limestone is found in Bankura and Purulia; quartz/silica sand is prevalent in Bankura, Hooghly and Purulia; Paschim Medinipur has manganese ore and sillimanite; and Bankura has tungsten and vermiculite. Purulia, Bankura and Birbhum stand out for their significant mineral reserves, with extensive mining operations.

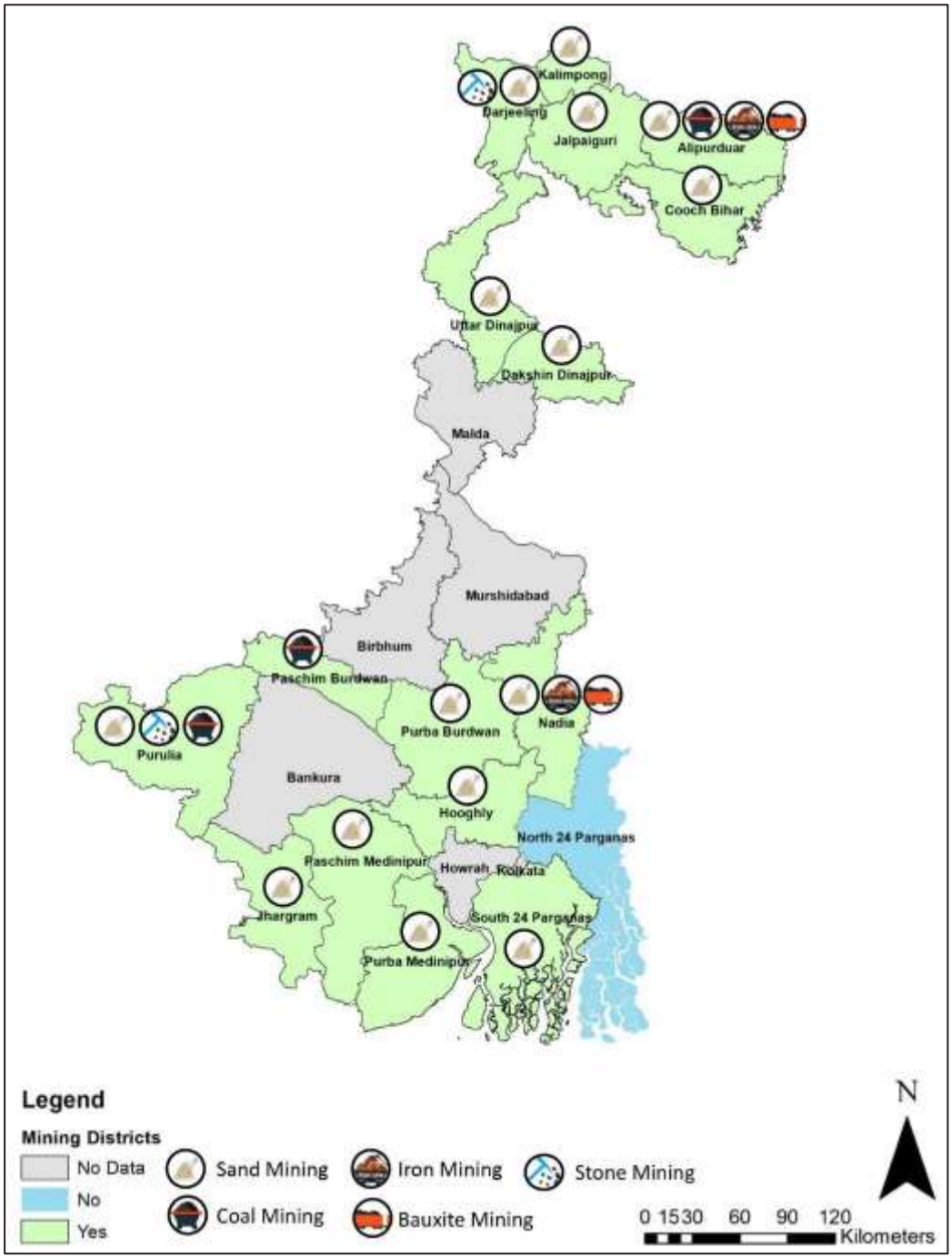
Sand mining is prevalent across nearly every district, primarily from riverbeds, which poses significant risks to riverine ecosystems. This unsustainable extraction alters river dynamics, causing widening of river courses and increased flooding risks. Unregulated sand mining also creates artificial channels, leading to medico-geological issues. Additionally, the rising demand for sand and aggregates is boosting stone-crushing activities, especially in Darjeeling and Purulia, with Birbhum reporting notably high stone-crushing activity (see: Map 26: Mining inventory of major minerals).

6.2 REGULATION OF MINING ACTIVITIES

The West Bengal Minor Mineral Concession Rules 2016 were enacted following Supreme Court and NGT directives, but critical gaps remain. For example, the rules allow short-term mining licenses that are exempt from social and environmental safeguards, including environmental clearance and mining plans, compounded by inadequate monitoring and enforcement.

MoEF&CC has now decentralized the process of granting such clearances for sand mining to state and district levels. The District Environmental Impact Authority (DEIA) is issuing environmental clearances for mining under 25 hectares. DEIA comprises of four members, three of which are from district administration. In

Map 26: Mining inventory of major minerals



Source: State Environment Plan, West Bengal 2021

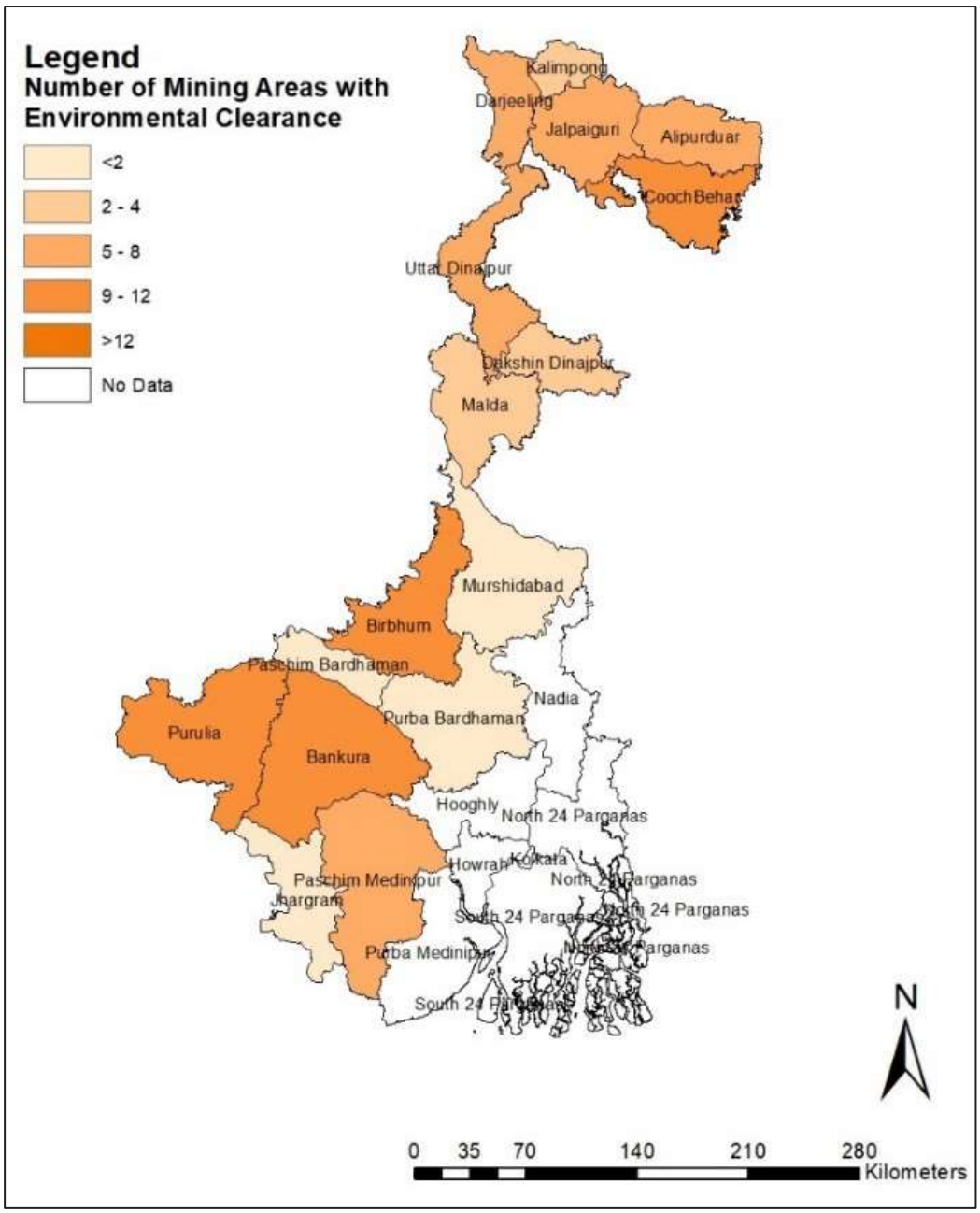
principle, decentralization is a step towards better environmental stringency and will also reduce informal and illegal mining activities. However, it will only be effective when the DEIA involves scientific expertise and representatives from the community.

6.2.1 EC clearance

In 2023, West Bengal has a total of 84 sand mining areas that meet environmental clearance (EC) conditions, with a significant concentration of these activities in specific districts. Bankura, Cooch Behar and Birbhum are the leading districts, each hosting over 10 sand mining sites with EC, highlighting a strong presence of regulated operations in these areas. Other districts, including Darjeeling, Alipurduar, Purulia and Uttar Dinajpur, show moderate mining activity, with 6 to 9 EC-approved sites.

On the other hand, Jhargram, Purba Bardhaman, Kalimpong and Malda report minimal sand mining activity, with just 1 to 3 sites each. However, Murshidabad and Paschim Bardhaman have no sand mining areas with environmental clearance, suggesting a lack of regulated operations in these regions. This distribution reveals regional disparities in the implementation and monitoring of environmentally compliant mining practices (see: Map 27: District wise number of areas having environmental clearance conditions for sand mining)

Map 27: District-wise number of areas having environmental clearance conditions for sand mining



Source: West Bengal Pollution Control Board

Theme 6: Air quality

Air pollution is one of the burning issues for the environment as it severely affects public health. The urban life of any country is at high risk due to air pollution, particularly during winter season. Different pollutants released due to various industrial as well as rapid urbanization and other man-made activities including fast expanding vehicular traffic are causing deep concern to all kind of living organisms on the earth.

Air pollution remains one of the most pressing environmental concerns, especially in urban areas, where its effects on public health are more pronounced. The situation worsens during the winter season, when pollutants such as particulate matter and ground-level ozone can concentrate and severely impact the respiratory systems of city residents. Rapid urbanization, industrial emissions and the increasing volume of vehicular traffic are significant contributors to this growing problem, posing a threat to all forms of life.

To combat these challenges, it is crucial to monitor air quality regularly. Such monitoring provides valuable insights into pollutant levels and their fluctuations over time. By understanding these levels, we can implement targeted measures to safeguard public health and mitigate the harmful effects of pollution. Additionally, meteorological changes—such as rising temperatures, altered weather patterns and more frequent extreme events like wildfires—further exacerbate air pollution, leading to the formation of hazardous air pollutants. Regular monitoring also helps identify key sources of pollution, enabling authorities to devise effective strategies for mitigating their impact and addressing climate change.

7.1 Air Quality Monitoring Stations

Under Section 17(3) of the Air (Prevention and Control of Pollution) Act, 1981, the WBPCB is tasked with collecting and disseminating information related to air pollution. Six cities in West Bengal—Kolkata, Howrah, Haldia, Durgapur, Asansol-Raniganj and Barrackpore—have been identified by the CPCB as Non-Attainment Cities under the National Clean Air Programme (NCAP), highlighting the need to improve air quality in these areas. Notably, out of the 12 pollutants monitored, PM10 and PM2.5 exceed permissible limits in West Bengal, particularly during the winter months, as per the National Ambient Air Quality Standards (NAAQS) 2009. To address air quality management and monitoring, West Bengal has established 170 air quality monitoring stations across its 23 districts as of 2023

Out of these 170 monitoring stations, 22 are real time monitoring stations. These stations are strategically distributed across various land-use areas, including both industrial and residential zones, ensuring comprehensive coverage of the region's air. The CPCB has employed a population-based criterion to determine the number of monitoring stations for cities based on the population criteria. The manual stations monitor particulate matter (PM10), nitrogen dioxide (NO2) and sulfur dioxide (SO2), while the real-time stations provide more detailed data, including PM10, PM2.5, various gaseous pollutants and meteorological parameters such as temperature, humidity and wind speed.

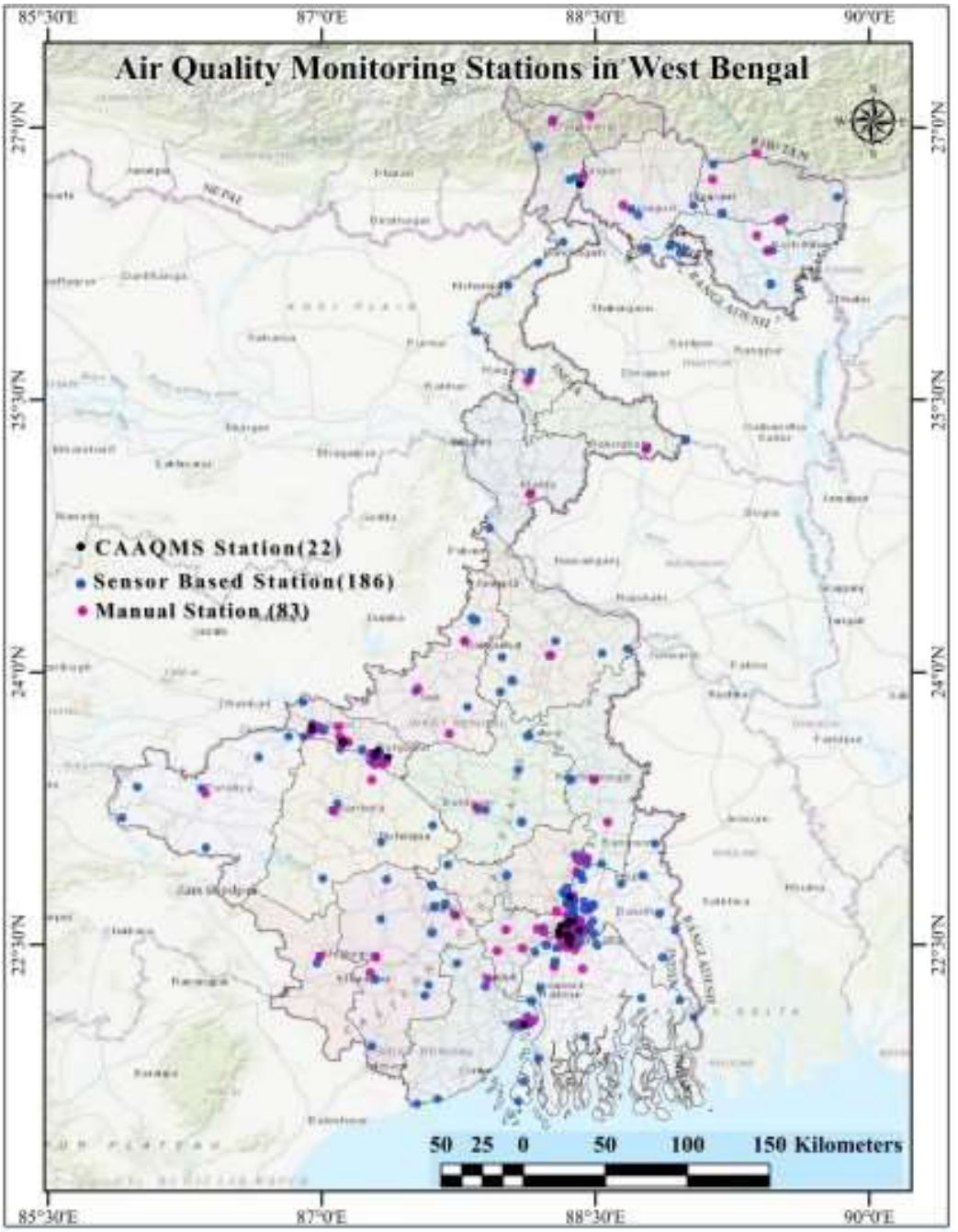
North 24 Parganas leads in the number of stations, hosting 29, reflecting its extensive network and strategic importance. Kolkata and Paschim Bardhaman follow, each with 17 stations, highlighting their significant urban and industrial roles. Purba Medinipur and South 24 Parganas also demonstrate considerable connectivity with 14 and 12 stations, respectively, emphasizing their sensitive environment (see: *Map 28: District wise number of air quality management stations in West Bengal*).

7.1.1 Air quality levels, trend analysis and compliance of NAAQS

In West Bengal, six cities have been identified as non-attainment: Kolkata, Howrah, Barrackpore, Haldia, Asansol and Durgapur. Non-attainment status of a city implies consistently high levels of air pollutants above the national ambient air quality standards. These cities have been identified as non-attainment based on the PM10 levels. While a predominant pollutant is considered a reason for non-attainment, the air in urban areas is laced with numerous pollutants - of these 12 are regulated under the National Ambient Air Quality Standards (NAAQS). As cities set up more monitoring stations, new areas of high exposure or air pollution can be identified. In the longer term, emissions must be permanently reduced so that the NAAQS is maintained at least 98 percent of the days in a year (as per the Air Act, 1981) and peak pollution episodes are prevented.

To meet the NAAQS, it may help to assess the target reduction required. As per the international best practices, such as the method used by the US Environmental Protection Agency (USEPA), a rolling annual average of the previous three years is taken to define the base pollution level and, accordingly, targets for pollution reductions are estimated to guide action and prepare action plans. Trend analysis helps to understand the impact of actions on long-term ambient concentration.

Map 28: District wise number of air quality management stations in West Bengal

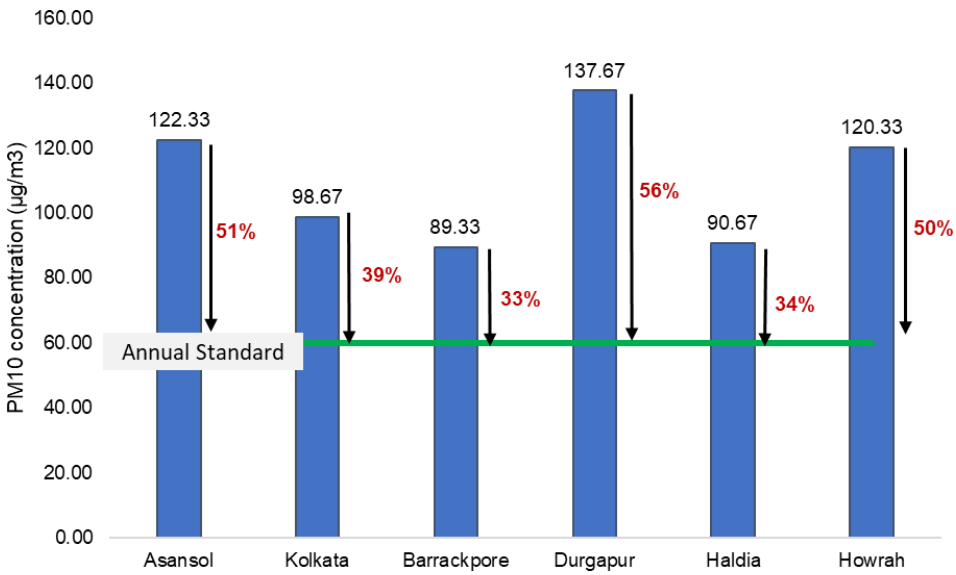


If a similar method is applied to the cities of West Bengal based on the annual data available from the PRANA portal for PM10 concentration levels, the indicative reduction target can be worked out for the non-attainment cities. The baseline year for the reduction target is considered an average of 2021-22 to 2023-24. Based on this three-year average trend, Durgapur must reduce the maximum PM10 concentration by 56 percent, followed by 51 percent by Asansol and 50 percent by Howrah to meet the annual standard of PM10 concentration.

Since the PRANA portal does not have data on other pollutant concentrations, other analysis was based on the data available from real-time monitoring stations on CPCB portal. Based on the real-time monitoring stations, the indicative reduction target can be worked out for the cities. The baseline year for the reduction target is considered as 2021-23. On the three-year average trend (2021-2023), West Bengal needs to cut the PM2.5 pollution level by 23 percent to meet the annual standard. However, within West Bengal, Durgapur and Asansol must reduce their particulate pollution by 24 and 20 percent to meet the annual safe standards.

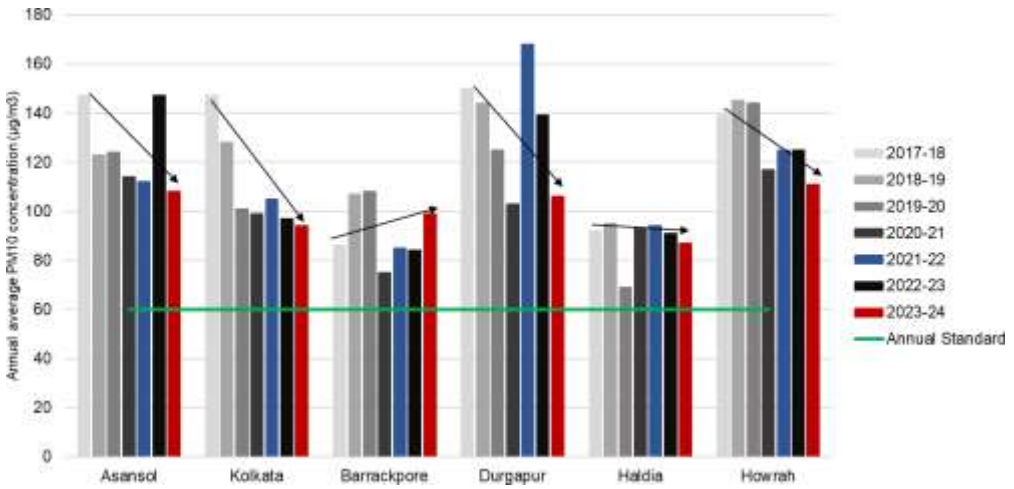
The annual trend of PM2.5 shows that the levels were higher in 2021and then decreased in 2022 and again in 2023. The year 2023 has seen a 20 percent improvement in PM2.5 levels compared to 2021.

Graph 15: Reduction target of PM10 concentration based on the three-year average value based on the data available from PRANA portal



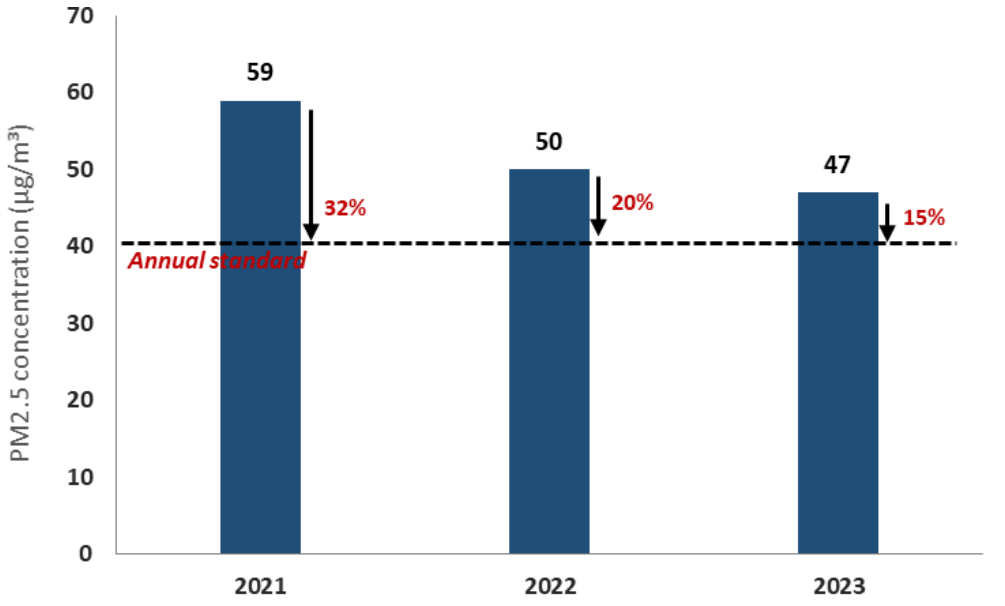
Source: CSE's analysis of the PM10 data based on the PRANA portal

Graph 16: Trend of PM10 concentration from 2017-18 to 2023-24 based on the data available from PRANA portal



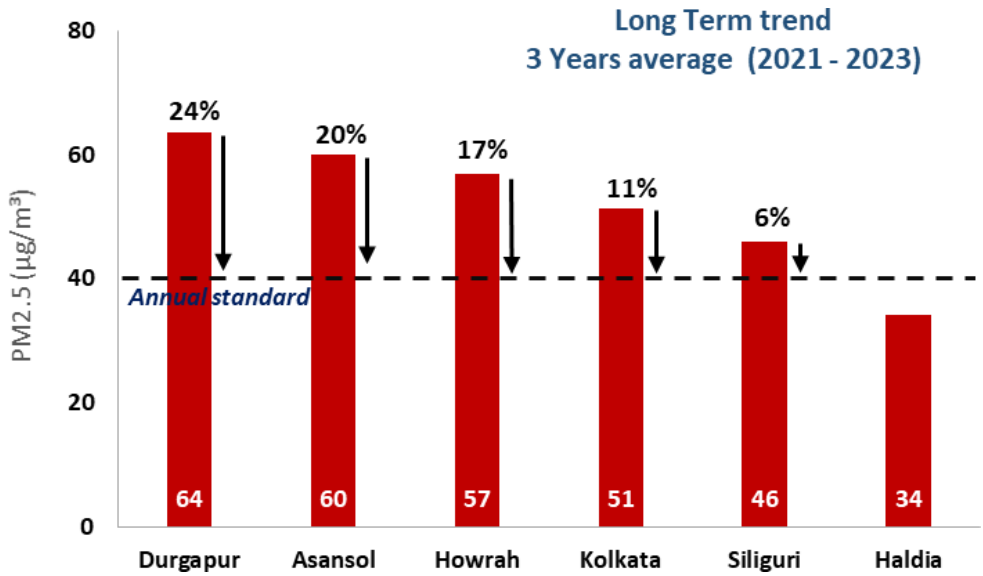
Source: CSE's analysis of the PM10 data based on the PRANA portal

Graph 17: PM2.5 – 3 years trend in West Bengal and its reduction target based on the real-time monitoring station



Source: CSE's analysis based on the data from C

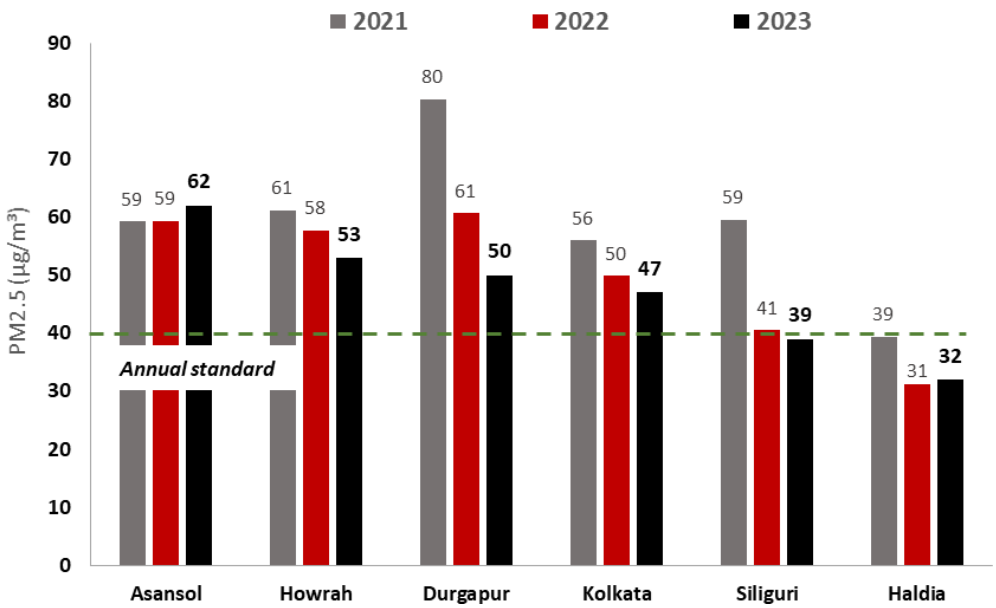
Graph 18: City-wise reduction target of PM2.5 concentration levels based on the real-time monitoring station



Note: Data from following CAAQM stations where continuous data is available since 2021.

Source: CSE's analysis based on the CPCB real-time air quality data

Graph 19: PM2.5 trend in cities of West Bengal

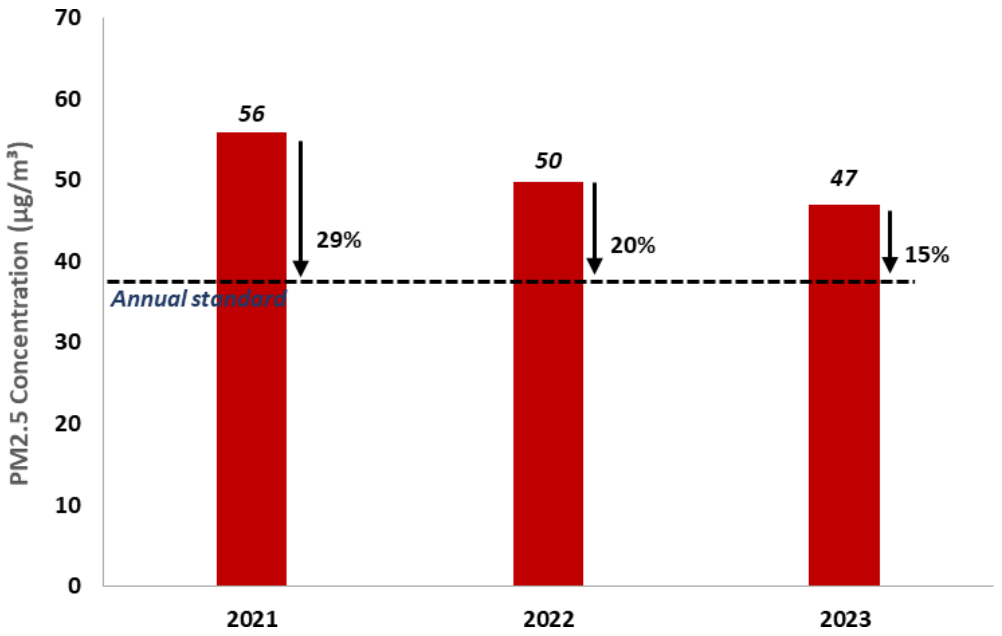


Note: Data from the following CAAQM stations where continuous data is available since 2021.
Source: CSE's analysis of based on the CPCB real-time air quality data

In the Kolkata Municipal Corporation area, looking at the three-year average long-term trend for Kolkata: the city needs to cut PM2.5 levels by 22 percent to meet the annual standard limit. In 2023, in Kolkata, Victoria is the most polluted station at 54µg/m^3 followed by Ballygunge and Jadavpur at 52µg/m^3 and 51µg/ m^3 respectively, whereas Rabindra Sarobar is the only station in Kolkata that is recording PM2.5 levels below the standard limit. In the last three years, 2021 has seen the highest PM2.5 concentration compared to 2020 and 2022. The levels are decreasing in 2022, however, some stations are now increasing at same level in 2023, as of year 2022 PM2.5 levels.

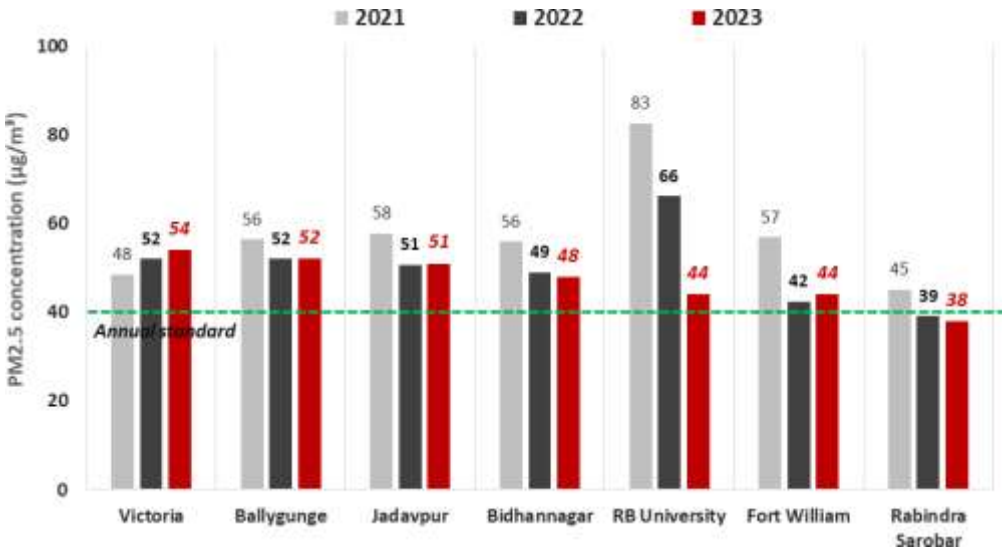
In the year 2022, the seasonal trend of PM2.5 in Kolkata shows the average PM2.5 levels for the summer months (March–May) reached 38µg/m^3, while the winter average (November – February) was observed at 92µg/m^3. Winter season is the most polluted compared to summer and monsoon season. During the year 2020-21 the winter average is the highest at 111µg/m^3, which declined in 2021-22 and again increased in 2022-23 to 92µg/m^3.

Graph 20: PM2.5 – 3 years trend in Kolkata



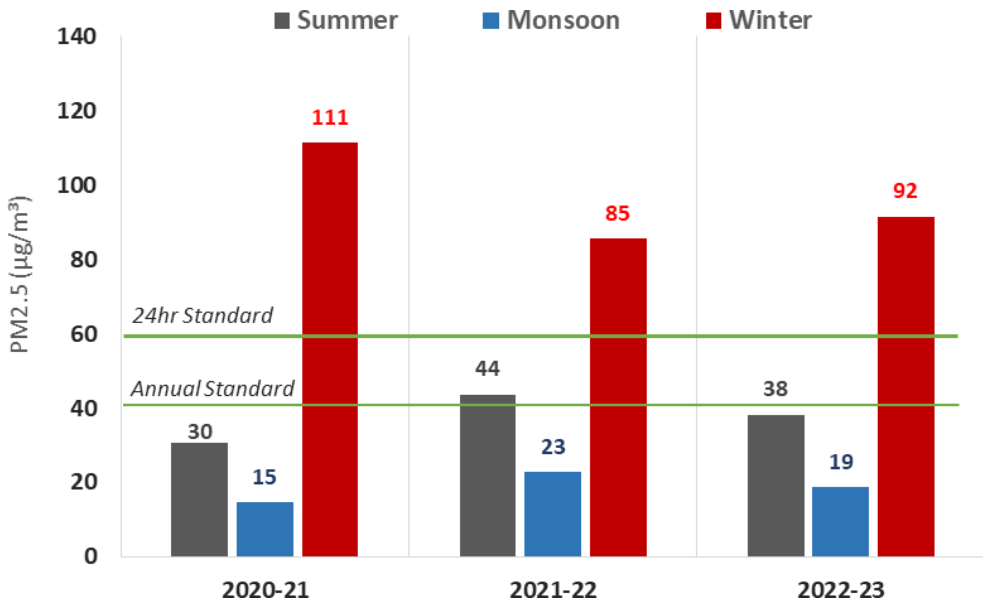
Source: CSE's analysis of based on the CPCB real-time air quality data

Graph 21: PM2.5 – Trend in the stations situated within Kolkata Municipal Corporation (KMC)



Note: Data from following CAAQM stations where continuous data is available since 2021.
Source: CSE's analysis CPCB real-time air quality data

Graph 22: Seasonal trend in PM2.5 within cities of Kolkata Municipal Corporation (KMC)



Note: Data from the following CAAQM stations where continuous data is available since 2020.
Seasonal months – summer (March – May), Monsoon (June – September)and winter (November – February). Source: CSE analysis CPCB's real-time data

The winter average (2022-23) pollution distribution maps were created using the Inverse distance weighted (IDW) interpolation technique for different pollutants. The KMC pollution concentration during the winters was calculated by interpolating spot data from each CAAQMS in Kolkata. Victoria, Bidhannagar, RB University and Jadavpur reports high levels of PM2.5, while the spatial distribution of PM10 levels is high at all location (above 160µg/m^3) except Rabindra Sarobar which records the lowest PM10 concentration levels at 126µg/m^3. The highest NO2 pollution was observed at Ballygunge, Bidhannagar and Rabindra Sarobar.

Towards airshed management: The West Bengal State Pollution Control Board, in collaboration with technical organizations, has initiated airshed-level air quality assessments using satellite-based monitoring. This effort aims to evaluate the evolving pollution landscape over time and space and to understand the transboundary movement of pollutants. This can be an opportunity for scale up to assess the entire state including areas that do not have ground level regulatory monitors and therefore fall in data shadow areas. This will be a critical intervention point for state-wide interventions.

7.2 Source Identification and contribution to air quality

Effective air quality management requires a thorough understanding of pollution sources and their contributions to overall pollution levels. While comprehensive source apportionment (SA) and emission inventory (EI) studies are not available for all cities in the state, insights from Kolkata and Howrah are valuable. Recent SA, EI and carrying capacity studies for the six non-attainment cities have been completed, with draft reports awaited from IIT Delhi for Durgapur and Asansol, CSIR-NEERI Kolkata for Barrackpore and Haldia and TERI Delhi for Kolkata and Howrah. Findings from CSIR-NEERI's study and SAFAR's emissions inventory studies (2020, 2022) indicate that combustion sources—industries, thermal power plants, transportation and households—account for over 70% (CSIR-NEERI) to 90% (SAFAR) of the pollution load. The prominent role of vehicles and industries highlights the urgent need for targeted emission-reduction measures. (see Table 9: Emissions inventory study' results for Kolkata and Howrah).

All the combustion sources which include industry and thermal power plants, transport, household pollution, open burning and hot mix plants together contributes more than 70 percent of the total pollution load in Kolkata and Howrah and the rest is dust pollution from roads and construction. Similarly, SAFAR that has considered more diverse set of pollution sources has found that

Table 9: Emissions inventory study' results for Kolkata and Howrah

Emission sources	CSIR-NEERI (2019) PM 2.5 emissions		Emission sources	SAFAR (2022) PM2.5 emissions
	Kolkata* (KMC)	Howrah*		KMC
Roads	24.75%	26.18%	Wind-blown road dust	2.82%
Households	27.96%	4.02%	Transport	32.39%
Transport	23.54%	6.16%	Industry	18.32%
Industry	7.04%	51.69%	Power plant	0.80%
Construction	3.29%	1.34%	Household	1.15%
Hot-mix plants	0.62%	1.23%	Slum	3.00%
Open burning	6.74%	7.49%	Street vendor	2.22%
Restaurants and eateries	4.86%	1.64%	Crop residue burning	1.14%
Thermal power	0.66%	NA	Cow dung	1.24%
Ironing vendors	0.29%	0.15%	Diesel generators	9.82%
Crematoria	0.22%	0.12%	Municipal solid waste burning	16.07%
Marine vessels	0.02%	NA	Construction	4.53%
			Incense sticks, mosquito coils, cigarettes	5.16%
			Crematory	1.36%
Total	100.00%	100.00%	Total	100.00%

*Registered vehicles (2004-18)

the combustion sources together add up to more than 90 percent of the pollution load. Vehicles and industry are among the key combustion sources.

Seasonal variation: NEERI source apportionment study has further highlighted the seasonal variation in the source contribution (see: Table 10: Seasonal variation in source contribution to PM2.5 concentration in Kolkata and Howrah: summer and winter). This broadly indicates that the influence of combustion sources increases and that of dust source decreases during winter including that of vehicles. A significant observation is that a large proportion of secondary particulate matter originates from combustion-related gases in the atmosphere and this proportion notably rises during the winter season.

A preliminary profiling of pollution sources highlights the need for targeted, source-specific mitigation strategies across the state and regions. Conducting a more detailed and comprehensive Source Apportionment (SA) and Emission Inventory (EI) study for the entire state could provide valuable insights to refine policy frameworks and implementation strategies.

Table 10: Seasonal variation in source contribution to PM2.5 concentration in Kolkata and Howrah: summer and winter

Sources	Summer (in %)		Winter (in %)	
Kolkata	Kolkata	Howrah	Kolkata	Howrah
Coal combustion	22	7	9	11
Vehicle	22	19	25	31
Wood combustion	11	20	15	11
Road dust	10	10	1	2
Open burning	4	8	5	4
Agricultural waste burning	2	8	-	2
Kerosene burning	2	1	-	-
Secondary aerosol	20	28	32	27
Unaccounted	7	-1	13	12

Source: NEERI

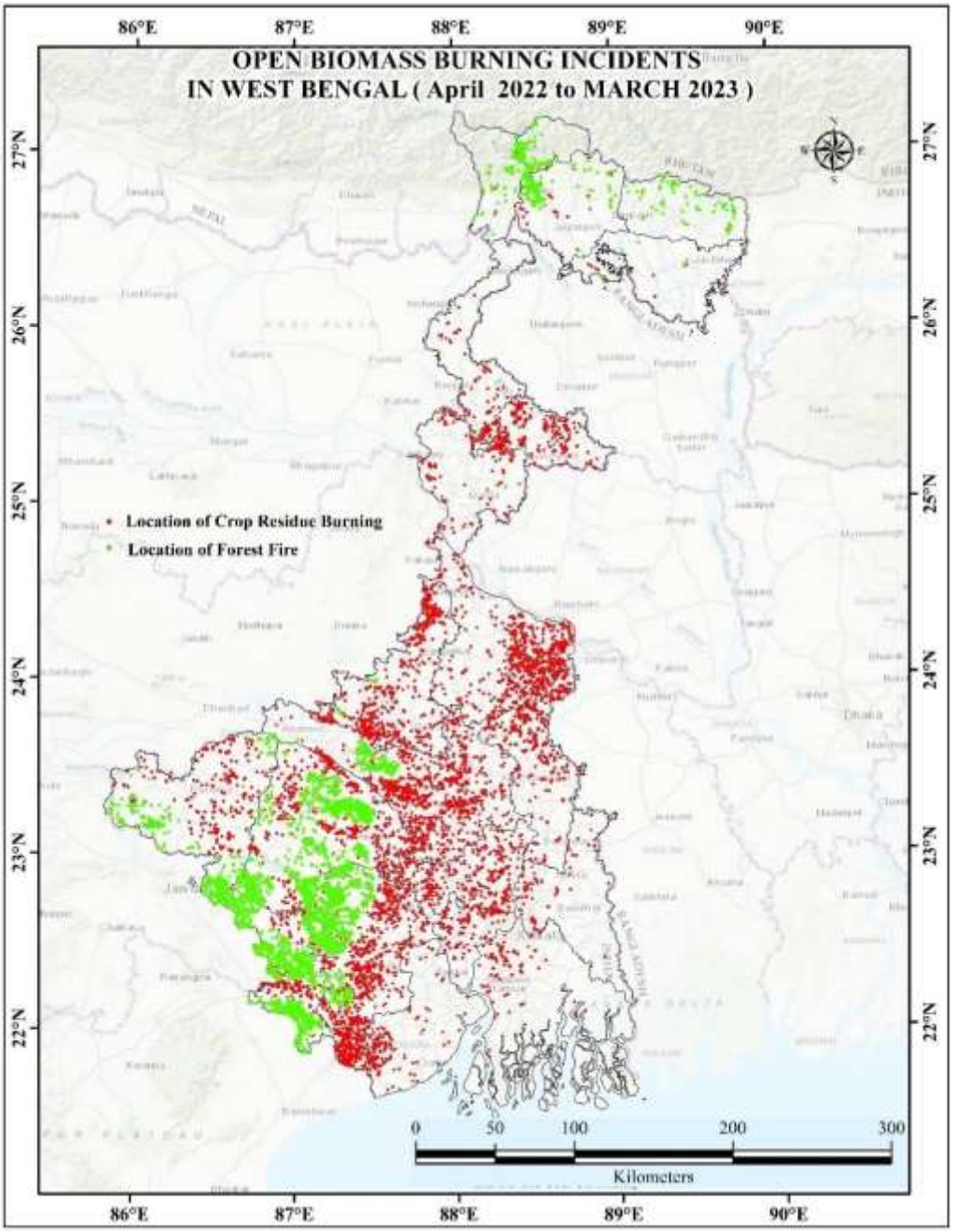
Future studies should also evaluate the regional movement of pollution and its influence on local air quality, aiding in the formulation of regional-level actions. Understanding the impact of upwind pollution sources on downwind areas is crucial. A 2021 study by the Bose Institute (*Sources of Poor Air Quality and Long-Term Variability Over Kolkata*, Elsevier) revealed that nearly 25% of PM2.5 pollution in Kolkata originates from outside Bengal. Aligning with these findings, the National Clean Air Programme (NCAP) emphasizes adopting a regional approach to develop an integrated action plan for air quality improvement.

7.2.1 Open Biomass Burning in West Bengal

Open biomass burning, including crop-residue burning, forest firesand coal mine fires, is a major contributor to air pollution in West Bengal. These fires release harmful pollutants like PM10, PM2.5, hydrocarbons and carbon dioxide. West Bengal has a net cropped area of 52.05 lakh hectares, accounting for 68 percent of its total area and is a major producer of rice, vegetables and jute. The state also has 13.4 percent forest cover.

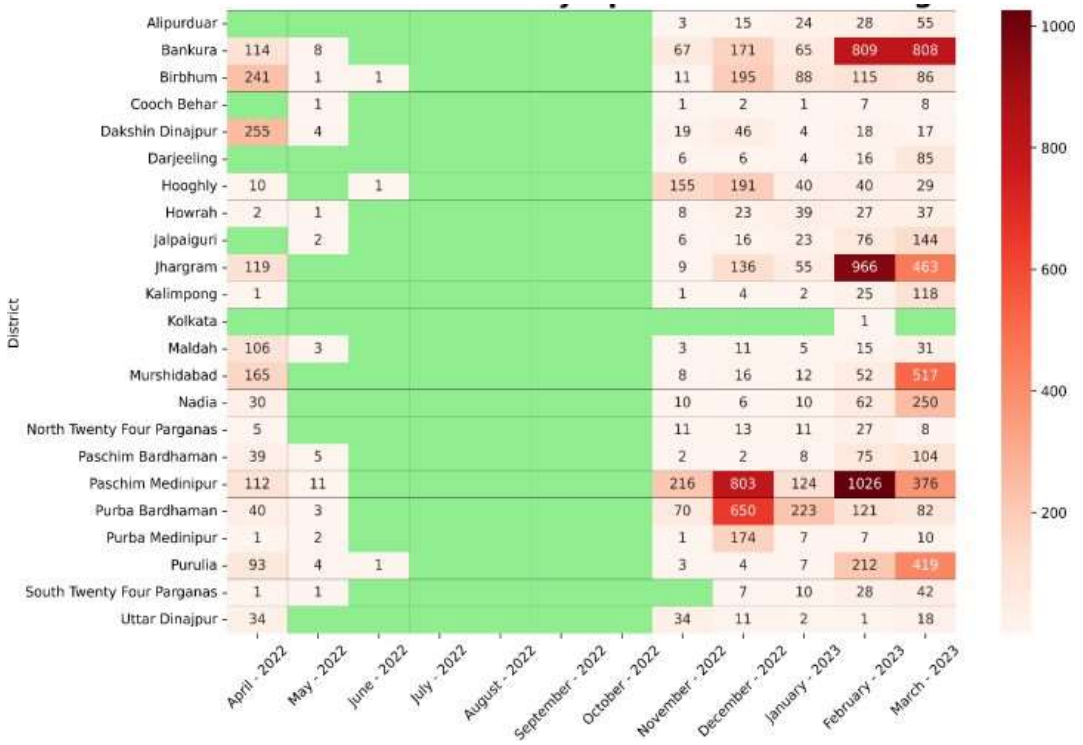
Fires are often set for land clearance, forest access, or to prevent elephant intrusions into villages. Between January and June 2023, 59 blocks recorded over 50 open biomass fire incidents, with areas like Salbani, Nayagram and Jhargram most affected. The peak period for forest fires is from February to April, with March being the most intense. Fires are often deliberately lit for access to forest resources and to manage wildlife (see: Map 29: Location of Open Biomass Burning in West Bengal (April 2022- March 2023) and Figure 6: District wise monthly open biomass burning).

Map 29: Location of Open Biomass Burning in West Bengal (April 2022-March 2023)



Source: West Bengal Pollution Control Board

Figure 6: District wise monthly open biomass burning



Source: West Bengal Pollution Control Board

To address this, a "community engagement" program is suggested, focusing on collaboration with farms and tribal communities, dynamic monitoring systems and improved stubble management solutions. Specific interventions are also needed in coal fire-prone areas like northern Paschim Bardhaman and Birbhum.

7.2.2 Air pollution from Industries

Several industrial enterprises contribute significantly to fugitive emissions and dust generation, particularly in sectors like mining, crushing and storage. Stone crushers, mineral grinding operations, foundries and brick kilns are among the key sources of these pollutants. To mitigate the impact, these industries must implement dust suppression measures and establish crusher zones that adhere to siting guidelines for effective monitoring. Additionally, controlling emissions from ancillary units, material transfer processes and industrial operations is essential for reducing fugitive emissions.

Industries categorized as high-polluting in the state are required to have some form of fugitive emission control technology or procedures in place. Depending on the industry type, emission characteristics and available technologies, various

dust extraction and suppression technologies are currently in use across the state to manage and reduce dust and particulate matter.

- Dust extraction systems viz, ESPs, bag houses and multi cyclones and wet scrubbers.
- Dust suppression systems viz., a) Dry Fog Dust Suppression Systems b) Wet Fog Dust Suppression Systems c) Water sprinkling systems d) Fog cannon e) Rain gun f) Pneumatic dust handling system.

Stone crushers operating with poor implementation of environmental guidelines cause high fugitive emissions. But the degree of their impact on ambient air and nearby inhabitants goes unaccounted. Since this industry does not have stack emissions, no air monitoring is required to be done by unit operators.

As mentioned before, mining is one of the primary activities in the industry sector of the state. Around four percent of the total coal mined in India is mined in West Bengal. The state has coal mines in three locations: Asansol-Raniganj and Durgapur in Bardhaman District, North Western Purulia and Bankura District and Deocha-Pachami-Dewanganj-Harisingha area in Birbhum District. These coal mines are owned and operated by different companies and entities.

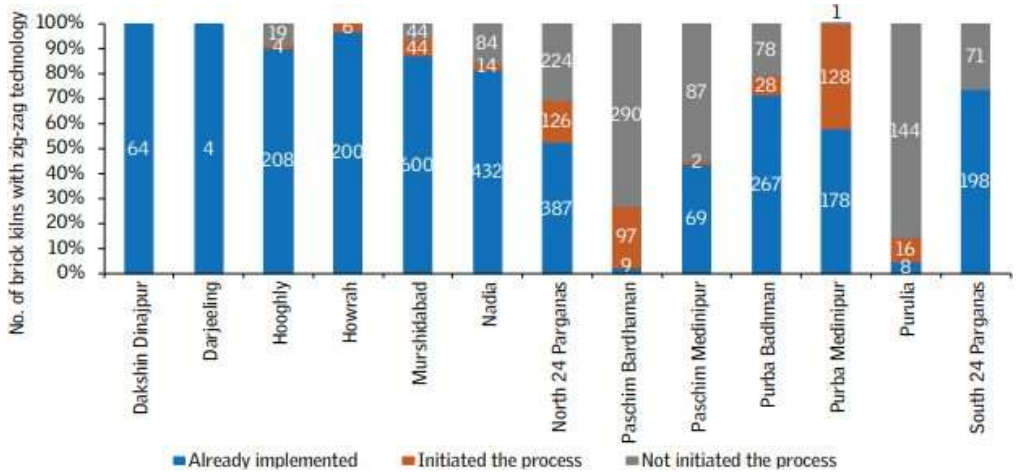
The following action points can be implemented to control the fugitive emissions:

- Shift from wet suppression to dry extraction system for dust control
- Proper infrastructure to arrest fugitive dust
- Declaration of crusher zones and relocating all units to these zones
- Installation of ambient air monitoring stations near crusher zones and conduct continuous compliance monitoring of the establishments
- Strengthening of state guidelines
- Display of consent information on gate

7.2.3 Brick kilns

The WBPCB maintains a detailed inventory of 4,131 brick kilns across 13 districts in West Bengal. The highest concentration is in North 24 Parganas (18 percent), followed by Murshidabad (17 percent) and Nadia (13 percent). As per an NGT order, all brick kilns must transition to zig-zag technology. Progress varies by district, with North 24 Parganas, South 24 Parganas, Purba Bardhman, Nadia, Purba Medinipur, Hooghly, Howrah, Murshidabad, Dakshin Dinajpur and Darjeeling having implemented this technology in over 50 percent of kilns (see Graph 23: District-wise number of brick kilns with zig-zag technology). Most of the brick kilns use pet coke, tyres, plastic, hazardous waste to burn the bricks through kiln.

Graph 23: District-wise number of brick kilns with zig-zag technology



Source: Based on the data provided by WBPCB

A MoEF&CC gazette notification on 22 February 2022 set stricter emissions standards for brick kilns, specifying stack height based on kiln capacity. New brick kilns must adopt zig-zag technology, vertical shafts, or use approved fuels such as piped natural gas or agricultural residues. Existing kilns near non-attainment cities must comply within one year, while those in other areas have two years. This shift to cleaner technologies and fuels will significantly reduce emissions.

7.2.4 Industrial waste burning

The issue of improper industrial waste disposal requires well-organized collection systems, particularly for non-hazardous waste, which is often overlooked compared to hazardous waste management. Without proper systems in place, non-hazardous waste is frequently burned in the open, contributing to pollution. To reduce such instances, it is essential to streamline the collection and disposal of industrial waste and hold industries and industry associations accountable for safe disposal practices.

Several types of industrial waste, such as fly ash, marble dust, slurry, quarry waste, zinc slag, blast furnace slag, rice husk and municipal solid waste, are generated across various sites. Instead of burning these materials, they can be incorporated into road construction, which would help reduce overall emissions.

According to the District Environment Plan, West Bengal has 832 industries generating hazardous waste. Howrah leads with 199 units, followed by Kolkata

(197), North 24 Parganas (121), South 24 Parganas (69)and Hooghly (56). Dakshin Dinajpur has no hazardous waste-generating industries and Kalimpong has only one. While hazardous waste management rules exist, strict enforcement is needed. Additionally, a robust system to manage non-hazardous waste is necessary to prevent open burning and minimize its environmental impact.

Thermal power plants: West Bengal has 16 operational coal-based thermal power plants. Farakka STPS has the highest installed capacity and consumes the most coal in the state. In 2020-21, West Bengal consumed around 47 million tonnes of domestic coal for power generation, which increased to 55 million in 2021-22.

These plants are mainly fueled by fossil fuels such as coal, oil and natural gas. Some industries such as aluminum, paper and cement are power-intensive industries. A faster roadmap is required to phase in the new standards. A transition plan for each plant must be developed to facilitate this process and ensure compliance. This will

Table 11: Status of coal-based TPPs in West Bengal

Sl no	Coal based TPPs	Capacity (MW) as on 31/03/2022	Coal consumption ('000 metric tons)		Net generation (GWh)	
			2017-18	2021-22	2017-18	2021-22
1	Farakka STPS	2,100	8,658	8,073	12,381	11,422
2	Sagardighi	1,600	3,889	7,298	5,718	10,991
3	Mejia	1,340	4,631	5,564	6,345	7,320
4	Kolaghat	1,260	3,748	3,391	4,208	3,789
5	Raghunathpur	1,200	1,422	3,960	2,104	5,696
6	Bakreswar	1,050	4,341	4,993	6,779	7,604
7	Mejia TPS EXT	1,000	3,231	4,300	6,182	5,794
8	Durgapur	1,000	4,097	4,121	5,101	6,049
9	Budge Budge	750	3,590	3,235	5,563	5,132
10	Haldia	600	2,981	2,939	4,175	3,948
11	D.P.L.	550	1,599	1,797	2,258	2,276
12	Santaldih	500	1,841	2,784	2,693	3,583
13	Bandel	335	1,407	1,367	1,713	1,559
14	India Power	300		895	25	1,003
15	Durgapur	210	657	251	832	188
16	Southern Repl	135	215	131	275	149
	Total	13,930	46,307	55,099	66,355	76,504

Source: Based on Central Electricity Authority (CEA), Ministry of Power data

enable stricter regulation of particulate matter, nitrogen oxides, sulfur dioxide and mercury emissions. The standards aim to prevent high levels of pollution and carbon from being embedded in new infrastructure for years to come, particularly as industrialization accelerates in the state. Enhanced stack monitoring through continuous emissions monitoring systems (CEMS) is essential.

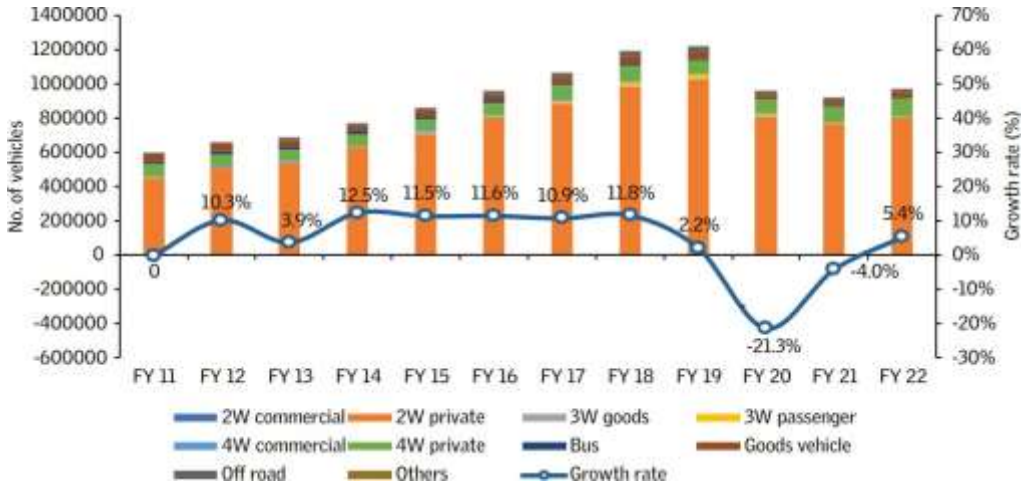
7.2.5 Vehicular pollution

West Bengal is urbanizing and motorizing rapidly. Vehicle numbers are rising steadily and bouncing back after the transitory decline during the COVID-19 pandemic. Two-wheeler (2W) sales were more impacted by the pandemic. Irrespective of the pandemic the four-wheeler (4W) registrations have seen a steady rise since FY 2019. The public transport segments, primarily the bus segment are declining.

In case of goods vehicles, registration of both three-wheeler (3W) goods and heavy-duty vehicles (HDVs) has declined after the pandemic. While 3W goods vehicle numbers are still down, HDV registration is bouncing back quickly. Also, annual registration of light duty vehicles has quadrupled since FY 2020 (*see* Graph 25: Segment-wise new vehicle registration in the state, 2012–23).

Personal vehicles dominate the trend. The percentage share of personal vehicles has remained high and has been increasing since 2020. Between FY 2011–12 and FY 2022–23, the share of private vehicles has increased by 5 percent.

Graph 25: Segment-wise new vehicle registration in the state, 2012–23



Source: Vehicle Registration data, Vahan, accessed in March 2023

In FY 2022–23, 97 percent of vehicles were ICE-powered, using diesel and petrol, though registrations of vehicles with cleaner propulsion systems, such as CNG, LPG and electric, have risen. Buses and heavy-duty trucks mainly use diesel but are gradually shifting to CNG and electric in urban centers. Smaller goods vehicles are also slowly adopting electric and CNG. This shift is driven by progressive policies promoting cleaner fuels, as vehicles remain a major source of pollution amid the state's growing vehicular population.

Due to the progressive tightening of vehicle emissions standards, the Bharat Stage-VI (BS VI) emissions standard has been implemented state-wide. This reduces particulate emissions of the new fleet by almost 82–93 percent and nitrogen oxide by 68 percent compared to BS IV level in diesel cars. The BS VI norms are also more effective from 2023 onwards with the follow-up implementation of real-world driving emissions regulations to bridge the gap between the certified emissions levels and real-world emissions performance on the road.

While new vehicle technologies and emissions control systems have improved and will continue to reduce tailpipe emissions, equal attention is needed for managing on-road vehicles. The focus should be on maintaining low emissions throughout a vehicle's lifespan, accelerating fleet renewal to benefit from BS VI standards and promoting rapid electrification to meet clean air goals. Additionally, transportation strategies will aim to reduce vehicle miles travelled and achieve an 80-85 percent modal share through public transport.

On-road emission inspection and monitoring

Currently, Pollution Under Control (PUC) programme which includes idling emission test is the widely used mechanism to check the emission levels of in-use vehicles in India. The petrol vehicles are tested for carbon monoxide, hydrocarbons and lambda test whereas diesel vehicles are only tested for smoke opacity, oil temperature, RPM, etc. PUC norms are linked to the different mass emission standards for vehicles. There is also an advisory from the Ministry of Road Transport and Highways for checking of the malfunctioning light of onboard diagnostic systems at the time of inspection and to return the vehicle for repair if the light is found to be 'on,' indicating a technical problem.

Currently, there are close to 2,000 PUC centers in the state. All PUC centers are integrated with the VAHAN portal and audited on an annual basis.

An Automated Inspection and Certification Center is under implementation at Behala. Additionally, at 12 other suitable government owned locations have

been identified for setting up of ATS, out of which for 6 locations belongs to the Transport Department. The proposal for IDT has been initiated for remaining six locations. These are more improved fitness testing centers for commercial vehicles.

The state has mandated the PUC for issuing vehicle fitness certificate. Challans are continuously issued to vehicles for non-compliance with the PUC requirements. The state is also considering linking the PUC certificate with vehicle insurance to improve compliance with the programme.

Improvement in the enforcement systems include linking of the PUC with the VAHAN database, automatic alert to vehicle owners for renewal of PUC certificates, linking refueling with valid PUC certificate and higher penalty. Another improvement will link the annual vehicle insurance with the PUC. In addition, all commercial vehicles must undergo annual roadworthiness and fitness tests through ATS under the Central Motor Vehicles Rules.

7.3 Initiatives of West Bengal Pollution Control Board (WBPCB):

- WBPCB has developed most intensive air quality monitoring network in the country. Ambient Air Quality is regularly monitored in 83 locations in West Bengal. In every District arrangement has been made for measurement of air pollution. Kolkata, Howrah, Haldia, Siliguri, Asansol, Durgapur and Barrackpore have 15 Continuous Automatic Air Qualities Monitoring Stations (AAQMs) for measuring air pollutants in real time round the clock.
- 175 Sensor based CAAQMS and 175 Real time Noise Monitoring Stations along with 125 LED Display Board inside the campus of educational institutions, police stations and district towns of our State have been installed and operative.
- Like previous year, the WBPCB has distributed around 560 nos. smokeless chulha among the road side eateries in non-attainment cities Howrah, Asansol and Durgapur in 2023 to replace wood and coal based chulha. This endeavor is a part of a program initiated for improvement of ambient air quality in and around Kolkata as per direction of the Hon'ble National Green Tribunal.
- Like earlier year, the WBPCB, in association with ULBs and Industries, engaged dedicated water sprinkling vehicles for water sprinkling on busy roads of towns for controlling air pollution in winter season due to flying of road dust.
- The Board has following ongoing research collaborations with the premier institutions: -
  - Projects on Source Apportionment, carrying capacity and emission inventory is ongoing by engaging IIT, Delhi, NEERI and TERI at NACs in

connection with air quality management.

- A project on "Controlling Fire in Landfill Site from Methane Emission-Use of Microbial Consortia for Achieving Clean Environment" will be undertaken by Centre for Climate & Environmental Studies, IISER, Kolkata.
- Initiated a pilot project to reduce the Fecal Coliform count at the discharge point of the STP and other sites by involving IISER, Kolkata.
- Project on "Hollow Fiber Membrane Based Drain Water Treatment Device for Reduction in Fecal Coliform and BOD Levels in Champdany Canal" in association with Department of Chemical Engineering, IIT, Kharagpur.

- World Environment Day was observed on 5th June, 2023 throughout the State to create environmental awareness among the people. Campaign program for noise, restrictions on use of banned single-use plastic carry bags, air and water pollution, use of loudspeaker continues.
- On the eve of World Environment Day i.e. on 5th. June, 2023, the WBPCB has published the following booklets / brochure / Poster / reports:
  - Annual Report, 2021-2022
  - Brochure on Mission LiFE (Bengali)
  - Book on Plastic Pollution (Bengali)
  - Posters on WED-23 theme & 7 Mission LiFE themes
- 'Paribesh App,' Integrated Grievance Management System (IGMS), Court Case Monitoring System (CCMS) and Paribesh News YouTube channel are functioning efficiently.
- Integrated Command & Control Centre (CCC) for Noise and air Monitoring Terminals is operating at Head office, WBPCB.
- In the collaborative effort for a quieter, cleaner and eco-friendly environment, the Board in association with Kolkata, Howrah, Barrackpore, Bidhannagar and Chandannagar Police Commissionerate conducted several meetings with police authorities, housing & puja committees, NGOs during Dewali-2023.
- As a part of Environment Education programme, the WBPCB has organized a workshop on air quality management for schools & colleges. Student received valuable inspiration and insights to campaign cleaner Kali Puja / Diwali, 2023.
- The WBPCB has set up a Testing Centre and a Laboratory in association with NEERI for obtaining NEERI certification on green cracker by the prospective green fire cracker manufacturers. The site is at Haldia Regional Office cum Laboratory Building of the Board.
- The Board has initiated development of Bio-Shield along the 7 km stretch of border of Jhargram district involving WBPCB, WBBB and District Authorities to mitigate the issues due to transboundary pollution on 8th September 2023.
- On World Environment Day, the West Bengal Pollution Control

Board has launched four special projects aimed at benefiting the environment. These initiatives include:

- Environmental Surveillance Drone Services
- Bus Roof Mounted Air Purification System (BRMAPS)
- Bus Inside Air Purification System (BIAPS)
- Solid Bio-Mass Cook Stove

- The WBPCB regularly conducts Environment Education Programme(EEP) previously known as, National Green Corp (NGC) Programme, involving students and teaches of 5632 nos. schools and 100 nos. colleges.
- 17 solar photovoltaic cells (10 KWP) based power generation units are in the process of installation in different schools / institutions across the State in 2023.
- The WBPCB and Department of Environment, GoWB is maintaining close coordination with Department of UDMA, GoWB for implementation of different provisions of Solid and Plastic Waste Management Rules.
- The Board has granted permission to the first 500 TPD C&D Waste Processing Plant of State at Patharghata, New Town in 2023.
- For Plastic Waste Management, surprise visits are conducted on regular basis to banned plastic items manufacturing units, markets in association with SUDA, CPCB and ULBs.
- 123 nos. of Legacy Dumpsites has been identified from 128 ULBs for management of Legacy Solid Waste through bio-mining in West Bengal. Special thrust has been given on 100% source segregation and disposal of solid waste adopting low-cost hybrid model etc.
- Initiatives have been taken for management of Fresh Solid Waste through Composting, Bio-methanation and Material Recovery Facility.
- WBPCB successfully achieved the monthly targets of Administrative Calendar 2023.
- WBPCB inaugurated 30 nos. Electric Vehicle Integrated Dust Suppressant Water Sprinkling Systems for abatement of Air Pollution in six NACs on 18th Dec 2023.
- WBPCB has been crowned with the prestigious PRITHIVI AWARD-2023.

7.3.1 Graded Response Action Plan (GRAP)

In November 2022, the Department of West Bengal along with the West Bengal Pollution Control Board have issued 10 points action plans to prevent a surge in air pollution during winter. This has been designed for Kolkata and other non-attainment cities in the state.

The action plan includes:

- Periodic mechanized sweeping and water sprinkling to roads, particularly at heavy traffic corridors and hotspots to suppress dust.
- Ensuring disposal of dust and garbage in designated sites.
- Stringent enforcement to stop open burning of garbage.
- Ensuring that demolition materials and waste generated from construction sites are properly contained; violator sites should be identified and closed.
- Stringently enforce prohibition on open burning of biomass and municipal solid waste.
- Synchronization of traffic movements for smooth flow of traffic.
- Continuously monitoring the implementation of norms at the identified pollution hotspots in the city.
- Strict enforcement of PUC (pollution under control) norms and acting against visibly polluting vehicles with heavy fines.
- Diversion of non-destined truck traffic and reducing 50 percent of heavy goods vehicles except vehicles carrying essential commodities or providing essential services.
- Strict action is also proposed against bursting of banned fire crackers and use of non-complaint diesel generator sets.

7.3.2 Awareness/Sensitization programs/workshops conducted against Stubble Burning

The WBPCB has been actively working to control open biomass burning by sending daily alerts to relevant authorities. These reports, which include mouza-level incidence details with coordinates, are shared with local police stations to enhance monitoring and response. Awareness programs have been initiated to educate the public and strict vigilance is being maintained in high-risk areas to prevent further incidents. The WBPCB also collaborates with the Forest and Agriculture Departments to mitigate open biomass burning. In the 2022-2023 period, ATRs were received for 1,660 cases, demonstrating ongoing efforts to address the issue.

7.3.3 Advancement of on-road emissions monitoring

New vehicle technologies have advanced considerably with the tightening of the mass emission standards from Bharat Stage IV (BS IV) to BS VI. There is a need to modernize the on-road emissions monitoring techniques and tests to address the emissions from vehicles in real world driving conditions. This is not possible with the idling testing under PUC. With modernization of the vehicle fleet and transition to BS VI emissions standards with advancement in emission control systems, the PUC is no longer the most effective strategy to identify the grossly polluting vehicles on the road. Also, a range of pollutants, including CO, CO2, HC,

NOx and smoke emissions, require monitoring but cannot be measured in the idle testing system of the vehicles under the PUC programme.

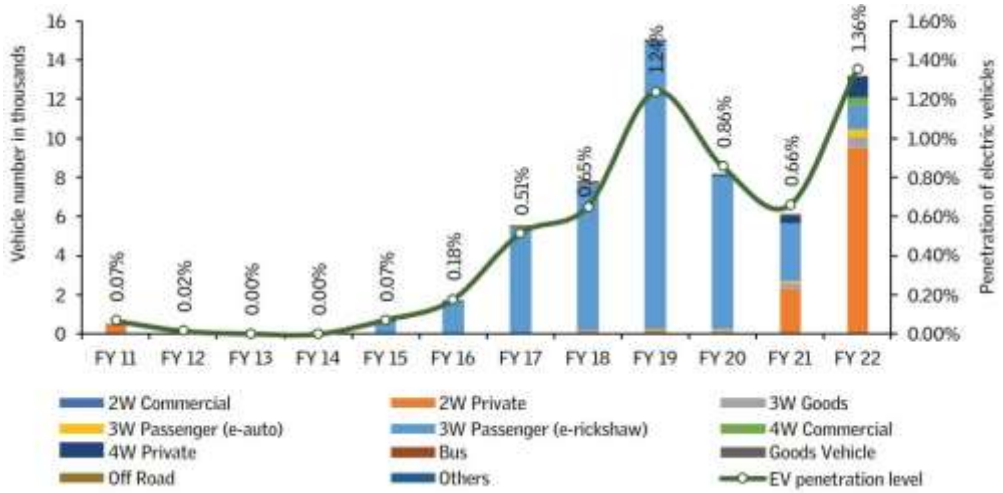
Following a 2009 Calcutta High Court directive to enhance emissions surveillance, the West Bengal Department of Transport introduced remote sensing devices (RSDs) for on-road monitoring in Kolkata. Now, in collaboration with the State Pollution Control Board, there are plans to expand the programme to six non-attainment cities. RSDs, using light absorption techniques, monitor exhaust emissions from moving vehicles without physical testing, enabling rapid screening of large fleets to identify high emitters for further testing and improved pollution management.

MoRTH is framing rules for the implementation of this advanced technology for monitoring of vehicles on the road. MoRTH has framed draft AIS 170 rules to define the scope of the programme. Final notification is awaited

7.3.4 Electric vehicles

West Bengal's electric vehicle (EV) policy, adopted in 2022, targets 10 lakh EVs and 1,00,000 public and semi-public charging stations by 2026, aiming for a ratio of 8 EVs per charging point. By 2022, EVs accounted for 1.36% of new vehicle registrations, with 95% of the fleet being e-rickshaws. registrations (*see Graph 26: Trends of annual EV registration in West Bengal*).

Graph 26: Trends of annual EV registration in West Bengal



Source: Vahan dashboard

The policy includes a dedicated EV accelerator cell, 100% exemption from road tax and registration charges for EVs and a fixed charging tariff of Rs 6 per kWh, below the commercial rate. Kolkata, Howrah, Asansol and Darjeeling are identified as model cities for electric mobility, with New Town serving as the testing ground. Green zones for non-fossil fuel vehicles are also planned, along with expanding charging infrastructure.

The state has procured 80 electric buses under FAME-1, with 75 operating in Kolkata and five in Digha. Plans under FAME-2 include the procurement of 2,000 more buses. Thirteen cities in West Bengal are eligible for PM e-bus seva grants. Kolkata received a green mobility award in 2021 for its efforts in transforming public transport.

Charging stations have been set up statewide and green corridors are planned along the Kolkata-Asansol and Kolkata-Digha routes to electrify heavy-duty vehicles, with rapid chargers every 25 km. The state aims to electrify 30-40% of new fleets by 2030, including two- to four-wheelers and heavy-duty vehicles.

Kolkata's electrification rate is slightly higher than the rest of the state, with projections for greater adoption in two- and four-wheelers. E-rickshaw registration has been halted in the core city area due to congestion. The implementation of Battery Waste Management Rules, 2022and recycling infrastructure will also be essential to support the EV ecosystem.

Theme 7: Noise Pollution Management

Noise pollution, an often-overlooked environmental hazard, poses significant threats to public health, well-being and overall quality of life. It stems from various sources such as industrial activities, transportation, construction and urbanization, contributing to increased stress levels, hearing impairments and other health issues. Effective noise pollution management is crucial to maintaining environmental harmony and ensuring a healthier living environment.

8.1 Real Time Ambient Noise Monitoring & Results:

Kolkata hosts ten Real-Time Ambient Noise Monitoring stations strategically located across various zones, reflecting diverse urban functions. These include industrial areas such as Kasba and Taratala, commercial zones like the Kolkata Municipal Corporation, Tollygunge and the WBPCB Headquarters, residential areas including Baishnabghata-Patuli, Bag Bazar and Birati-Neelanchaland silence zones at SSKM Hospital and R.G. Kar Hospital. This distribution ensures comprehensive noise monitoring across the city's industrial, commercial, residential and sensitive zones.

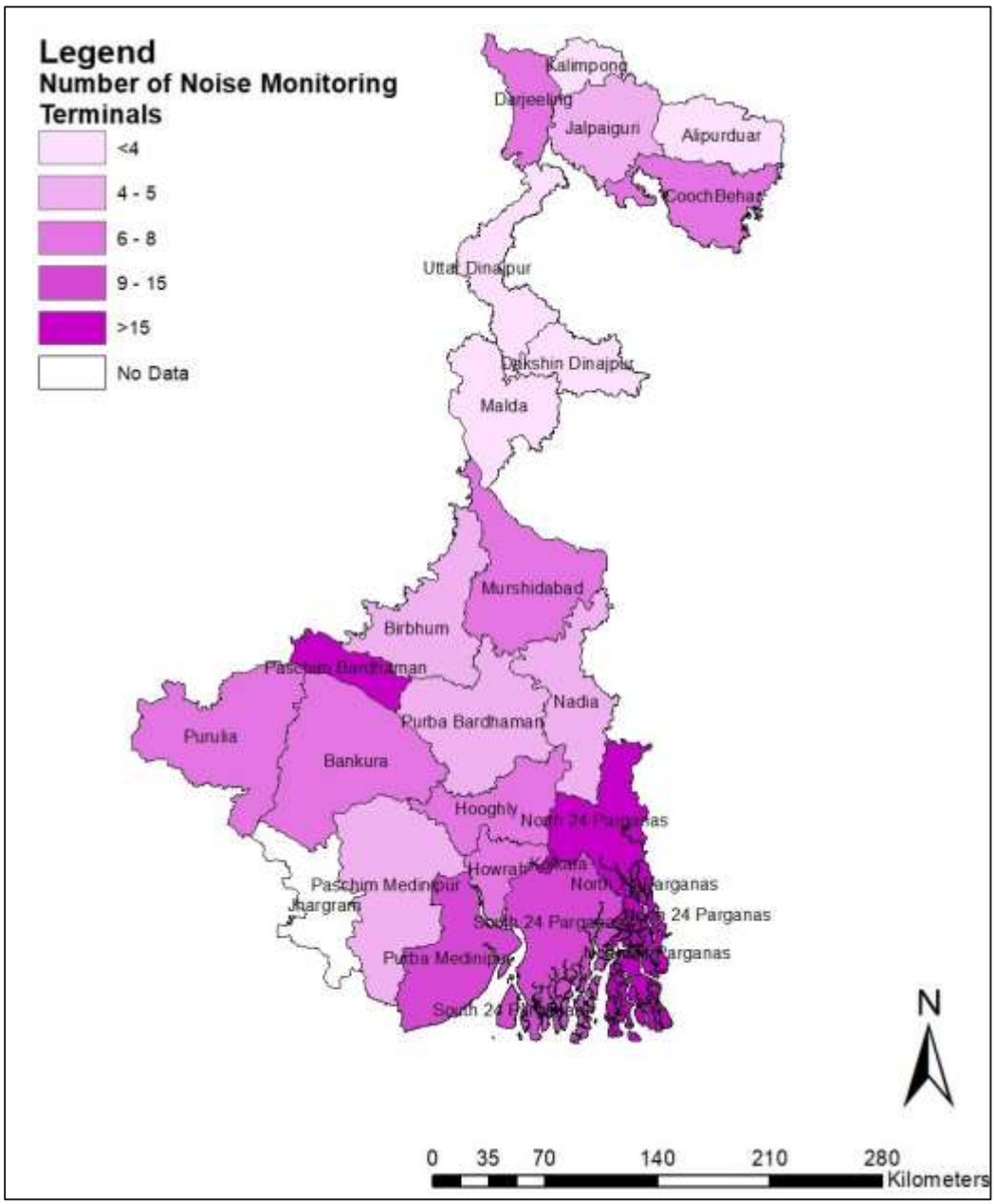
Regionally, North 24 Parganas leads with the highest number of noise monitoring terminals (29), followed by Kolkata and Paschim Bardhaman with 17 each, highlighting their urban density and environmental monitoring needs. Districts such as Purba Medinipur and South 24 Parganas also maintain significant coverage with 14 and 12 terminals, respectively. In contrast, less urbanized areas like Kalimpong and Malda are minimally equipped, with only 1–2 terminals each, indicating potential gaps in noise surveillance infrastructure in these regions (see: Map 30: District wise number of noise monitoring terminals in West Bengal).

8.2 Noise Pollution monitoring in Kolkata during Kali Puja and Diwali, 2022

In Kolkata, effective noise pollution monitoring is a critical aspect of managing environmental compliance during festivals like Kali Puja and Diwali. The use of noise-generating fireworks exceeding 90 dB(AI) at 5 meters, including items like chocolate bombs, chain crackers, Kali Patka, Dodoma and other similar firecrackers, is strictly prohibited by law in West Bengal. Enforcement is carried out by the police authorities, who are empowered to act against violations, including the indiscriminate use of loudspeakers and banned firecrackers.

To ensure compliance, the State Pollution Control Board conducts awareness campaigns in Kolkata ahead of Kali Puja and Diwali, educating the public about the harmful effects of noise pollution and the legal restrictions on banned firecrackers. Additionally, special control rooms are set up at the State Board's headquarters in Paribesh Bhawan and regional offices during these festivals to monitor noise levels, address public grievances and ensure adherence to noise pollution regulations. These initiatives contribute to maintaining permissible noise levels and safeguarding public health during the festive season.

Map 30: District wise number of noise monitoring terminals in West Bengal



Source: West Bengal Pollution Control Board

9 Sector-Wise Action Plan

The SEP for West Bengal has been developed based on the inputs shared by the District Administration and various departments responsible for different sectors of environmental management. The plan has been designed in compliance with the directives of the National Green Tribunal (NGT) and specifically addresses the issues outlined by the NGT for each sector.

This action plan identifies key policy measures and strategies, along with a clear timeline for implementation, which includes both short-term and medium-term goals. It also designates the agencies responsible for carrying out these actions. Each action point is clearly defined with key performance indicators to assess the impact and progress of implementation. The plan aligns with both state and national regulations within the respective sectors to ensure consistency with broader legal frameworks.

9.1 Waste Management Plan

Most districts have reported data on municipal solid waste, demonstrating progress in this area. However, there is an opportunity to enhance data collection for other solid waste streams such as plastic, C&D waste and biomedical waste. Creating a detailed inventory and assessing the status of these waste streams will further strengthen solid waste management operations.

S. no.	Action points for all districts	Agency responsible
Short-term priority action		
1.1	Implement the priority actions identified by the State Urban Development Agency in response to the NGT order No. 673/2018 dated 20.09.2018 and 606/2018 dated 16.01.2019 and 02.04.2019 (clause No. IV, 39.i of page no. 22 and 23).[24]	Urban Local Bodies, State Urban Development Agency, State Level Committee on Solid Waste Management, WBPCB
1.2	Frame waste byelaws and incorporating the provisions of solid waste management (SWM) Rules 2016. Include roles and responsibilities of different actors like waste generators, ULBs, UD&MA and WBPCB, private sector and others in integrated solid waste management. Include mandatory segregation of waste at source in streams like plastic waste, construction and demolition waste, e-waste, bio-medical waste and hazardous waste. Enable their handling as per their respective rules notified in 2016. All local bodies (Urban and Rural) to have waste by-laws. The byelaws should include user fee and penalties when failing to comply to the byelaws or provisions of SWM Rules 2016.[25]	Urban local bodies, SUDA, UDMA, KMDA P&RD
1.3	Take stringent action against illegal dumping in water bodies and low-lying areas and open burning of solid waste including biomass, leaves, tyres, etc. to control such activities. Impose a complete ban on garbage burning.	Urban Local Body WBPCB P&RD
1.4	Enable waste segregation at source: Segregate waste streams at household level into wet (green bin) and dry (blue bin) and separately for domestic hazardous waste (black pouch of thickness more than 50 microns) as per the SWM Rules 2016. Introduce appropriately colored bins. Nirmal Bangla mission has enabled door-to-door collection, segregation, bioremediation at dumpsites and processing of fresh waste. Under these programmes, all ULBs are expected to divert at least 80 percent of the municipal solid waste from dumpsites while ensuring 100 percent remediation of legacy waste by 2026. A few ULBs have initiated treatment of solid waste by composting or bio-methanation. In order to run these units successfully, segregation at source is necessary. Failing to comply to segregation as per SWM Rules 2016, households, institutions and entities are penalizable.	WBPCB, ULBs, RWAs, institutions, individual households

1.5	Enable door-to-door collection, transportation and segregated neighborhood storage: West Bengal has a system wherein door-to-door waste collection is divided into 'beats.' A beat comprises of a fixed number of lanes and fixed households. The waste is collected in tricycles, wheelbarrows or pushcarts. Compartmentalize these modes to separate wet and dry waste and transport from household to primary storage. Cover the modes to prevent odor and spillage. The SoE report suggests West Bengal generates 435 grams per capita per day of solid waste on an average. However, the volume of waste is highly dependent on socio-economic characteristics of a city. Record the volume of waste collected in a beat for at least a week to determine the daily average of waste generation in that area for each stream – biodegradable and non-biodegradable. For primary storage at neighborhood levels, install appropriately sized waste containers with capacity ranging from 120 liters to 4500 liters depending on the volume of the waste collected in a beat. Identify location of these containers in collaboration with the residents. Use GPS in collection and transportation vehicles in cities with population above 5 lakhs mandatorily and publish the route map as per the SWM Rules 2016	All Local Bodies (Urban & Rural) P&RD
1.6	Facilitate processing of organic waste at a decentralized level: Incorporate 100 percent decentralized processing using bio-CNG and nature-based solutions such as windrow composting and vermicomposting. Earmark space for composting of horticulture waste in public parks. Work out the possibilities of establishing decentralized composting or bio-methanation plants with users or waste generators at neighborhood level. About 50-60 percent of the waste generated in West Bengal is biodegradable in nature. If segregated in compliance to the SWM rules, waste can be treated on-site thereby reducing the land requirement for processing facility or landfill by half. ULBs can help create a market for compost sale.	Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.7	Include the informal sector in waste management and disposal: several households have employed private informal individuals to collect and transport the waste. Internalize these individuals by employing them under the ULB to conduct formal waste management services. Provide them with formal training, safety gear and appropriate equipment for conducting the services.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

1.8	Implement a roadmap to reduce plastic use. WBPCB is collaborating with the Indian Plastic Federation and SUDA to implement Extended Producer's Responsibility (EPR). Strengthen these efforts. It has also banned plastic carry bags in heritage and tourist areas, restricting bags under 75 microns. On June 5, 2023. This initiative should be extended to all residential and commercial areas. Aggressively promote use of biodegradable plastics, cotton cloth and jute bags. Incentives could be given to consumer for depositing used plastic bottles and other articles in the form of coupons - a vending machine system to be created.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.9	Recognize the recyclers and dealers in the cities and authorize them to collect plastic waste upon scrutiny of their handling and recycling facility.	Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.10	Encourage collection centers under the EPR model as per the plastic waste management rules, 2016 and e-waste management rules 2016. Integrate the informal sector in the EPR framework of the city for plastic waste management.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.11	Set up strong monitoring and surveillance system for implementation of the C&D rules and on-site dust control measures: Implement inspection of construction sites for segregated storage of C&D waste and enforcement of dust control measures. Adopt appropriate measures for control of fugitive emissions from construction and material handling, conveying and screening operations. This can be done with water sprinkling, curtains, barriers and dust suppression units. Impose stringent penalty that acts as a deterrent.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.12	Promote recycling and reuse of C&D waste as construction material. A C&D waste recycling plant with a capacity of 1600 TPD was established in Patharghata, Kolkata, in 2023 to serve KMC and BMC. As per the C&D waste policy, four clusters have been identified to establish C&D waste processing facility and their execution should be prioritized. Relevant authorities should work to identify additional clusters across the state. For material handling and construction demolition, it should be obligatory on part of the developers to provide evidence of debris disposal at collection points or designated sites. ULBs to identify and earmark collection points for each ward such that each collection point covers a radius of not more	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

	than 3 km. All construction projects to submit a C&D waste management plan during the building plan approval, hand over the waste to the service provider, pay user charges and use recycled products to the extent of 20 percent of total construction materials	
1.13	Impose spot fine on littering: Install twin-bins (biodegradable and non-biodegradable) in commercial, institutional and public areas like bus stops, parks, footpaths, etc. and strategic locations at every 100-150 m to prevent littering.	ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.14	Bulk waste generators to set up decentralized waste handling and processing facility as per the SWM Rules 2016. A bulk waste generator is an entity that generates waste above 100 kg per day on an average.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

Medium-term action		
1.1	All local body to make an action plan on waste management in accordance to the SWM Rules of 2016 with a time bound strategy. There are several policies and rules that govern this sector. This plan should include the short-term priority actions as well as the provisions of respective rules for municipal solid waste, plastic waste, construction and demolition waste, e-waste, bio-medical waste and hazardous waste.	Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.2	Setup transfer stations instead of secondary storage bins mandatorily for cities with population above 5 lakhs as per the SWM Rules 2016. There should be one transfer stations in each ward and waste from primary storage should be brought to these stations in covered vehicles. Arrange for material recovery facility at the transfer stations to separate recyclables like PET bottles, LDPE plastics, soft drink cans, glass, metals, etc. Install compactors to create refuse derived fuels pellets for non-recyclables.	ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.3	Develop and maintain a waste inventory for major cities of West Bengal: Properties of waste vary from place to place and depends on which type of land use it came from. Conduct waste characterization studies to determine physical and chemical properties of the waste generated like moisture content, calorific value, Carbon/Nitrogen ratio, etc. This will help in identifying most appropriate method for treatment of waste such as composting, bio methanation or waste to energy	WBPCB supported by CPCB, IMD, DSTBT

	including the seasonal variations.	
1.4	Remediation of the legacy waste at saturated landfill sites: The government has planned to remediate legacy waste from 123 dumpsites across the state, as reported by SUDA, showcasing a proactive approach. Efforts should be accelerated to execute this initiative promptly. Additionally, other dumpsites should be identified and bio- remediation plans should be developed for implementation. Regular tracking of methods used for remediation will ensure timely and comprehensive cleanup. Prevent spontaneous fires in landfills. Avoid opting for waste to energy plants as those are cost- intensive, less effective and have serious environmental and public health hazards.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

1.5	Shift completely to scientific landfills: Adopt the approach of near zero landfill city by minimizing the requirement for a landfill. Wherever required, go for engineered landfills at a site identified scientifically after conducting carrying capacity analysis and ensuring it does not bear environmental and public health risks. Establish systems to prevent illegal dumping of waste at random dumpsites especially in the smaller cities. Bring the waste dumped at these illegal sites to the engineered landfill.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.6	Set up a waste management public information dissemination system for different streams of waste based on the Waste Management Rules 2016. This should clearly lay down the roles and responsibilities of the citizens and the ULB in the entire process of waste management including impacts of unscientific waste management and public health advisory. Set up system for dissemination of information to public through website and local media. This may include a portal for public to collaborate with the ULB for effective waste management Build public awareness programmes in assistance	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

	with NGOs, educational institutions and RWAs to conduct demonstrations for integrated waste management. Ensure involvement of children in the process	
1.7	Establish monitoring mechanisms for implementation of waste byelaws and action plans: ULBs to update month-wise targets/ actions in the online format shared by the Urban Development & Municipal Affairs (UD&MA) department. An annual report also to be submitted to WBPCB and UD&MA department as provided in the SWM Rules 2016. A database for implementation of action plan must be set up to ensure adoption of SWM Rules without further delay.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
1.8	Develop capacity at ULB level for implementation of the waste byelaws. ULBs should be trained on how to develop and maintain inventory of waste, appropriate treatment methods and achieve the state's aim for a zero-landfill state.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

9.2 Water Quality Management Plan

S. no.	Elaboration on action points	Agency responsible
Short-term priority action		
1.1	Mitigate data gaps: Indicators such as the control of riverside activities and the protection of floodplains must be reported by all districts with the utmost urgency.	ULBs, WBPCB, Public Health Engineering Department (PHED), WRIDD, SWID,Central Groundwater Board (CGWB), Irrigation and Waterways Department (I&WD) Development Authorities Department of P&RD, GoWB
1.2	Water quality monitoring:	
	Prepare an inventory of water bodies using information from the Hydrogeological Atlas of West Bengal. This should include mapping of riverbanks, shorelines, nalas/drains, lakes and ponds, seasonal variation in their levels, dissolved oxygen, biological oxygen demand and other important information. This information should be available on an online platform	ULBs, WBPCB, Public Health Engineering Department (PHED), WRIDD, SWID,Central Groundwater Board (CGWB), Irrigation and Waterways

		Department (I&WD) Development Authorities Department of P&RD, GoWB)
	Implement water audits and expand energy efficient water infrastructure and shift to clean energy. Adopt protocol for water audits across institutions, residential buildings and irrigation systems. Expansion plan and technology for adaptation of energy efficient systems based on renewable energy.	Department of UD&MA, GoWB Department of WRIDD, GoWB Department of Power, GoWB Department of Non-Conventional & Renewable Energy Sources, GoWB Ministry of New & Renewable Energy (MNRE) West Bengal Pollution Control Board
	Expand continuous Real Time Water Quality Monitoring Station on water bodies including other rivers and major lakes. Check if the quality meets CPCB Guidelines for Water Quality Management 2008.	WBPCB Department of UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
	Create a water quality monitoring cell: Upload water quality data for both surface and ground water at ULB level on an online platform. The cell to monitor all activities related to water quality including dumping of solid waste, sewage discharge, encroachment of flood plains, control of riverside activities, etc.	ULBs, WBPCB, PHED, IWD, CGWB, UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
	Prevent discharge of untreated sewage into the water bodies: Issue directives to all SPI and Red and Orange category industries to submit a discharge water quality report	ULBs, WBPCB, PHED
	Wastewater treatment through nature- based solutions (rivers and inland waterbodies, ponds, etc.) Local bodies should adopt constructed wetlands—an alternative and cost-effective solution to energy intensive	UD&MA, GoWB [SUDA] ULBs & Municipalities

	treatment systems to treat waste water. Adoption of floating wetlands for purification of water (with aquatic plants like cattails, canna, bulrush, citronella, hibiscus, fountain grass, floral herbs and ashwagandha to decompose microorganisms) Geo-mapping of waterbodies should be done by all local bodies (urban and rural) for protection and better documentation.	Development Authorities Department of P&RD, GoWB WBPCB, WRIDD and SWID
1.3	Groundwater database and quality:	
	Conduct ground water surveys to identify quality of groundwater at city level and identified over exploited, polluted and critical areas. Ground Water Year-Book 2022 contains information such as location of groundwater monitoring wells, depth to water and quality of groundwater. Utilize and update this information at ULB level by conducting fresh sampling of borewells present in the urban areas. Seal all contaminated borewells and tubewells found unfit for public use.	CGWB, WBPCB, WRIDD. PHED
	Introduce a groundwater abstraction and use permit system that can cap extraction and use at sustainable yield of groundwater only from the shallow aquifer in each sector. This can define water allocation, abstraction technology, metering technology, etc. All groundwater extraction must be strictly regulated and limited to the shallow aquifer, so that it can be recharged by rainwater easily.	ULB, CGWB, WBPCB, WRIDD. PHED
1.4	Rainwater harvesting:	
	All new and existing building complexes and colonies must implement an area-wide plan for rainwater harvesting. According to the revised Environment Impact Assessment Guidelines, there should be one bore-well for groundwater recharge for every 5,000 sq m of floor area. In areas where groundwater recharge is not feasible, rainwater should be harvested and stored for reuse.	ULBs & Municipalities Development Authorities Department of P&RD, WRIDD, I&WD
	Implement periodic (pre-monsoon and post-monsoon) inspection, maintenance and monitoring programmes for rainwater harvesting structures: Expand the "Jal Dharo Jal Bharo" initiative to construct and restore water bodies and retention structures. Monitoring will help understand the impacts of the structures on groundwater quantity and quality. The groundwater level and quality data monitored during pre-monsoon and post-monsoon periods should be available in the public domain. This is also needed to ensure rainwater harvesting structures are being properly operated without any negative fallouts.	UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB PHED, WBPCB
1.5	Dumping of solid waste on river banks: Take stringent action on illegal dumping of solid waste along river banks and into the wetlands.	ULBs and WBPCB

1.6	Control all river side activities all year round: Prevent riverside open defecation and take measures for idol immersion. Ensure that idol immersion takes place in dedicated areas. Follow the guidelines issued by CPCB on idol immersion. [25] Impose ban on sale of idols painted with non-biodegradable chemical dyes. Discourage painting of idols in general or use water soluble and non-toxic natural dyes.	WBPCB UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
Short-term to medium-term action (6 months to 1 year)		
1.7	Other action points for the Government of West Bengal:	
	Prevent encroachment of flood plains: Map areas of encroachment by geo-tagging and take swift action to clear all encroachment. Initiate plantation drives in reclaimed flood plains to prevent erosion of sandy riverbanks	ULBs, WBPCB, IWD, West Bengal Wasteland Development Corporation Ltd., West Bengal Forest Department and West Bengal Forest and Biodiversity Conservation Society
	Region-wise plan and target for river basin wise micro watershed management: Development of integrated regional watershed plans and river catchment rejuvenation. Comprehensive watershed management plans for major river basins (e.g. Hooghly, Maurakshi, Damodar Teesta, Torsha etc.) to extend these strategic approaches. Hydrological and terrain modeling for watershed management of surface water resources.	ULBs, WBPCB, I&WD, West Bengal Wasteland Development Corporation Ltd., West Bengal Forest Department and West Bengal Forest and Biodiversity Conservation Society
	Build awareness campaigns on the impact of water pollution on public health	ULB, PHED, Health & Family Welfare Department (HFWD)

9.3 Domestic Sewage Management Plan

S. no.	Elaboration on action points	Agency responsible
Short-term to medium-term action (6 months to 1 year)		
1.1	Need a city/town-wise database of sewage management: WBPCB currently monitor 48 STPs located across various cities. However, ULBs currently do not have an account of sewage generation and volume and quality of water being discharged into the water bodies. Prepare aninventory of sewage treatment plants (STPs) along with the status of their operations. Providing toilets is not a solution to sustainable sewage management. In absence of connection to sewage network and low treatment capacity, sewage is disposed in garbage dumps; storm water drains or water bodies. Map the number of households connected to the sewage network. Faecal Sludge and Sanitation Management approach enables an efficient database of sewage management in cities and helps in informing policy decision. Explore possibilities of co-treatment of solid and liquid wastes under the Swachh Bharat Mission (see Annexure III)	WBPCB UD&MA, GoWB [SUDA] , ULBs & Municipalities, Development Authorities, Department of P&RD, GoWB
1.2	Provision of treatment infrastructure:	
	Setup decentralized STPs at building and colony level for treatment, recycling and reuse of water. Treated wastewater can be reused on-site for landscaping, flushing, cooling tower and other end uses. Excess treated water can be discharged as per CPCB norms. Natural treatment systems need to be promoted. On-site sewage treatment which can treat 100 percent of the wastewater needs to be treated before discharge into waterbodies or water channel.	WBPCB UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
	Promote options of separating grey and black water with dual plumbing system or single stack system with separate recirculation lines for flushing. For dual piping purpose, one pipe carries fresh water (from bore well, tube well, overhead tanks etc.) and the other recycled grey water (from local treatment systems). The grey water should be completely separated from black water before treatment. Separating grey and black water is essential but expensive. Recycled grey water can be used for flushing purpose and not recycled black water. Recycled black water may clog the flushing system. The treated grey water will be used for flush tanks. The black water coming out of the toilets will be treated and used for green areas. The grey and black water coming out of the toilets, bathrooms and kitchen can also be treated together through reed bed/microbe beds to the level of irrigation standard. Sludge from on-site sewage treatment, including septic tanks, can be collected, conveyed and disposed as per the Central Public Health and	ULBs and WBPCB

	Environmental Engineering Organization's (CPHEEO) Manual on Sewerage and Sewage Treatment Systems, 2013. The alternative is to design the sewage treatment system for reuse in industry.	
1.3	Discharge of sewage into water bodies:	
	Install Continuous Effluent Monitoring Station (CEMS) at the outlet of STPs to ensure the these STPs meet the prescribed standards as per CPCB.	WBPCB UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB
	Monitor water quality to ensure sewer lines do not contaminate stormwater drains: Test every month the biological oxygen demand (BOD) of the key stormwater drains every 5 km, to ensure there is no contamination from leakage of sewage.	WBPCB UD&MA, GoWB [SUDA] ULBs & Municipalities Development Authorities Department of P&RD, GoWB

1.4	Other action points for Government of West Bengal:	
	Mandate industry and construction industry to re-use treated water. Also, promote use of treated water for city beautification and greening	WBPCB ULBs & Municipalities Development Authorities Department of P&RD, GoWB
	Promote and mandate water-efficient fixtures in buildings: As more and more water will be supplied, more wastewater will be generated, therefore more will be the cost for its treatment, which makes sewage management unsustainable for the cities. Make it mandatory to replace old fixtures that use more water with water-efficient fixtures. Policy initiatives like labelling of water-efficient fixtures, rebates on the fixtures, rebates on water bills etc. can help. These fixtures can substantially reduce the volume of sewage generated. Refer parameters like Baseline Flow Rates / Consumption for plumbing fixtures in Uniform Plumbing Code of India.	ULBs & Municipalities Development Authorities Department of P&RD, GoWB
	Initiate a public awareness and outreach programme. Create awareness in the community about the importance of water and incentivize them to use water carefully and wisely (including school awareness programmes). Prepare model demo projects, water information centers etc.	ULBs, WBPCB and HFWD Development Authorities Department of

		P&RD, GoWB

9.4 Industrial Wastewater Management Plan

S. no.	Elaboration on action points	Agency responsible
Short-term to medium-term action (6 months to 1 year)		
1.1	Mitigate data gaps: Indicators such as the total quantity of industrial wastewater generated, the quantity of treated industrial wastewater discharged into nalas/rivers and details of common effluent treatment facilities must be collected by all districts and shared with the utmost priority.	WBPCB, MSME
	Mitigate industrial water pollution and recover wastewater: Implement upscaled plans for critically polluted areas and industries with high water usage and pollution potential. Need industry-wise generation of wastewater mapping and monitoring. Eliminate hazardous and harmful materials used in the production process. Adopt waste management, waste minimization and recycling of water.	WBPCB
1.2	Quantity of untreated wastewater: prepare a zero industrial wastewater plan. Review and establish the need for wastewater treatment plants and reduce discharge of untreated or partially wastewater into water bodies.	WBPCB
	Prepare an inventory of the water polluting industries in the catchment of River Ganga, Hooghly and Subarnarekha covering assessment on aspects relating to status of Consents under Water & Air Acts and Authorization, Effluent Generation, ETP Capacities and final mode of effluent discharge.	WBPCB
1.3	Number of industries not meeting discharge standards and stringent action of non-compliance:	WBPCB
	Take stringent action against the identified industries not meeting discharge standards and in operation without Consent of the West Bengal Pollution Control Board	
	Common Effluent Treatment Plant: Review status of installed capacity to treat industrial effluents. Expand capacity to ensure indiscriminate discharge into water bodies. Ensure action against the industries who have not installed Effluent Treatment Plants (ETP). ETPs that exist but not operating or treated effluent is not meeting the prescribed standards should be penalized as well.	WBPCB
1.4	Setup mechanism for regular monitoring and sampling of water quality of rivers and various drains on monthly basis.	WBPCB

9.5 Air Quality Management Plan

S. no.	Elaboration on action points	Agency responsible
Short-term priority action (within 6 months)		
1.1	Action plans for non-attainment cities: Prepare and implement clean air action plans for the seven non-attainment cities	WBPCB ULBs & Municipalities Development Authorities
1.2	Industrial air pollution (large industries):	
	Implement of SOx and NOx standards notified by MOEF&CC on January 29, 2018 for 35 categories of industries in and around category A, B and C cities. Strengthen and implement strategies needed for critically polluted industrial areas. Strengthen the current siting policy for industries to be notified in future.	WBPCB
	Implement existing standards for PM and ensure compliance through regular testing & CEMS enabled monitoring (See action 2.4). Also take precautions for minimizing fugitive emissions through the preparation of a checklist for industrial zones and units, specific to each type of industry. Carry out regular inspection	WBPCB ULBs & Municipalities Development Authorities
	Prepare a clean fuel policy and provide incentives for clean fuels for the state: for this identify approved and non-approved fuels. For this notify a list of approved fuels. Promote relatively cleaner fuels like gas (Coal Bed Methane, natural gas etc.) and electricity. Discourage fuels with very high sulphur and heavy metals like furnace oil, pet coke, tyre oil etc.(except where it is used as feedstock like cement).Need for a favorable taxation and pricing policy to make cleaner fuels more competitive. Incentivize replacement of boilers to switch to cleaner fuels. Clean fuel strategy needed for small and medium scale units with nominal or no emission control system	WBPCB, Department of ICE and MSME
	Identify the units that need to install Continuous Emission Monitoring System (CEMS) across all targeted and applicable polluting industry: Ensure calibration and working of CEMS in all industries in the urban airshed or area of influence and provide information to monitoring agencies to take appropriate actions. Specify the mechanism for quality control and quality assurance of CEMS data and ensure that data is available online and the reported data is compared with applicable prescribed limits and not the older standards. Compliance checking to be enforced routinely to prevent tampering with the CEMS. This needs to be done for all sectors including sponge iron units, cement units, iron and steel industries, rice mills and jute mills.	WBPCB, Department of ICE and MSME

	Identification of cumulative impact of industrial emissions such as total load from a specified area. Prescribe more stringent pollution control action for each type of industry. For instance, different actions for sponge iron units and rice mills.	WBPCB, Department of ICE and MSME
1.3	Industrial air pollution (brick kilns and small industries):	
	Identification and implementation of fugitive emission control measures in ancillary units, material transfer and handling and emissions during industrial processes. Informal industrial units will require stringent monitoring. Hold quarterly inspections	WBPCB, Department of ICE and MSME
	Enforce restrictions on operations of intensively polluting industries within urban airshed zones during high pollution periods. Upgrade all existing Air pollution Control devices. Enforce restrictions on operations of brick kilns within urban airshed zones during high pollution periods; allow only those Brick kilns that comply with rectangular zig-zag design with induced draft or those with improved technology. Initiate phasing out of traditional brick kilns	Dept of land and Land Reform WBPCB, KMDA, HMC, Department of MSME
1.4	Vehicular pollution monitoring:	
	Plan and implement adequate number of PUC center for emissions testing of on-road vehicles. Strengthen periodic auditing and over- sight of PUC centers and calibration of equipment and third-party checks. Link PUC certificates with mandatory third-party insurance for vehicles to ensure 100 percent compliance as per the Directives of the Hon'ble Supreme Court and the MoRTH notification. Ensure real-time updates for all WB registered vehicles with the VAHAN database for compliance. Develop a mechanism for ensuring that no vehicle is allowed to ply without valid PUC certificate.	Transport department, MoRTH
	Prepare Traffic Impact Assessment (TIA) guidelines and permit new developments based on the formulated TIA guidelines. Make necessary infrastructure augmentations based on traffic impact assessments and levy costs to the developer, if needed and possible. Traffic management plans for special days, i.e. during Durga Puja festival/ during urban flood situation are important, prepare these plans and implement.	Traffic police, urban development authorities, SUDA, UD&MA department

1.5	Improve monitoring infrastructure state-wide:	
	Set up adequate number of real time automatic monitoring stations: The grid plan should be representative of population distribution and land use including residential, commercial, industrial, roadside and sensitive areas. Also include hot spots such as near traffic areas and landfill sites. Refer to the CPCB's thumb rule as prescribed in IS:5182 (Part 14), 2000 on Recommended minimum number of stations, population-wise (Also mentioned in Guidelines for Ambient Air Quality Monitoring, CPCB, 200327). Among all twelve pollutants to be monitored, special focus is needed on PM2.5 and ozone monitoring. Use air quality sensors at probable hotspots to complement air-quality monitoring (based on CPCB/ MoEF&CC guidelines).	WBPCB, supported by CPCB
	Use air quality information provided by satellite-based monitoring to complement ground-based air quality monitoring and unmonitored areas. This is useful to identify agricultural burning/ forest fires, regional pollution etc. that have impact on urban air quality.	WBPCB, CPCB, IMD, West Bengal State Council for Science and Technology

9.6 Mining Management Plan

S. no.	Elaboration on action points	Agency responsible
Short-term priority action (within 6 months)		
1.1	Mitigate data gap: Indicators such as the types of mining activities, the number of mining licenses issued in the district and the area covered under mining must be collected by all districts and shared as a priority.	WBPCB, DEIA
1.2	Remove data inconsistencies: districts have reported number of mining areas meeting environment clearance conditions or consent conditions of WBPCB to be more than the number of mining licenses. Identified districts to review their data and check for inconsistencies.	DEIA, WBPCB
1.3	Need stringent monitoring: Majority of districts are involved in sand mining due to an intricate river system across the state. A fertile plain gives leeway for fireclay mining. Ban illegal sand and fireclay mining. Take stringent action against brick kilns located near the urban areas. Use of excavators is prohibited to lift sand from riverbed in West Bengal, take stringent action if found being used.	DEIA, WBPCB
1.4	Review mining potential:	WBPCB
	Apply the concept of mineral (minor and major) paragenesis in regional and local context. Mineral paragenesis is an equilibrium assemblage of different minerals in one rock. This concept facilitates a more scientific mapping of mining	WBPCB, Districts Administration

	areas.	
	Utilize remote sensing data such as multi sensor airborne survey, LAND SAT imageries, etc. to check upon the reserves of prominent minerals in respective districts.	WBPCB
	Commission review studies of the already intense mineral field blocks to understand the mining potential as well as environmental threats. Need an inventory of mineral blocks to facilitate monitoring.	WBPCB, DSTBT, Districts Administration
	Need more aggressive surface sampling, geochemical survey, soil analysis and assays of minor and major minerals followed by grid pattern and chemical assay of bore hole samples at short depth of interval by technical experts	WBPCB
1.5	Other action points for the Government of West Bengal:	WBPCB
	Amend West Bengal Minor Mineral Concession Rules 2016 ("Rules") and other regulatory controls to include environmental safeguards for stringency	WBPCB
	Involve technical experts and community in district environmental impact authority (DEIA). Current structures are an extension of district administration. Including technical experts and community provides helps prevent adverse social and environmental impact of mining activities. Technical experts help evaluate Community involvement provides more surveillance against illegal mining.	WBPCB
	Build capacity of DEIA and local representatives on the environmental impact assessment for mining.	WBPCB

9.7 Noise Pollution Management Plan

S. no.	Elaboration on action points	Agency responsible
Short-term priority action (within 6 months)		
1.1	Mitigate data gap: Indicators such as the implementation of ambient noise standards in residential and silent zones, the placement of signboards in silent zones within towns and cities and noise monitoring studies in districts must be collected and shared by all districts with the highest priority.	WBPCB
1.2	Capacity to monitor noise levels:	
	Install noise pollution monitoring systems based on land use as suggested in the Noise Pollution (Regulation and Control Rules 2000) (see Annexure IV)	WBPCB, ULB, Districts Administration
	Identify silence zones	District Administration, ULB, UMDA
1.3	Compliance to ambient noise:	

	Increase frequency of implementation of ambient noise standards	District Administration, Traffic police and transport Department
1.4	Other action points for the Government of West Bengal:	
	Ban pressure horns	Traffic Police and Transport Department
	Enable proper maintenance and service of vehicular engines by establishing	District Administration, Traffic police and transport Department
	Build campaigns to spread awareness on sources of noise pollution and its impact on human health	WBPCB, District Administration

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