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An Empirical Study on the Legal Implications of Environmental Negligence with specific reference to the Case of Adyar River and its Impact on Public Health

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ABSTRACT

What was once a pristine waterway associated with Chennai's natural heritage and layered historical significance, the Adyar River, is now a quintessential example of the callousness that is symptomatic of urban India's environmental neglect. Rapid industrialization, rampant urbanization and the continuous discharge of untreated municipal and industrial wastes have taken their toll on the river's water quality and its eventual collapse. This is compounded by recent studies that have found 'forever chemicals' – perfluoroalkyl and polyfluoroalkyl substances (PFAS) - in concentrations where levels exceed safe thresholds by thousands of times according to IIT Madras, and carry potential health implications including liver damage and cancer. Other reports by Tamil Nadu Pollution Control Board have documented critical breaches in the river with, for example, none dissolved oxygen and extraordinarily high levels of coliform bacteria, all of which illustrate the construction of pollution which makes it impossible for the river to sustain any aquatic life. Despite the dire state of many rivers in Tamil Nadu, and environmental neglect, judicial processes such as the Southern Bench of the National Green Tribunal, although potholed with delays, have pointed to systemic problems in legal enforcement being the critical fault for the erosion of public health and environmental advocacy, and demanded immediate action. Using a mixed-methods examination leveraging the quantitative survey data with qualitative data from communities affected in Saidapet's slums, this study will use the legal consequences of environmental neglect to scrutinize public health. In conclusion, the research presents a framework to integrate environmental governance, legal accountability, and community participation focused on sustainable restorative action for the Adyar River and healthier futures for the people of Chennai.

I. INTRODUCTION

Adyar River is one of many important rivers in the city of Chennai. It is located in the

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Kanchipuram district, and originates from Chembarambakkam Lake. The Adyar River flows for 42.5 km before draining into the Bay of Bengal at the Adyar Estuary. The Adyar River shapes the city of Chennai, and acts as a wall, giving some separation between South and Central Chennai. Nearing the sea, the Adyar River forms the Adyar Estuary which stretches from Adyar Bridge to the sandbar at the coast. The estuary is an ecological region, covering around 300 acres. It is home to different species of birds and several marine species. Because of its ecological significance, it was declared a protected wildlife reserve in 1987. The Adyar Creek is a backwater formed as a result of the sandbar where tidal waters mingle between the river and sea.

A Historical and Environmental Profile of the Adyar River

The Adyar River, formerly known as the Vanmiki River, is one of Chennai's oldest water bodies, along with the Cooum River and Buckingham Canal. Until the 1950s and 1960s, it was a clean waterbody that was used for travel, sightseeing and boating. In fact, it was a mode of travel along the river in the 1940s. The bridge across the river, Elphinstone Bridge (now Thiru-Vi-Ka Bridge), built in 1840 connected South Madras to Santhome and Mylapore.Before this, the Marmalong Bridge (now Maraimalai Adigalar Bridge) was the only crossing over the Adyar River. During the 18th and early 19th centuries, the north bank of the Adyar was a prime European settlement, with British East India Company officials building luxurious houses along the river. However, over time, the Adyar river that flows through the heart of the Chennai city has undergone a drastic transformation, becoming severely polluted due to a multitude of human activities. This environmental degradation now poses substantial risks to the health and well-being of the people residing in and around Chennai. A river is considered dead when it is incapable of sustaining any form of life – fish or aquatic plants, in it. This happens when the pollution level in the river is so high that all the oxygen in the water is depleted and the same has happened with the Adyar river. The new water flowing through the Adyar waterway becomes blocked upstream of the city and diverted to capacity stores. The waterway's opening into the ocean is blocked by sand bars, which discourages tidal flushing activity. Although the Tamil Nadu government has allocated significant sum of money to revive the Adyar river, the progress remains moderate. The government established a trust to facilitate heightened effort in cleaning the waterway within the city over an extended period.

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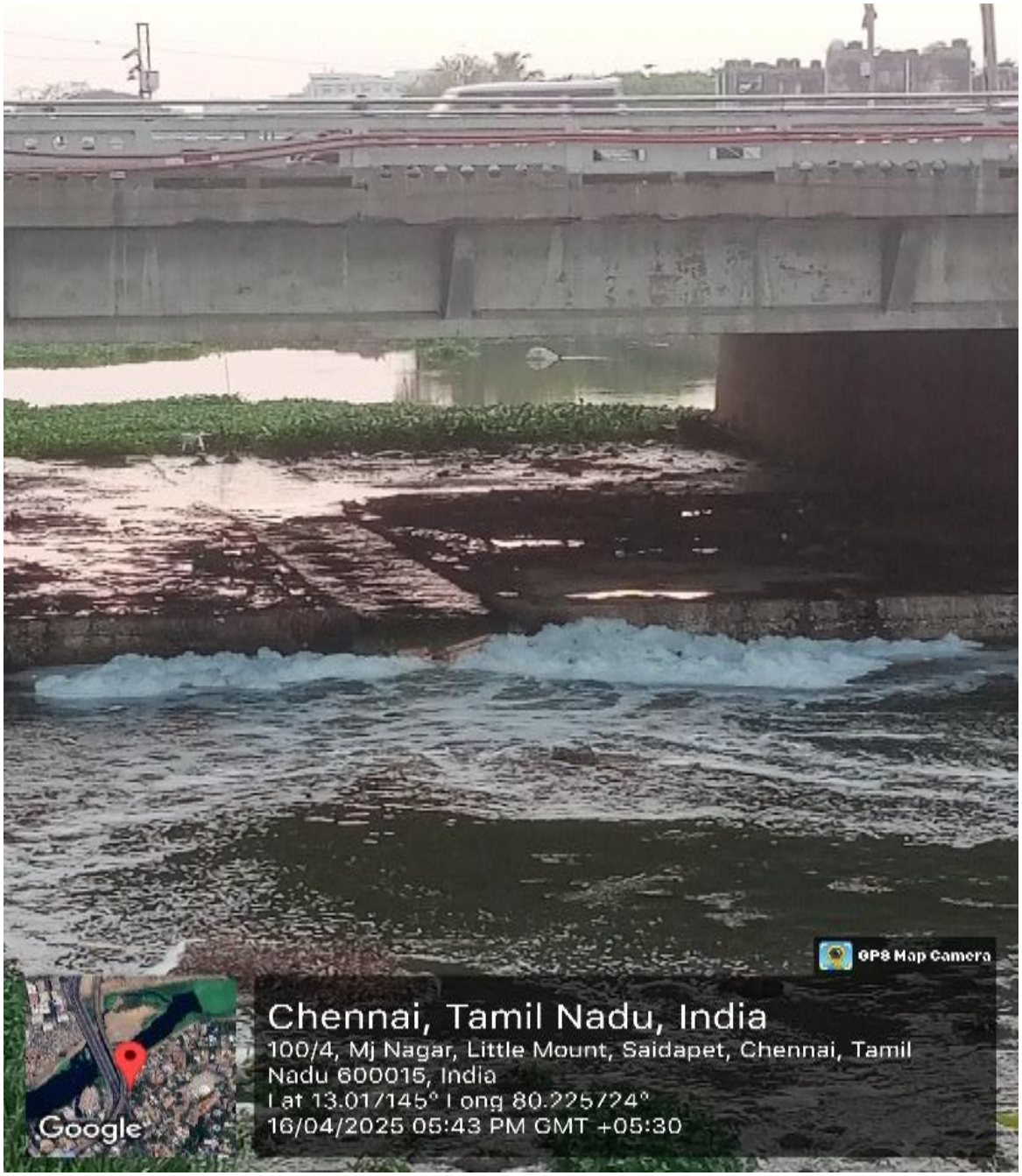
Crisis of Environmental Negligence



According to the Tamil Nadu Pollution Control Board (TNPCB) report from October 2024, the severe contamination, including fecal coliform levels at 1,026 MPN per 100ml—over ten times the permissible limit of 100 MPN per 100ml. Total coliform concentrations reached 7,500 MPN per 100ml, signalling widespread bacterial pollution. The TNPCB report also said dissolved oxygen (DO) levels were nil, far below the 4 mg/L needed to sustain aquatic life, while biological oxygen demand (BOD) hit 30 mg/L (against a 3 mg/L standard) and chemical oxygen demand (COD) soared to 136 mg/L.

According to T Swaminathan, a former scientist at the National Environmental Engineering

Research Institute, the current water treatment process is effective at removing suspended solids and basic inorganic chemicals. However, it lacks the capability to remove organic chemicals like PFAS from water.

People living in Chennai are probably exposed to contaminated drinking water. A study by IIT Madras has stated that lakes in Chennai have alarming levels of 'forever' chemicals that can cause cancer and fluorine atoms bonded together by strong chemical bonds that don't naturally break down. 'Forever chemicals' refer to Perfluoroalkyl Substances and Polyfluoroalkyl Substances (PFAS), which are substances known for their long-lasting properties and potential health risks, such as liver damage and cancer. According to a study conducted by IIT Madras, the water in Chennai contains PFAS concentrations that exceed safety levels set by the American Environmental Protection Agency (EPA) by approximately 19,400 times. These chemicals were found in groundwater near various locations, including the Perungudi dump yard, Adyar river, Buckingham Canal, Chembarambakkam lake (even though it receives treated water), and the treated water from the lake.

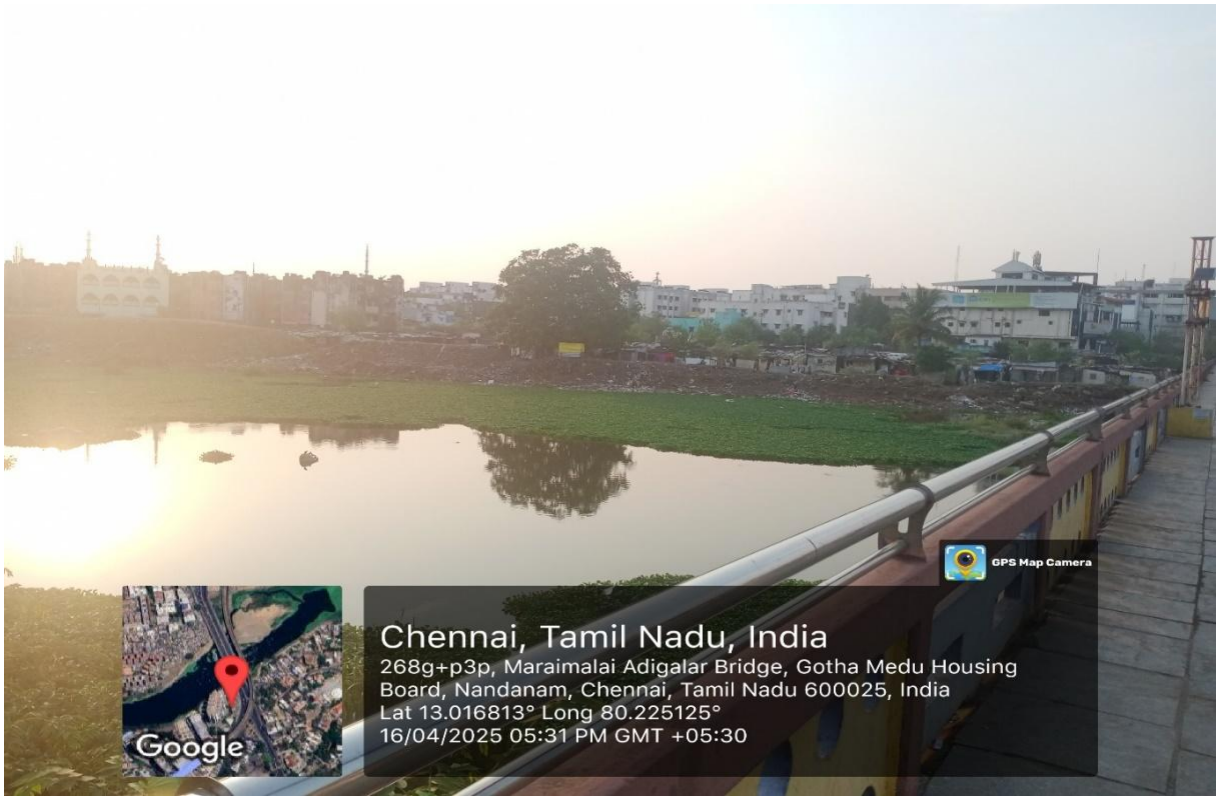
The Southern Bench of the National Green Tribunal (NGT) has issued a notice to the Tamil Nadu government and related departments, spotlighting the alarming pollution levels in the Adyar River.

This research paper aims to comprehensively analyse the legal implications of the environmental negligence that has led to the degradation of the Adyar River. It will assess the impact of this pollution on public health within Chennai, identify the relevant legal framework and applicable principles in India, determine the potential liabilities of various stakeholders involved, and ultimately recommend legal and policy measures for the river's restoration and the protection of public health for the communities it affects.

Impact of Adyar River Pollution on Public Health in Chennai:

The pollution of the Adyar river in Chennai presents a multitude of health risks to the surrounding population, stemming from the diverse array of contaminants present in its waters. Exposure to untreated sewage, which is considered a primary pollutant, can cause a number of waterborne illnesses, including diarrhoea, cholera, typhoid, and other gastrointestinal illnesses, which can be a severe health risk, especially among the population density in these areas. The heavy metals such as lead, chromium, and mercury found in the waters of the canal has the potential to cause neurological damage, kidney malfunction, and other chronic illnesses as they bioaccumulate in the food web of aquatic organisms and possibly in humans who consume aquatic organisms. Also, standing water related to siltation and blockages of the canal serves

as a breeding ground for mosquitoes and the increased transmission of vector-borne diseases such as malaria, dengue, and chikungunya in the district. The water that pollutes the river can seep into the underlying aquifers, leading to contamination of groundwater sources used for drinking water in parts of Chennai. The contamination of the Adyar river has a range of pollutants that pose a varying range of health risks for the population with respect to organ systems and can lead to acute and chronic illnesses in the Chennai population.



According to reports, there has been an alarming increase in vector-borne disease cases in Chennai and public health experts have suggested this may be partly attributed to the dire state of disrepair of the Adyar river. The overall deterioration of the river is leading to the burden of infectious diseases in the city, draining the public health system and demanding additional resources for disease surveillance, disease prevention, and disease treatment.

A few studies and reports have started to explore the specific implications for health and disease in river communities on the Adyar river. Reports document the dangerous contamination of groundwater drinking sources in areas near polluted waterways within Chennai; it is clearly a concern as the residents who rely on these sources may be drinking polluted water. There is a documented incidence of residents living near industrial areas that discharge effluent into the river, feeling more likely to develop serious diseases such as cancer and tuberculosis and having skin and respiratory issues, and can draw a direct connection between the industrial pollution and health consequences. The reports and limited initial studies show that the

implications for health in communities living near a polluted river are many, but we need formal epidemiological studies to not only define the full impact of health implications, but to also quantify statutory causal actions between types of pollution and disease incidences.

There are very real implications for the long-term health of people living in Chennai as a result of ongoing exposure to pollutants and heavy metals from the Adyar river. As the studies confirm, even low levels of heavy metal exposure can lead to the development of chronic conditions in a variety of organ systems, developmental problems especially in children, and perhaps eventually increase the risk of some forms of cancer through cellular damage that adds to these risks over time. Similarly, we now know that ongoing exposure to PFAS will create chronic effects even at low concentrations, as they stay in the environment and the human body for a long time and can create chronic health ailments in the future - immune system disorders, hormone imbalances, and possibly chronic illnesses or disorders later in life. Also, the cumulative health consequences of exposure over long periods of time are very complex and may lead to serious or life threatening health complications that do not manifest right away, but may have crippling long-term health consequences. The potential long-term health implications are a huge societal cost as the environmental negligence becomes clear, and there is a range of potential consequences for the future health and productivity of people in the Chennai community.

The Legal Framework for Environmental Negligence and Water Pollution in India

Through the legal structure in India, there are multiple potential avenues of protecting the environment and public health, creating a basis for action in respect of the environmental negligence that is present in the Adyar river case. At the highest level of legal framework is the Constitution of India, where Article 48A tells the State to safeguard and improve the environment. Furthermore, Article 51A(g) tells citizens that it is a fundamental duty to safeguard and improve the natural environment including forests, lakes, rivers, and wildlife. Most notably, the Supreme Court of India has explained that Article 21 which safeguarding the fundamental right to life is interpreted to include a right to a clean and healthy environment, thus creating a constitutional duty to mitigate pollution which impacts this right. These constitutional provisions give a base structure for environmental protection in the country and connect it to the most fundamental of human rights, and provides a legal obligation if pollution is harming our water bodies, as in the case of the Adyar river. These articles impose a duty on the state to protect the environment, but also upon the citizens, to safeguard the environment, both duties combined together creating a foundation of environmental legislation and action available to them.

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The principal legislation in India regulating water pollution is the Water (Prevention and Control of Pollution) Act, 1974. The Water Act was passed in order to prevent and minimize water pollution and prevent the deterioration and restore the purity of the country's water resources. The Water Act has established the Central Pollution Control Board (CPCB) at the Country level and the State Pollution Control Boards (SPCBs) at the State level, to prevent and control water pollution, protect water and ensure that complainants or strengthen the provisions to deal with water pollution, including setting standards for water quality, monitoring levels of pollution, creating regulations regarding industrial and other activities that can cause water pollution, and preventing violations. The Water Act prohibits discharge of any pollutant into a body of water at any location that exceeds that which is approved by the applicable boards and does not provide prior, limited to two types of discharge: municipal and industrial. The penalties for not complying with the Water Act include fines and jail time. The Water Act has also been amended several times since its passage, including the 1988 amendment, and those provisions were created to enhance and improve the standards of the act and better suit current environmental needs. The Act is one of the primary legislation for water pollution regulation in India, and it supplies the framework needed for regulatory agencies like the Tamil Nadu Pollution Control Board (TNPCB) to mitigate the problems of the Adyar river. The discharge standards and the consent conditions in the Act are directly relevant to the pollution of the river and therefore, the TNPCB's enforcement of the legislation will be critical to the river's recovery.

The Environment (Protection) Act, 1986 is complementary to the Water Act and provides an example of a comprehensive or “umbrella” legislation that has been passed as a complete piece of legislation to protect and improve the environment as a whole. The Environment (Protection) Act authorized the central government to take measures it deemed necessary to protect and improve the quality of the environment. For instance, the Act allows the government to set national standards for quality of the environment and emissions, controls on the places where industry can locate, a process for dealing with hazardous waste as well as safety to prevent accidents in respect of hazardous substances to protect the health and well-being of citizens. The Environment (Protection) Act likewise authorizes coordination of the various activities of central or state authorities with authority under other laws dealing with the environment such as the Water Act and the Air (Prevention and Control of Pollution) Act, 1981. Like the Water Act, the Environment (Protection) Act also provide penalties, including jail time and/or fines, for those who violate its regulations. This law gives the Government general authority to address environmental concerns, including the widespread water pollution of the Adyar river,

and can be broadly applied in combination with the separate and specific aspects of the Water Act to address the multiple issues affecting the river. The EPA's unique focus on public health and hazardous substance management makes it particularly applicable to the type of pollution seen in the Adyar river.

The National Green Tribunal Act, 2010 represents the continuation of efforts to strengthen the legal regime for the protection of the environment. The Act established the National Green Tribunal (NGT) as a specialized judicial body for the substantive and speedy disposal of cases related to environmental protection and conservation of the environment and natural resources. The NGT is granted jurisdiction over a number of mentioned environmental laws in various statutes, including the Water (Prevention and Control of Pollution) Act, 1974, and the Environment (Protection) Act, 1986. The tribunal is empowered to provide relief and compensation for harm and damage to a person or property as a result of environmental pollution, as well as order restoration and revival of the environment. The tribunal will adhere to and be guided by the general principles of environmental law, including the principles of sustainable development, precautionary principle, and principle of polluter pays.

The NGT is an established specialized forum to adjudicate all manner of environmental litigation and offers a more accessible and knowledgeable route to address environmental harm and other disputes. The NGT has already addressed a wide variety of pollution matters in India, including those harming rivers and other water bodies, and its focus on all cases directly pertaining to the Adyar river illustrates its significance for communities to grapple with its legal wreckage to address environmental harm. The NGT has been designed and intended to deliver speedy environmental justice and has specific jurisdiction over important environmental laws. It represents a vital forum for affected communities polluted by the Adyar river to pursue redressal and institutional accountability.

In addition to the primary Acts, a set of rules and notifications made under these Acts have detailed the operational details of how the Acts were to be implemented. For example, the Water (Prevention and Control of Pollution) Rules, 1975 and amendments, defined the processes and standards for the monitoring of water quality and the consent process. The Environment (Protection) Rules, 1986 and notifications made thereunder, prescribed the standards for emissions and discharges by industries, the management of hazardous wastes and pollutants, etc. The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 and amendments in 2016, and the Solid Waste Management Rules, 2016, respectively, also governed individual classes of waste that would lead to pollution. All of the above have operational rules and have specific thresholds that would have likely been

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transgressed in the situation of the Adyar river prior to being polluted, which would be the basis for punitive action and enforcement from regulatory authorities like the TNPCB.

The following is a list of projects completed and underway by the Chennai Rivers Restoration Trust (CRRT):

1) CRRT has completed the following Eco- Restoration Projects:
    a) Tholkappia Poonga -Eco Restoration of Adyar Creek (58 Acre)
    b) Eco-Restoration of Adyar Estuary (300 Acre)
2) On- going Eco -Restoration Projects of CRRT:
    a) Integrated Cooum River Eco-Restoration Project (ICRERP)
    b) Adyar River Restoration Project (ARRP)

Research Problem

At the heart of this issue is the degradation of the Adyar river and its effects on public health due to carelessness. This likely involves multiple stakeholders, as in any problem, potential actors include the government, industries, and the local community. There is a good chance that the current laws were not adhered to, or that legislation was not adequate, to take on the severity of the problem.

Significance of the Study

This research is important because it is addressing an urgent environmental and public health problem in a heavily populated urban centre. The manuscript can provide evidence-based recommendations that could enhance policy decisions, and legal reform, and improve enforcement of existing legislation. This research can also stimulate public discourse about environmental irresponsibility and subsequently the need for better environmental protection. This research could also serve as a case study for dealing with similar appropriations for environmental action in other urban waterways.

Review of Literature

1. **Urban Pollution and Environmental Law in India – A. Sharma (2014):** It states that "the ongoing degradation of water bodies indicates a systematic failure to uphold environmental laws in rapidly urbanizing territories." This work presents a thorough examination of how municipal and industrial discharges that go unchecked result in less-than-desirable outcomes for water quality and consequentially, public health.

2. **Water, Law, and Society: Environmental Justice in a Developing World – R. Mathur (2017):** Environmental injustice does not occur by chance; it is bred out of a lack of cohesive policy and the continued lack of legal enforcement." Mathur takes a multidisciplinary approach, demonstrating the links between legal failures, environmental degradation, and the resulting issues of public health. His work provides compelling evidence to examine the areas in which lack of enforcement of policy allows the health of the Adyar River's ecosystem and the well-being of the surrounding communities to decline.

3. **Polluted Waters: Environmental Degradation and Public Health – L. Gupta (2019):** It is mentioned that "the persistent pollution of urban rivers is a good indicator of governance failure that valued urban industrial advancement over the health of communities." This piece provides data and engaging case studies showing how environmental negligence resulted in a rise of cases of waterborne illnesses and respiratory illnesses. Gupta's discussion is important in understanding the connections between public health and environmental degradation, similar to the struggles that residents encountered along the Adyar River.

4. **Environmental Law in India: Triumphs and Failures – R. Menon (2016):** While he may not be able to identify the reasons why, Menon (2016) exclaims that "even if India has graet environmental laws on paper, these laws, in practice, are poorly implemented due to bureaucratic inefficiency and conflicting interests resulting in environmental negligence." Through an analysis of a series of landmark cases, Menon highlights the gap between laws and enforcement.

5. **Public Health and Environment: The Costs of Negligence - S. Verma (2018):** It concludes, "The destruction of vital water resources creates the conditions for health emergencies, as a breakdown of environmental safeguards leads to an uptick in disease burdens". In this work, it chronicles several stories of environmental neglect affecting the health of communities. It presents a strong case for the adoption of enforceable requirements in environmental policy.

Objectives of the Study

This study is worthwhile because it tackles an urgent environmental and public health problem in one of the most populated urban areas in the world. This paper can provide evidence-based information to inform policy decisions, legal reforms, and enforcement action. This research can help bring awareness about the implications of environmental neglect and the significance of environmental protection. This research can also serve as a case study for related environmental issues in other urban waterways.

Hypothesis

H1 - Environmental negligence surrounding the Adyar river enhances the decline of public health due to lack of air quality and water quality standards.

H2 - Concurrently, lax environmental enforcement and ineffective restoration programs damage the ecology of the river creating legal and public health issues for their community.

Research Questions

1. What is the nature and extent of the public health impacts associated with the river's pollution?
2. To what extent has environmental negligence contributed to the river's degradation?
3. What legal remedies and strategies can be implemented to address environmental negligence and protect public health?

Scope

This study is significant because it demonstrates that environmental negligence and weak policy enforcement degrade the Adyar River's air and water quality, thereby severely impacting public health and underscoring the urgent need for effective legal reforms.

Limitations

The study conducted, from a sample size of 50 residents in the areas surrounding the Adyar river, is subject to several limitations. The study is limited by geography, since it can only be generalized to the area of the river. There are legal issues and public education issues involved, such as the confusion regarding environmental responsibilities. The research also had limits of time and funding. The extent of the research would be limited by these factors. Even with all of the effort to ensure clarity, the participants may still have different interpretations of the questions that could lead to variation in the validity of the responses.

II. RESEARCH METHODOLOGY

In this study, the author takes an empirical and non-doctrinal approach to identify the legal implications of environmental neglect (as a form of negligence) and its legality for public health, taking the Adyar River as examined through a case study in Saidapet location in Tamil Nadu. The methodology depends on primary data collection from communities that are affected by environmental neglect. The analysis of the primary evidence will then assist in providing commentary to determine implications for their public health, while also identifying relevant legal concepts.

Research Approach

This research utilizes non-doctrinal (empirical) research involving real data from variety of data-gathering methods, for the purpose of using surveys to explore the public health and legal ramifications of the environmental neglect of the Adyar River. The research utilized both quantitative and qualitative methods to obtain a more holistic view of the issue while ensuring the results would be firmly rooted in reality.

Data Collection Instrument

The primary data collection instrument that was used in this study was a structured questionnaire survey or questionnaire design. The questionnaire was developed to elicit information related to the awareness, perceptions, and experiences of respondents about the pollution in the Adyar River, effects on public health, views on legal enforcement and community action.

Data Collection Method

The data were collected through face-to-face interviews in the slum areas of Saidapet near the Adyar River. This method was selected to ensure inclusivity, as for many of the respondents there might be no access to a digital survey or reluctance to take part in that way. The face-to-face interview method allowed collection of thorough responses and clarifications of questions when necessary.

Sample & Size

The research concentrates on a target population made up of slum residents in Saidapet along the Adyar river, who are affected by the pollution. A sample size of 50 respondents were chosen to provide sufficient diversity and representativeness given the time and resources available.

Sampling

We employed a Non-Probability Purposive Sampling Technique so that the study included participants who were either directly affected by pollution of the Adyar River. This method ensured that the sample consisted of individuals who had relevant experiences and insight in keeping with the aims of the study.

Data Analysis

The data that was collected was analysed using both quantitative and qualitative methods:

Quantitative Methods: The responses to closed-ended questions were tallied and statistically analysed for trends and patterns. Visual tools like tables and pie charts were employed for

effective representation of the data.

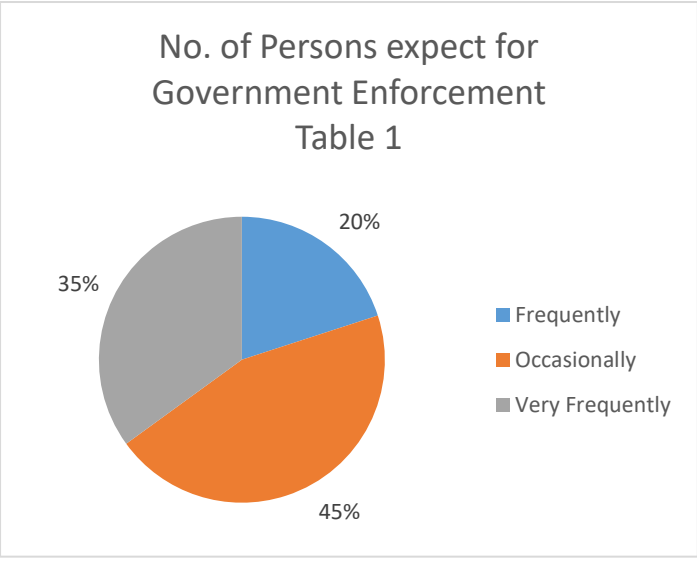
Qualitative Analysis: Open-ended responses were thematically analysed to uncover insights into the lived experiences and perceptions of the respondents regarding the environmental and health impacts of the Adyar River's pollution.

III. Findings and interferences

Figure 1:

Are policies enforced by the government implemented properly, given the varied responses on enforcement frequency?

Table 1	
Priority in improving River condition	Government enforcement
Row Labels	**Count of Effect of Negligence**
Frequently	20%
Occasionally	45%
Very Frequently	35%
Grand Total	**100%**



Only 20% of respondents indicated that government policies are enforced frequently. A combined 80% (45% "occasionally" and 35% "very frequently") suggests that enforcement is neither consistent nor robust.

Finding: There is significant variability and perceived weakness in government enforcement, potentially contributing to the continuing degradation of the river.

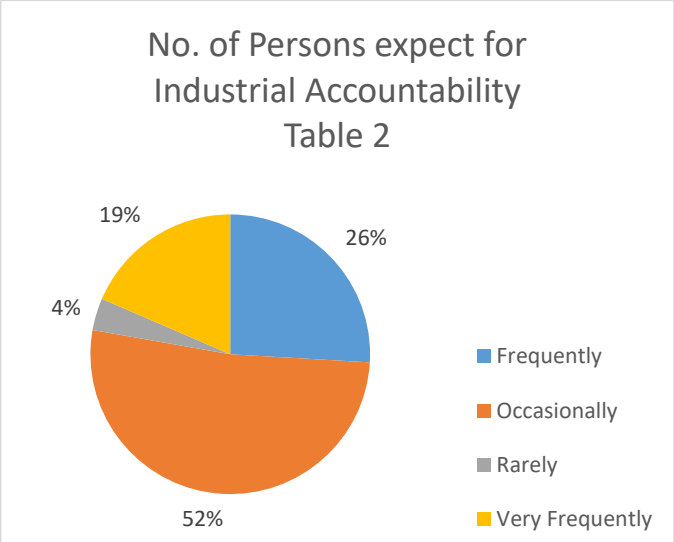
INFERENCES

- Respondents who reported occasional negligence by authorities recommended strict government enforcement to curb pollution.
- This indicates that inconsistent regulatory actions have led to dissatisfaction, reinforcing the need for stronger oversight and policy implementation.

Figure 2:

Are industries held accountable for pollution, considering the frequency of reported accountability issues?

Table 2	
Priority in improving River condition	Industrial accountability
Row Labels	**Count of Effect of Negligence**
Frequently	26%
Occasionally	52%
Rarely	4%
Very Frequently	19%
Grand Total	**100%**



Responses show that 26% report industrial accountability issues as frequent and 19% as very frequent, with 52% indicating occasional issues.

Finding: Industries are widely seen as a major contributor to pollution, with almost half of the respondents reporting regular accountability issues. This points toward a need for stricter monitoring and enforcement measures on industrial discharges.

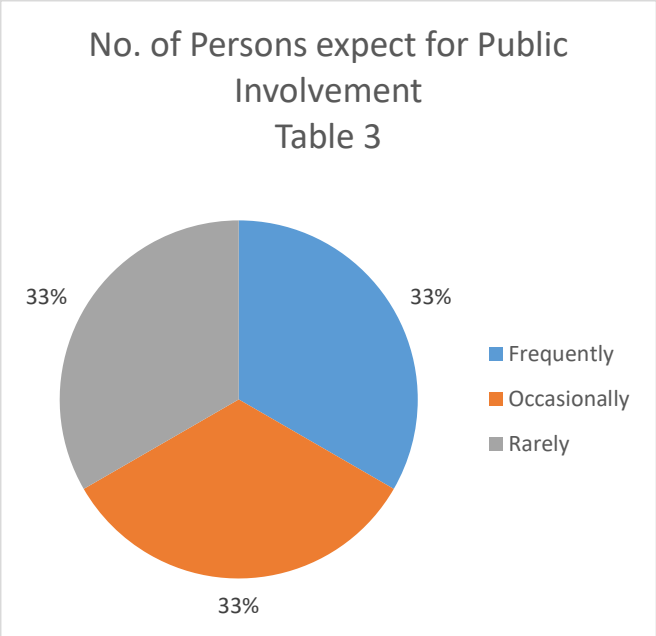
INFERENCES

- Individuals who identified occasional negligence by authorities preferred strict industrial accountability as a solution.
- The data suggests that weak government enforcement has amplified industrial irresponsibility, making strict compliance regulations a priority.

Figure 3:

Is public involvement sufficient in improving the river's condition, as indicated by the equal distribution of responses?

Table 3	
Priority in improving River condition	Public involvement
Row Labels	**Count of Effect of Negligence**
Frequently	33%
Occasionally	33%
Rarely	33%
Grand Total	**100%**



Responses are uniformly distributed at 33% for "frequent," "occasional," and "rare" public involvement.

Finding: There is no clear consensus on the level of public involvement; the even distribution suggests that community participation in restoration efforts is inconsistent and not prioritized.

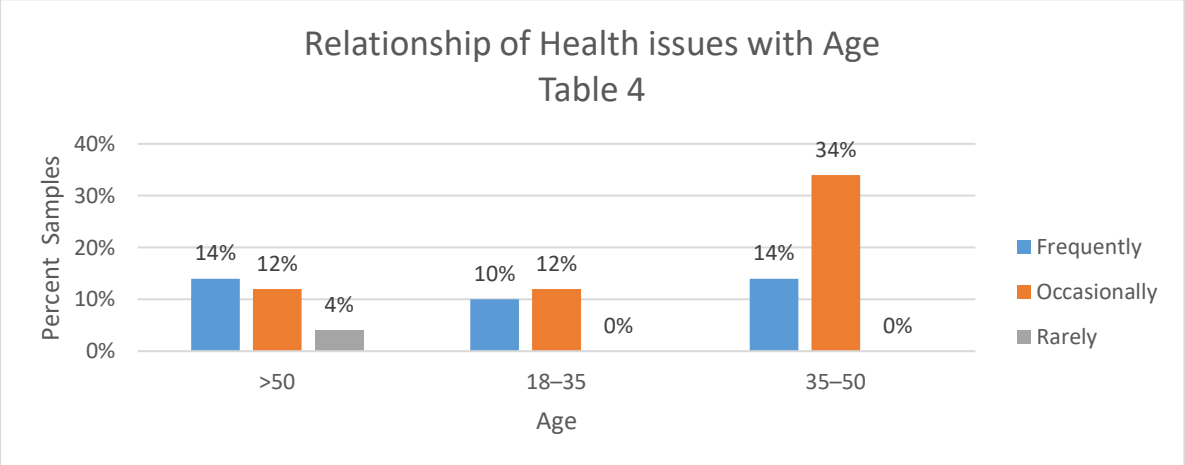
INFERENCES

- Public involvement is equally important in controlling pollution and curbing government negligence.
- However, the data shows inconsistent levels of engagement, highlighting the need for structured and accessible community participation in environmental restoration.

Figure 4:

Are health issues related to river pollution more prevalent among the 35–50 age group compared to the other age groups?

Table 4				
Count of Frequency of Health issues	**Column Labels**			
Row Labels	**Frequently**	**Occasionally**	**Rarely**	**Grand Total**
>50	14%	12%	4%	30%
18–35	10%	12%	0%	22%
35–50	14%	34%	0%	48%
Grand Total	**38%**	**58%**	**4%**	**100%**



The age group 35-50 shows the highest overall frequency (48%), with particularly high

"occasionally" responses (34%). Younger respondents (18-35) report fewer issues (22%), while those over 50 account for 30%.

Finding: Middle-aged individuals (35-50) are most affected by health issues related to river pollution, possibly due to longer or cumulative exposure.

INFERENCES

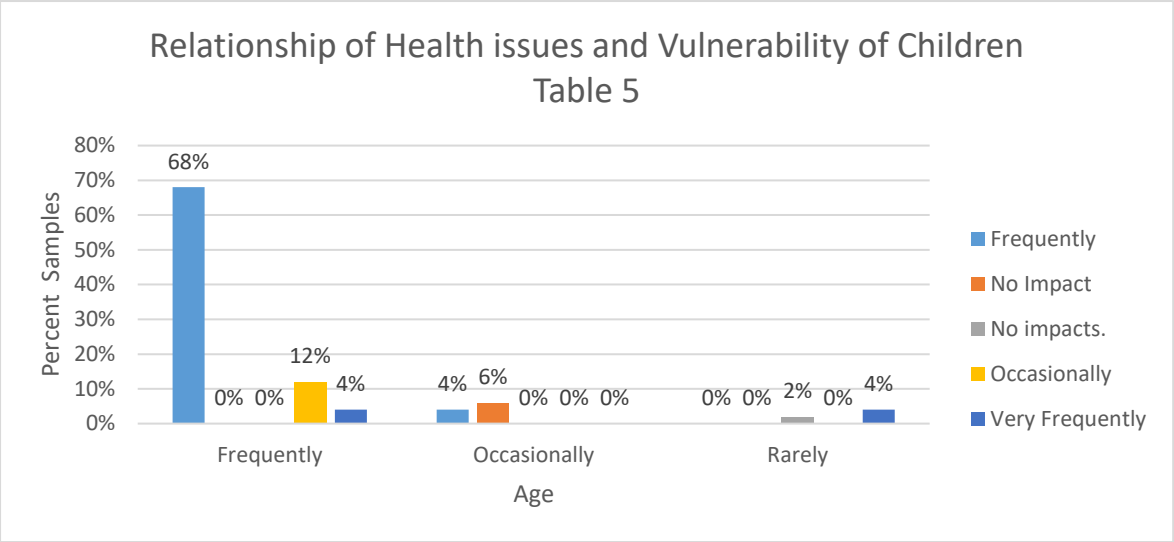
- Persons above 50 years frequently experience health issues, while individuals aged 35–50 years suffer from occasional ailments.
- This indicates that older populations are more vulnerable to environmental hazards, necessitating age-specific public health interventions.

Figure 5:

Does the data suggest that children's health is severely impacted by the river's pollution?

Table 5

Count of Vulnerability of Children Health	Column Labels					
Row Labels	**Frequently**	**No Impact**	**No impacts.**	**Occasionally**	**Very Frequently**	**Grand Total**
Frequently	68%	0%	0%	12%	4%	84%
Occasionally	4%	6%	0%	0%	0%	10%
Rarely	0%	0%	2%	0%	4%	6%
Grand Total	**72%**	**6%**	**2%**	**12%**	**8%**	**100%**



A dominant 84% report that the impact on children's health occurs frequently.

Finding: The data indicates extreme vulnerability among children, suggesting that pollution in the river poses severe health risks to the younger population.

INFERENCES

- Children who suffer frequent health issues report higher cases during the rainy season, pointing to water contamination as a key disease trigger.
- Seasonal factors exacerbate waterborne diseases, reinforcing the urgency of monsoon-specific public health measures.

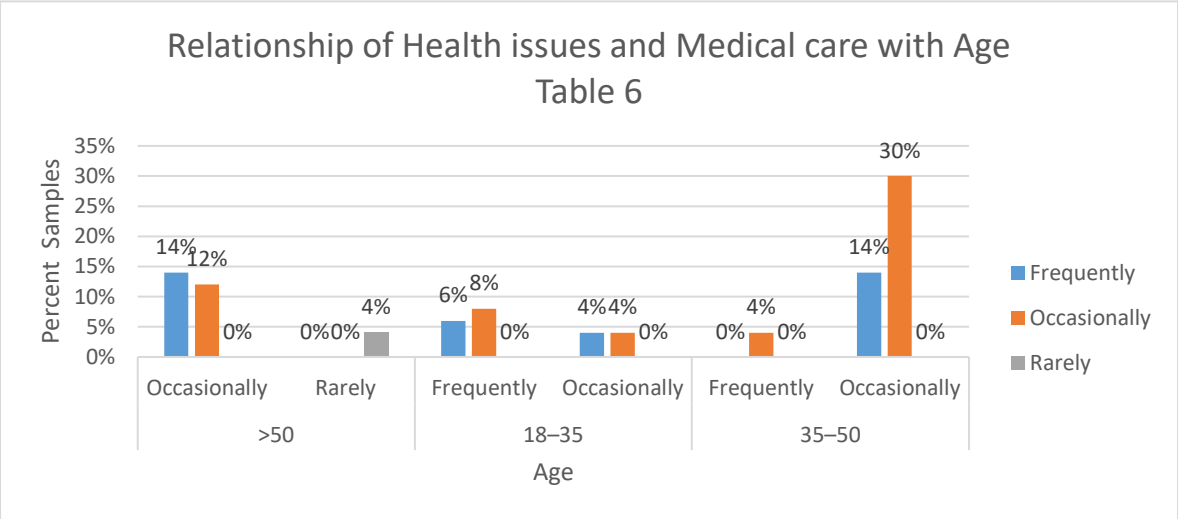
Figure 6:

Does the distribution of health issues and medical care by age indicate a higher need for intervention in any specific age group?

Table 6

Count of Frequency of Health issues	**Column Labels**			
Row Labels	**Frequently**	**Occasionally**	**Rarely**	**Grand Total**
>50	**14%**	**12%**	**4%**	**30%**
Occasionally	14%	12%	0%	26%

Rarely	0%	0%	4%	4%
18–35	**10%**	**12%**	**0%**	**22%**
Frequently	6%	8%	0%	14%
Occasionally	4%	4%	0%	8%
35–50	**14%**	**34%**	**0%**	**48%**
Frequently	0%	4%	0%	4%
Occasionally	14%	30%	0%	44%
Grand Total	**38%**	**58%**	**4%**	**100%**



Similar trends as Table 4 are evident, with the 35-50 age group showing a higher frequency of health issues and corresponding medical care demands.

Finding: There is a strong correlation between age, particularly among middle-aged groups, and the need for medical intervention, reinforcing the critical impact of pollution on public health.

INFERENCES

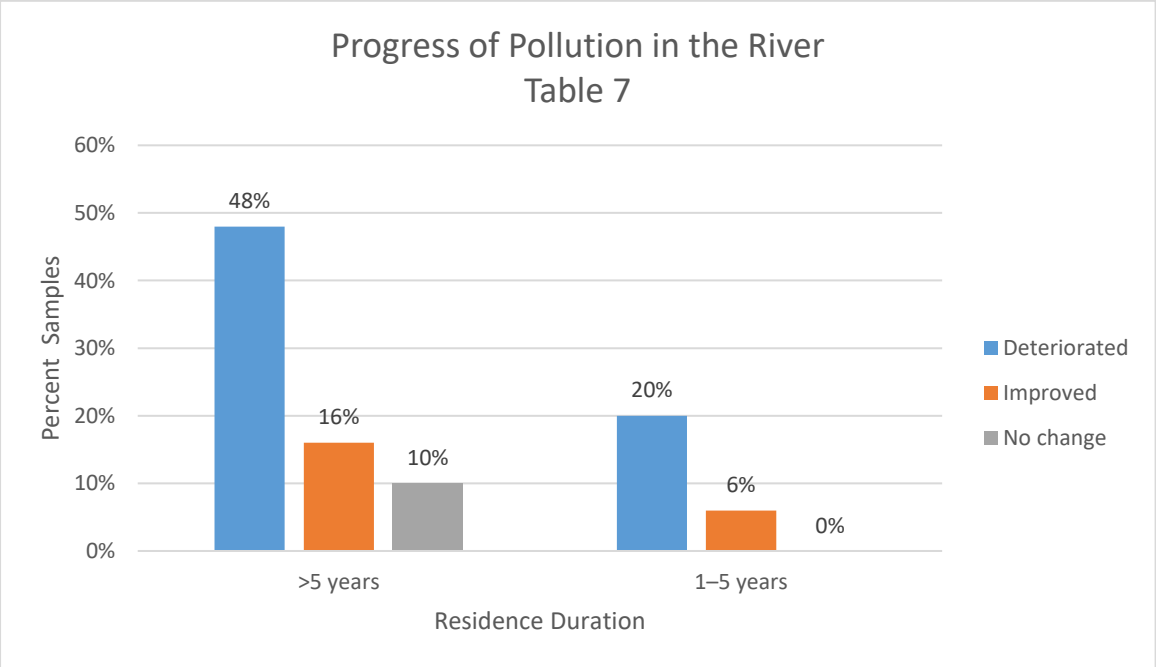
- Older individuals (>50 years) with occasional health issues seek medical care frequently, demonstrating their higher vulnerability.

- Middle-aged individuals (35-50 years) tend to seek medical help occasionally, suggesting a lower immediate health burden but a potential risk for long-term consequences.

Figure 7:

Does the reported deterioration of the river's condition, especially among long-term residents, suggest that environmental negligence has worsened over time?

Table 7				
Count of Progress of Pollution	**Column Labels**			
Row Labels	**Deteriorated**	**Improved**	**No change**	**Grand Total**
>5 years	48%	16%	10%	74%
1–5 years	20%	6%	0%	26%
Grand Total	**68%**	**22%**	**10%**	**100%**



Among long-term residents (>5 years), 48% report that the river's condition has deteriorated, compared to 20% for those living 1–5 years. Overall, 68% believe the condition has deteriorated, with only 22% noting improvement and 10% no change.

Finding: Long-term residents perceive a marked decline in river quality over time, highlighting

a worsening environmental situation due to persistent negligence.

INFERENCES

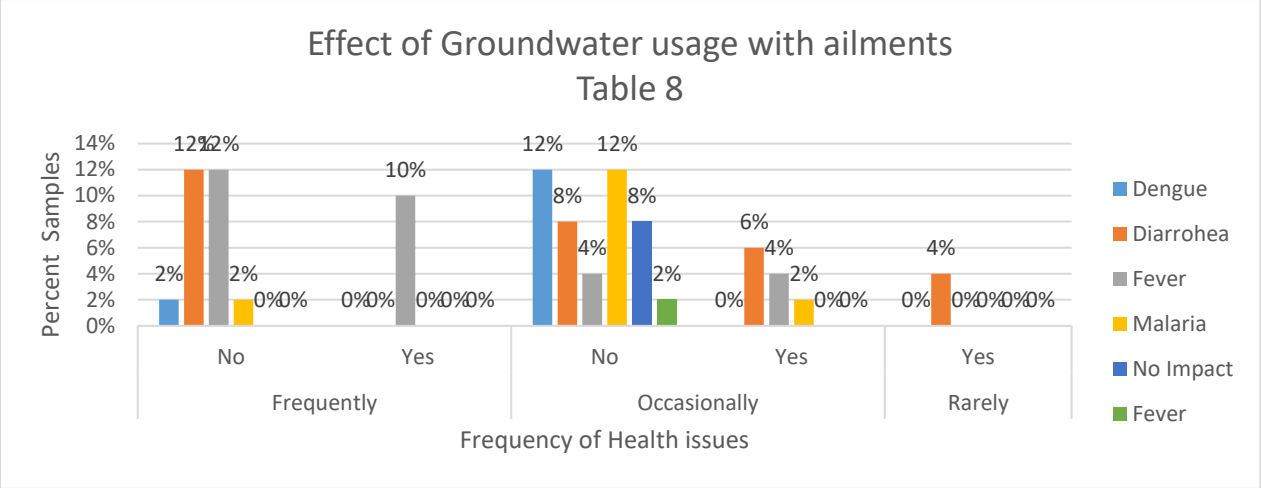
- Long-term residents (>5 years) have noticed significant deterioration of the river over time.
- This reveals the cumulative impact of environmental negligence, signalling a need for continuous pollution control measures rather than reactive efforts.

Figure 8:

Is there a clear link between the usage of groundwater for domestic purposes and the incidence of health ailments?

Table 8

Count of Usage of groundwater for domestic purposes, such as cooking or bathing?	**Column Labels**						
Row Labels	**Dengue**	**Diarrohea**	**Fever**	**Malaria**	**No Impact**	**Fever**	**Grand Total**
Frequently	**2%**	**12%**	**22%**	**2%**	**0%**	**0%**	**38%**
No	2%	12%	12%	2%	0%	0%	28%
Yes	0%	0%	10%	0%	0%	0%	10%
Occasionally	**12%**	**14%**	**8%**	**14%**	**8%**	**2%**	**58%**
No	12%	8%	4%	12%	8%	2%	46%
Yes	0%	6%	4%	2%	0%	0%	12%
Rarely	**0%**	**4%**	**0%**	**0%**	**0%**	**0%**	**4%**
Yes	0%	4%	0%	0%	0%	0%	4%
Grand Total	**14%**	**30%**	**30%**	**16%**	**8%**	**2%**	**100%**



Analysis reveals significant incidences of health issues such as fever and diarrhoea in relation to the use of groundwater. Even though exact percentages vary for each ailment, the data suggests that contaminated groundwater is a contributing factor to these health risks.

Finding: There is a strong indication that using groundwater for everyday purposes is linked with elevated health risks, underscoring the need for improved water quality management.

INFERENCES

- Groundwater use does not directly correlate with frequent health ailments.
- Instead, vector-borne diseases like malaria and dengue are linked to surface water contamination, stressing the need for mosquito control and improved drainage.

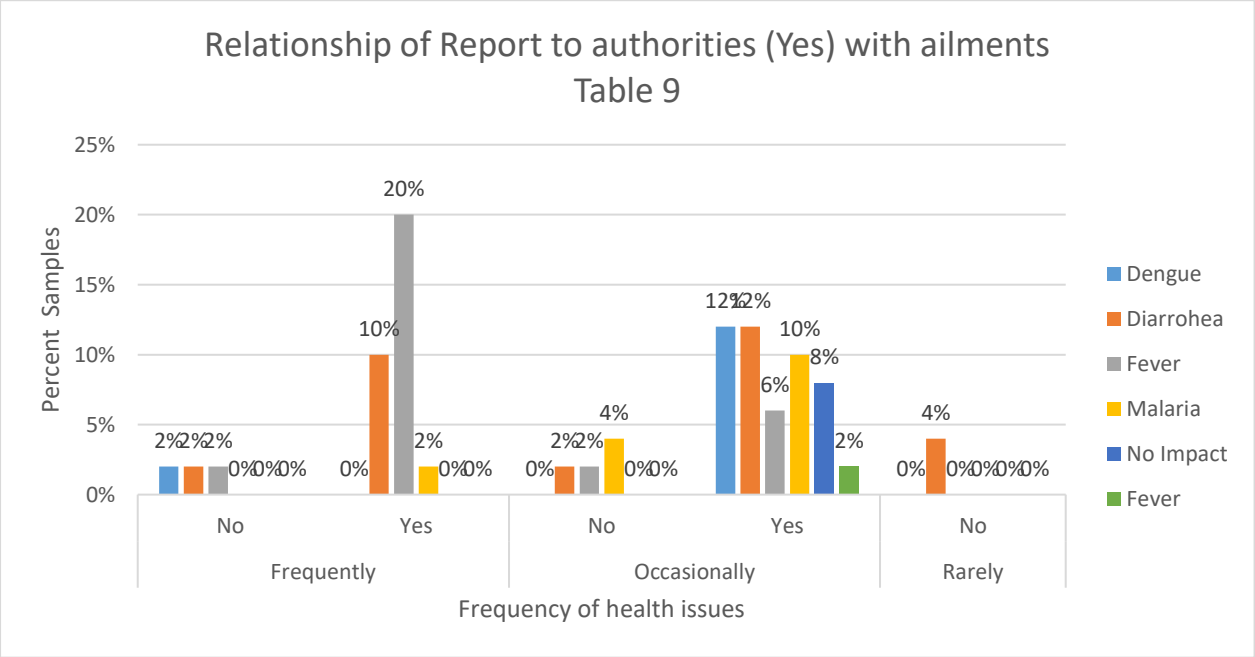
Figure 9:

Are community members consistently reporting environmental issues to authorities, or is the reporting mechanism underutilized?

Table 9

Count of Report to Corporation Authorities	**Column Labels**						
Row Labels	**Dengue**	**Diarrohea**	**Fever**	**Malaria**	**No Impact**	**Fever**	**Grand Total**
Frequently	**2%**	**12%**	**22%**	**2%**	**0%**	**0%**	**38%**

No	2%	2%	2%	0%	0%	0%	6%
Yes	0%	10%	20%	2%	0%	0%	32%
Occasionally	**12%**	**14%**	**8%**	**14%**	**8%**	**2%**	**58%**
No	0%	2%	2%	4%	0%	0%	8%
Yes	12%	12%	6%	10%	8%	2%	50%
Rarely	**0%**	**4%**	**0%**	**0%**	**0%**	**0%**	**4%**
No	0%	4%	0%	0%	0%	0%	4%
Grand Total	**14%**	**30%**	**30%**	**16%**	**8%**	**2%**	**100%**



The distribution of responses indicates variability, with only a portion of the community reporting issues frequently or consistently.

Finding: The inconsistent reporting pattern may reflect barriers such as distrust in authority responsiveness or ineffective reporting mechanisms, which could hinder timely redress of environmental problems.

INFERENCES

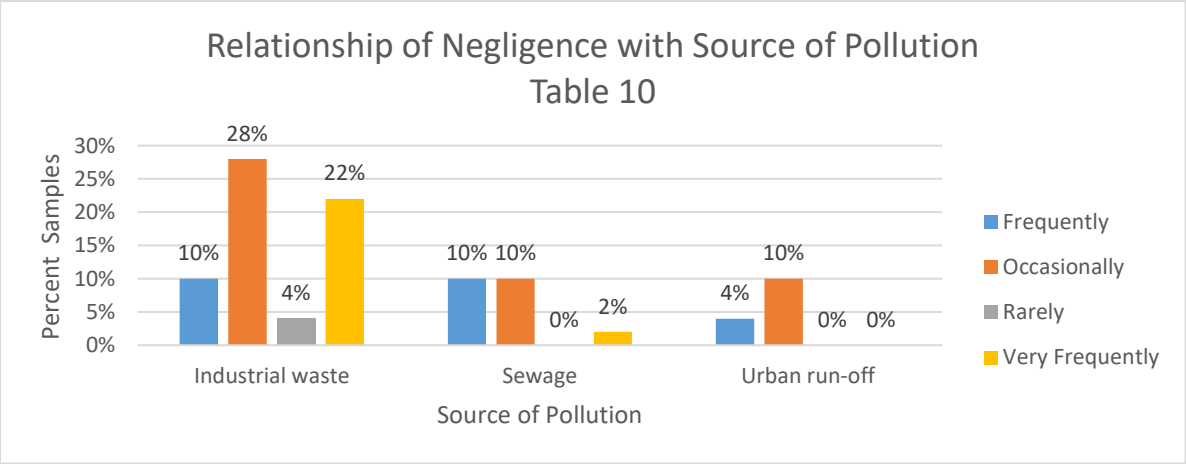
- Individuals frequently experiencing diarrhoea and fever actively report pollution issues to authorities.

- The trend suggests that people recognize the connection between water contamination and public health, yet the effectiveness of grievance redressal remains uncertain.

Figure 10:

Does the data clearly indicate that industrial waste is the primary source of pollution compared to sewage and urban run-off?

Table 10					
Count of Primary sources of pollution	**Column Labels**				
Row Labels	**Frequently**	**Occasionally**	**Rarely**	**Very Frequently**	**Grand Total**
Industrial waste	10%	28%	4%	22%	64%
Sewage	10%	10%	0%	2%	22%
Urban run-off	4%	10%	0%	0%	14%
Grand Total	**24%**	**48%**	**4%**	**24%**	**100%**



A significant 64% of respondents attribute pollution mainly to industrial waste, compared to 22% for sewage and 14% for urban run-off.

Finding: Industrial waste emerges as the predominant source of pollution in the river, suggesting that targeted regulatory actions against industrial discharges could yield the most impact.

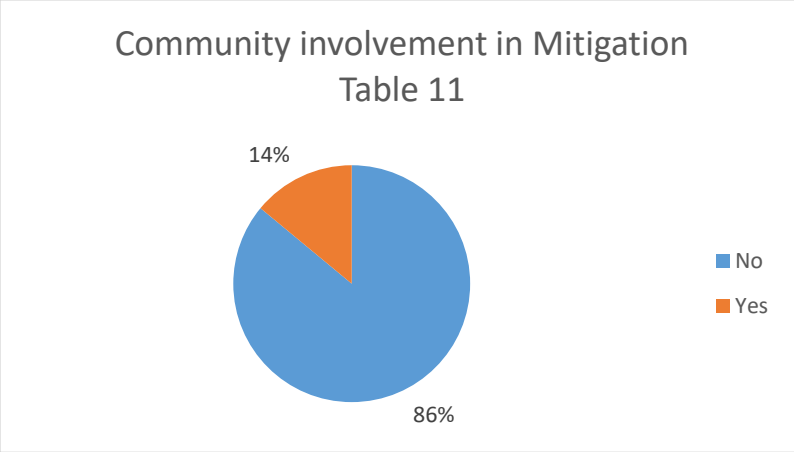
INFERENCES

- Industrial waste is widely perceived as the dominant pollution source, particularly among those who note occasional government negligence.
- This strengthens the case for rigorous industrial regulation and enforcement as a key intervention strategy.

Figure 11:

Is the level of community involvement in mitigation efforts sufficient, considering the high percentage of respondents reporting no involvement?

Table 11	
Row Labels	**Count of Community involvement in mitigation**
No	86%
Yes	14%
Grand Total	**100%**



An overwhelming 86% of respondents report no community involvement in remediation efforts; only 14% confirmed active participation.

Finding: There is a critical lack of community engagement in mitigation efforts, indicating a need for policy and educational initiatives to mobilize local stakeholder involvement.

INFERENCES

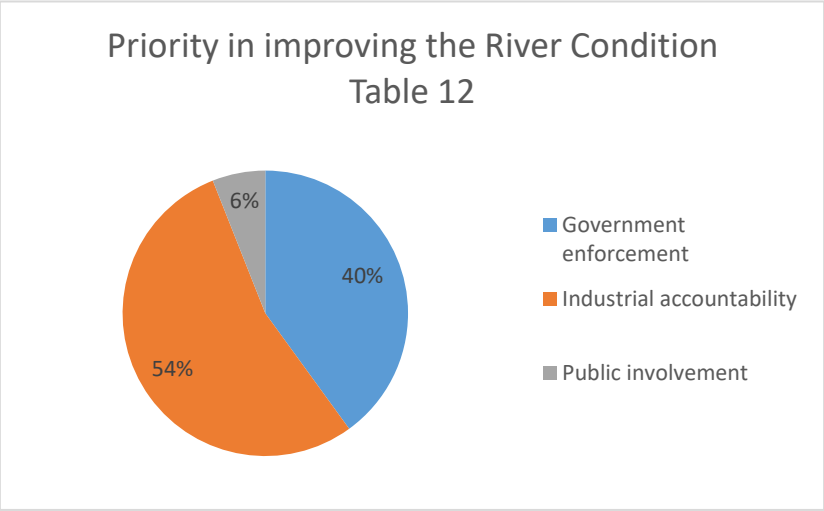
- The majority of respondents do not believe community involvement is a viable solution to pollution mitigation.

- This underscores the expectation that government-led regulatory action would be more effective than citizen-driven initiatives.

Figure 12:

Does the prioritization of industrial accountability and government enforcement over public involvement suggest that regulatory measures should take precedence?

Table 12	
Row Labels	**Count of Priority in improving River condition**
Government enforcement	40%
Industrial accountability	54%
Public involvement	6%
Grand Total	**100%**



Respondents prioritize industrial accountability (54%) and government enforcement (40%), while public involvement is considered only 6%.

Finding: The emphasis is on strengthening regulatory oversight and industrial compliance rather than community-based initiatives, suggesting that policy interventions should focus on strengthening these Institutional mechanisms in the short term.

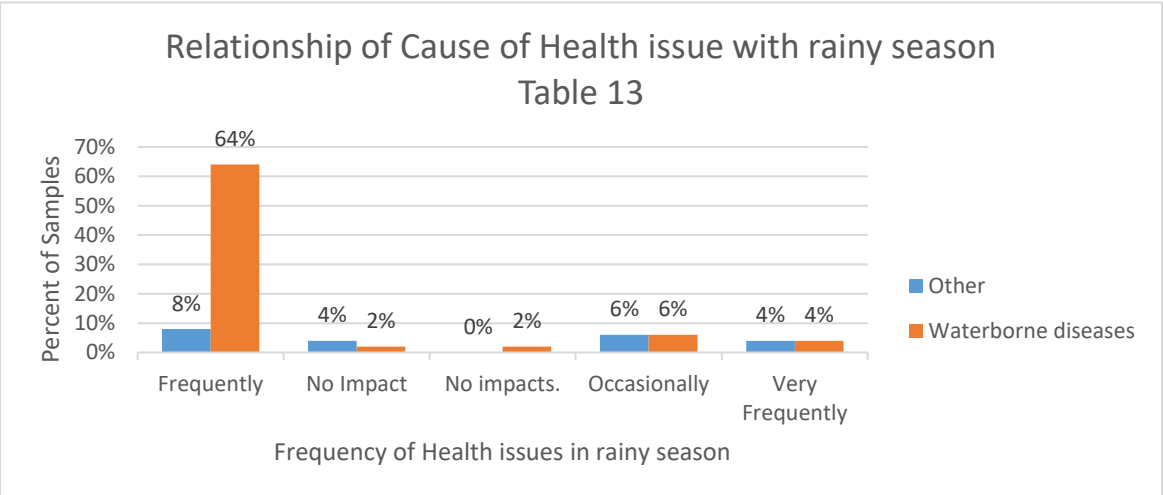
INFERENCES

- Industrial accountability ranked highest, followed by government enforcement, while public involvement was considered least significant.
- This suggests that institutional and industrial interventions should take precedence over community-driven initiatives in pollution control.

Figure 13:

Do the responses indicate that waterborne diseases are the primary cause of health deterioration in the affected community?

Table 13			
Count of Reason for Health Deterioration	**Column Labels**		
Row Labels	**Other**	**Waterborne diseases**	**Grand Total**
Frequently	8%	64%	72%
No Impact	4%	2%	6%
No impacts.	0%	2%	2%
Occasionally	6%	6%	12%
Very Frequently	4%	4%	8%
Grand Total	**22%**	**78%**	**100%**



Waterborne diseases are identified as the primary cause of health deterioration, with 64% of respondents indicating a frequent occurrence.

Finding: The high frequency of waterborne diseases strongly links polluted water as the major health hazard, emphasizing an urgent need for effective water treatment and public health

measures.

INFERENCES

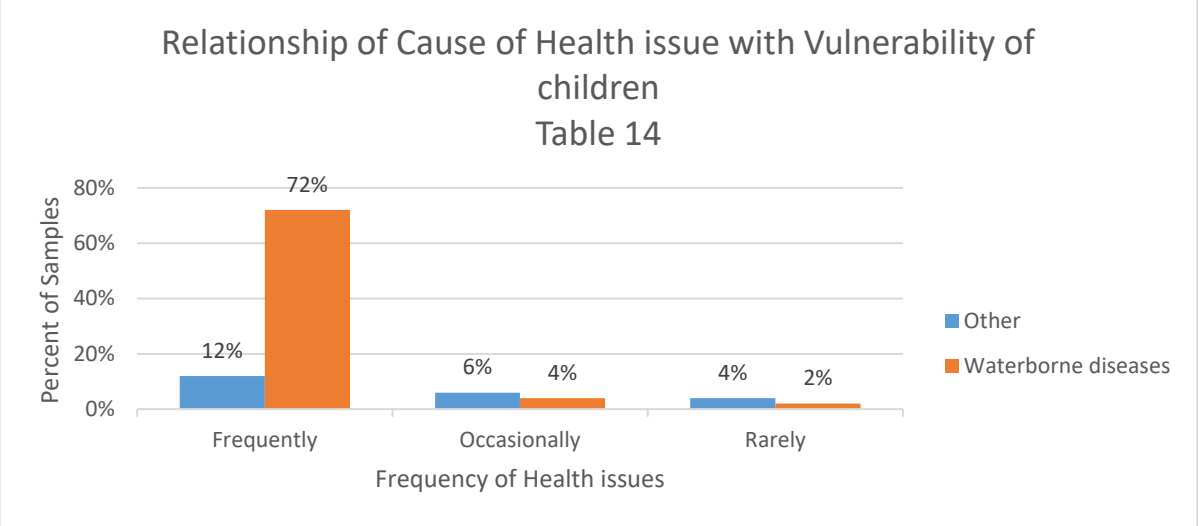
- Waterborne diseases spike during the monsoon, reinforcing their seasonal nature and direct link to water contamination.
- Effective rainy-season sanitation policies and improved drainage systems could mitigate the public health risks.

Figure 14:

Is the high frequency of waterborne diseases consistent enough across analyses to confirm it as the main reason for declining health?

Table 14

Count of Reason for Health Detorioration2	**Column Labels**		
Row Labels	**Other**	**Waterborne diseases**	**Grand Total**
Frequently	12%	72%	84%
Occasionally	6%	4%	10%
Rarely	4%	2%	6%
Grand Total	**22%**	**78%**	**100%**



Similar to the first analysis, around 72% in the frequent category again point to waterborne diseases as a leading cause of health decline.

Finding: The consistency across analyses reinforces that waterborne diseases form the critical health risk associated with the polluted river, a factor that should drive immediate intervention strategies.

INFERENCES

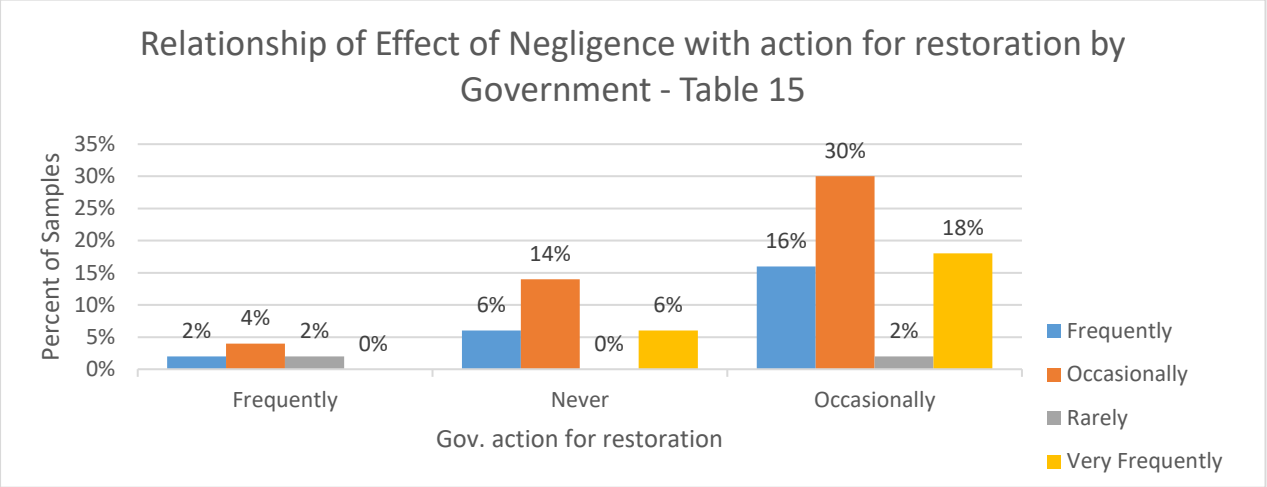
- Children are highly vulnerable to waterborne diseases, requiring targeted interventions for safe water supply.
- The prevalence of waterborne illnesses among children highlights the urgent need for sanitation reform and accessible healthcare infrastructure.

Figure 15:

Does the combined frequency of responses (frequent and very frequent) indicate that environmental negligence has a significantly recurring impact on the community?

Table 15

Count of Effect of Negligence	**Column Labels**				
Row Labels	**Frequently**	**Occasionally**	**Rarely**	**Very Frequently**	**Grand Total**
Frequently	2%	4%	2%	0%	8%
Never	6%	14%	0%	6%	26%
Occasionally	16%	30%	2%	18%	66%
Grand Total	**24%**	**48%**	**4%**	**24%**	**100%**



Nearly half of the respondents (24% frequently and 24% very frequently) indicate that environmental negligence has a persistent and recurring impact, while 48% report occasional effects.

Finding: The data clearly shows that environmental negligence is having a significant and sustained adverse impact on the community, underpinning the necessity for comprehensive remedial measures**.**

INFERENCES

- Frequent negligence by authorities corresponds with only occasional restoration actions, revealing a pattern of reactive and nominal interventions.
- The findings suggest minimal regulatory commitment to sustained environmental restoration, reinforcing the need for proactive enforcement strategies.

Results and Discussions:

Hypothesis	Statement	Resul
H1	Environmental negligence in the case of the Adyar river significantly contributes to the degradation of public health due to poor air and water quality.	Partially Accepted
H2	Inadequate enforcement of environmental laws and ineffective restoration policies exacerbate the river's ecological decline,	Accepted

	creating legal and public health challenges for the local community.	

IV. Conclusion

The findings from this study provide substantial empirical evidence supporting the hypothesis that environmental negligence in the case of the Adyar River significantly contributes to public health degradation due to poor air and water quality.

The data shows how ineffective enforcement of environmental regulations and policies for restoring impaired resources contributes to pollution, which is causing growing health impacts, especially among children and the elderly who are the most vulnerable populations.

An important finding from the results is that industrial waste is the major contributor to pollution, which matches the apparent lack of enforcement by the regulating agencies. The indications of government negligence suggest that while some of the environmental governing bodies have engaged in attempts to mitigate poor environmental governance, these attempts are minimal rather than effective. The rare times the pollution regulations have been enforced along with the erratic and limited response from government has resulted in routine pollution levels, which highlights the need to be proactive rather reactive in the context of cleanup.

From a public health perspective, the data indicates vector-borne and waterborne diseases being the most important, especially during the rainy season irradiated when contamination levels rise. In particular, children and people above age 50 are highly susceptible, with a reasonable proportion of their illnesses arising from the environmental hazards associated with contamination from polluted water sources. The study indicates that health concerns are seasonal with the peak of concerns during the monsoon months, but also stresses that this is the time intervention could mitigate the health issues in susceptible populations so that the health conditions do not worsen.

Even though pollution-related health threats are acknowledged, the results show very little public involvement in pollution prevention, and suggests that public participation, by itself, may not be enough to achieve systemic environmental restoration.

Respondents prioritize industrial accountability and stricter government enforcement over community-driven solutions, reflecting a general expectation that pollution control should be led by institutional frameworks rather than citizen efforts.

Furthermore, the data supports the argument that legal interventions must focus on strengthening industrial regulations, proactive pollution control mechanisms, and effective

enforcement frameworks. Lastly, the findings point toward stronger governmental intervention and policy reform as the most viable strategy to reverse environmental negligence and safeguard public health.

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