ARCHITECTURE THAT HEALS THE RIVER

INCARNATION OF MANIKARNIKA GHAT FOR ECO-SPIRITUAL ENVIRONMENT

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INCARNATION OF MANIKARNIKA GHAT FOR ECO-SPIRITUAL ENVIRONMENT

VARANASI, INDIA

Aaryan Buddhadev*1, Bhavna Vimawala2, Lovlesh Sharma3

1.Faculty of Architecture, Sarvajanik College of Engineering and Technology, Surat, India

2. Faculty of Architecture, Sarvajanik College of Engineering and Technology, Surat, India

3.National Insititute of urban Affairs, Delhi, India

*Correspondin author's

Email ID- aaryan25buddhadev@gmail.com

Phone number- +91 9825236890

Two side of Varanasi, one built for the people,other one- built by the people

Graphic credits: Author

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ABSTRACT

"Religion is the manifestation of the existential crisis."

- Prof. Sankalpa

India is the mosaic of culture that has cultivated the tradition of deep-seated mythical origins through generations, which has shaped the discourse patterns consciously or unconsciously, resulting some major significant issues. For India, the river Ganga is the earthly form of divinity that grants eternal salvation and has gained a motherly status (Ganga Mai). This research reflects the issue that **questions the faith and its Rituals** regarding the Ganga as the paradoxical mirror to the built environment of Varanasi (Holy City of Death) which coerces us to ponder –**What does water want?**

A time where world is facing pollution in almost every other way, **water is the most vulnerable natural resource**. Rather than solving the issues, one way or other **we all are part** of polluting the rivers. India is renowned with deep rooted cultures that celebrates rivers as form of divine, a goddess. Inspite of this, today the national river Ganga is facing vast pollution threatens. One of its small reason is the rituals, the faith that is **engaging people with whole river** in its **cosmic capital** Varanasi .

Ghats(Riverfronts) are the tangible forms that helps people to devote their faith to the rivers. The worship of river leads to the ritual activities that bestow the faith with many bio degradable and non-biodegradable matters.This research investigates the vulnerability of river against the carcinogenic waste producing rituals done by people. It is the **study of waste mapping** and its management across three major Ghats of Varanasi - **Assi ghat, MAnikarnika Ghat, Dashashwamedh Ghat.**

-

The world is moving **towards sustainability with the growing challenges** faced by our very own natural resources day by day. **Water belongs to river first rather than the people**, we must respect it. This research would offer the insights on how can **ritual waste generation be a source of income** for the localites, and different ways to mitigate the river pollution from varying waste sourcing points that degrades the water quality standards year by year.

Keywords :

Cosmic capital, faith, rituals, water, vulnerable, pollution, ghats, river Ganga, waste mapping

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1 INTRODUCTION

"What we call religion is merely organized belief, with its dogamas, rituals, mysteries and superstitions ."

- J.Krishnamurti

India's cosmic capital, boasting as one of the world's oldest inhabited urban settlements, features a vast sacred landscape where various religions perform rituals along its Ghats (riverfronts). This city stands as a central figure, illustrating its impact on the environment and the dependence on water for locals, fishermen, and farmers across its delta plains. Varanasi is adorned with a diverse tapestry of culture that resonates with mythical narratives. However, religious practices raise fundamental questions about their relevance today. Each Ghat has distinct rituals, significantly affecting the river's health. It's hard to scale down the blasting impact of 3 million people visiting these Ghats annually offering mountains of flowers, earthen lamps, ashes, and hairs. Once offered (flowers, earthen lamps, ashes) and symbolically accepted by the goddess Ganga, they are no longer useful and enter the category of waste.

"Each religion has its own Sacred book, its mediator , its priests, its ways of threatening and holding people."

-J.Krishnamurti

Every day approximately 200 bodies are cremated on Manikarnika Ghat (the burning Ghat) which requires 200kg-300kg of wood (weight equivalent to 10 elephants). Along with that, the unlettered beliefs regarding the death of pregnant women, , infants, and people who died by poisoned snakes and those who have leprosy are dumped directly into the river Ganga. This body takes 2 to 3 weeks to decompose, which also caters to the water dependency for 1/10th population of India

More than 315 tons of waste (weight equivalent to 79 elephants) drain into the river every year, with 36 big and small drains directly connected to the river Ganga that tosses 200 million liters of untreated wastewater every day. This leads to a higher concentration of coliform bacteria in the water, ranging from 40,000 to 80,000, a spike increase in cases of illnesses, infections, and harmful diseases that

questions the growing generation in the town. How are these practices even relevant to the pace of the growing population and their demands in the current time?

Despite these facts, how does one cleanse a river revered as the epitome of purity itself?

Once a Life of creation is today nothing less than the carcinogenic symbol of culture. Architecture transcends religion yet intervenes in the relationship between humans and their cultural diversity. This juxtaposition between cultural heritage and environmental decline raises profound questions about sustainability and accountability, necessitating action and awareness within this sacred city. The flux of human culture and religion remains immutable But with the growing pace of life it questions the different dimensions of human and its dependency on mother nature.

Perhaps, the reality is that the faith of 4000 years old can't undo the negligence caused in the last 50 years.

1.1 Background

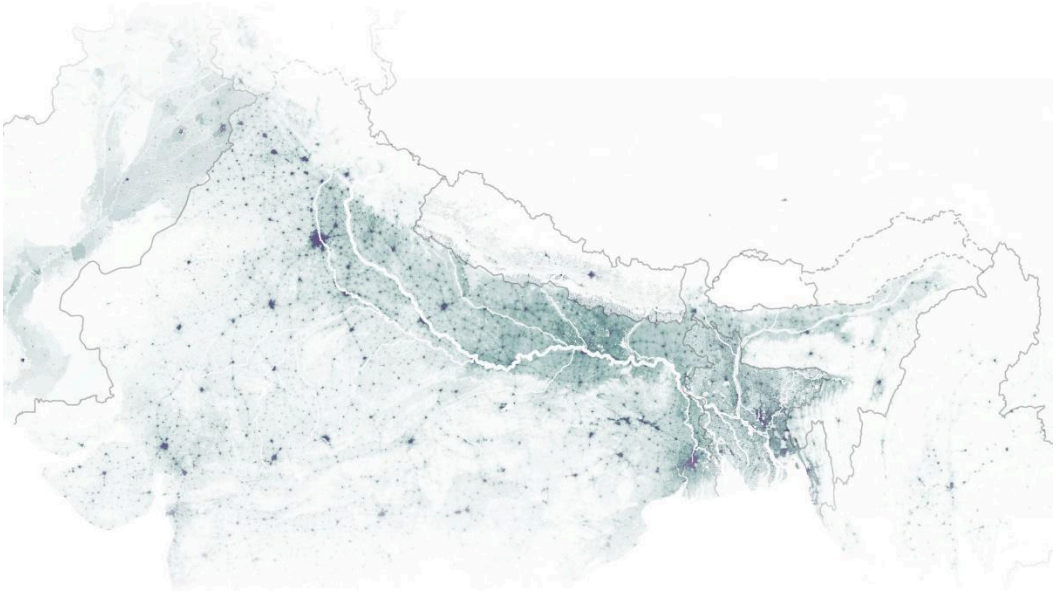

Figure 1 river ganges across India

Source: Author

The Ganga basin accounts for a little more than **one-fourth (26.3%) of the country's** total geographical area and is the biggest river basin in India, covering the entire states of Uttarakhand, Uttar Pradesh (UP), Bihar, Delhi, and parts of Punjab, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, and West Bengal. The Ganga basin is bound in the north by the Himalayas and in the south by the Vindhyas. The **main river stream originates in the Garhwal Himalaya**. The ice-cave of Gaumukh at the snout of the Gangotri glacier, 4100 meters above sea level, is recognized as the traditional source of River The river cuts its path through the Himalayas and **flows a distance of about 205 Kilometers from Gaumukh** and transverses through two districts of Uttrakhand state i.e. Uttarkashi and Tehri to reach Devprayg where another head stream, the Alaknanda, joins it to form Holy Ganga.**Total Length of river is 2525kms** which has its stretch of 450kms in Uttrakhand, **1000kms in Uttar Pradesh** , 405kms in Bihar, 40Kms in Jarkhand and 520kms in West Bengal. **Total catchment area of ganga Basin is 8,61,404kms (26.4%) of India.** Main stem of river Ganga houses a population with high density. In absence of proper sanitation, abstraction of surface and groundwater for irrigation and drinking purposes and partially treated domestic and industrial effluent turns Ganga into a polluted river in the stretch from Kannuj to trighat in the state of Uttar Pradesh and also makes the water of river Ganga unfit even for bathing purposes.

1.2 Context

Figure 2 Two sides of praying Ganga Mai

Source: Author

India is renowned as the birthplace of several of the Worlds major religions and the civiliztions holding their religious significance growing and flourishing, then and now across its sacred rivers. The belief that **the divine is embedded in nature** is part of the spiritual discourse of the religions of antiquity. Nature has been worshipped in one form or the other in different cultures of the world. In India, rivers are considered sacred, purifying, life-giving, and redeeming. The corporeality of the rivers is subsumed and often modified by its metaphorical, mystical, and metaphysical associations.

The sentiment behind this belief is that **we depend on rivers or lakes for almost everything**; food, transport, drinking water, bathing, irrigation, and yes **even washing away our wastes**. Life in ancient India was not possible without rivers hence they assumed a **divine motherly status**. This sentiment is not limited to rivers within India but any water body that gives one sustenance. We realize that **major water bodies in India are highly polluted** due to industrial and sewage effluents. We must combine action and **awareness with worship** and clean up our divine rivers

It is rivers, or more specifically the lands around them that sustained population and gave rise to societies and ultimately civilization. Most ancient cities were, and are still situated on the bank of rivers. This research interprets cultural practices in the Ghats of Varanasi and describes how **waste is an essential part of life and growth in traditional thinking**.

There are many rituals performed within the sacred Ghats of Varanasi, once offered (flowers, earthen lamps, ashes) and symbolically accepted by the goddess Ganga, they are no longer useful and enter the **category of waste**. **As pollution mounts in the river, a change in the cultural perception of Ganga Ghats and the ability to deal with waste is necessary**. A planning model for waste management on these Ghats of Varanasi with strategic narratives in managing this waste is outlined in this research.

1.3 Vital facts

- As shownin below figure ,the history of ganga cleaning with government initiatives has been seen increasing year by year with higher sanctioned budgets but yet no significant improvement has been seen.
- **Ganga action plan came in 1985** with first sewerage treatment plant (STP) by **Rajiv Gandhi at Rajendra Prasad Ghat** .this plan covered 25 towns with 260 scehemes that promotes the water cleanliness with better outcomes to people.
    - **Same Action plan has been extended in 1993** as part 2 of it.
- **Later,National River Conservation plan came in 1995**. This plan has been treating 41 main rivewrs along ganga mainstream and8 gangqa basin rivers with its small to medium tributataries
- Under Modi Governmemnt, Namami Ganga Clean Mission (NGCM) took place with integrated conservation mission,basin based mutli sectores approach.
    - This came up with the Council of National Ganga (NGC) in 2016
    - With sanctioned budget of 20 thousand crs.
- **The same mission has been continue under his umbrealla with now sanctioned budget of 22,500crs for term 2021-2026.**
- Inspite of such promising intitiatives and work from government,thewe water quality standards have been tremendously decreasing year by year that affects the marine life along with the people dependent on river for their livelihood.

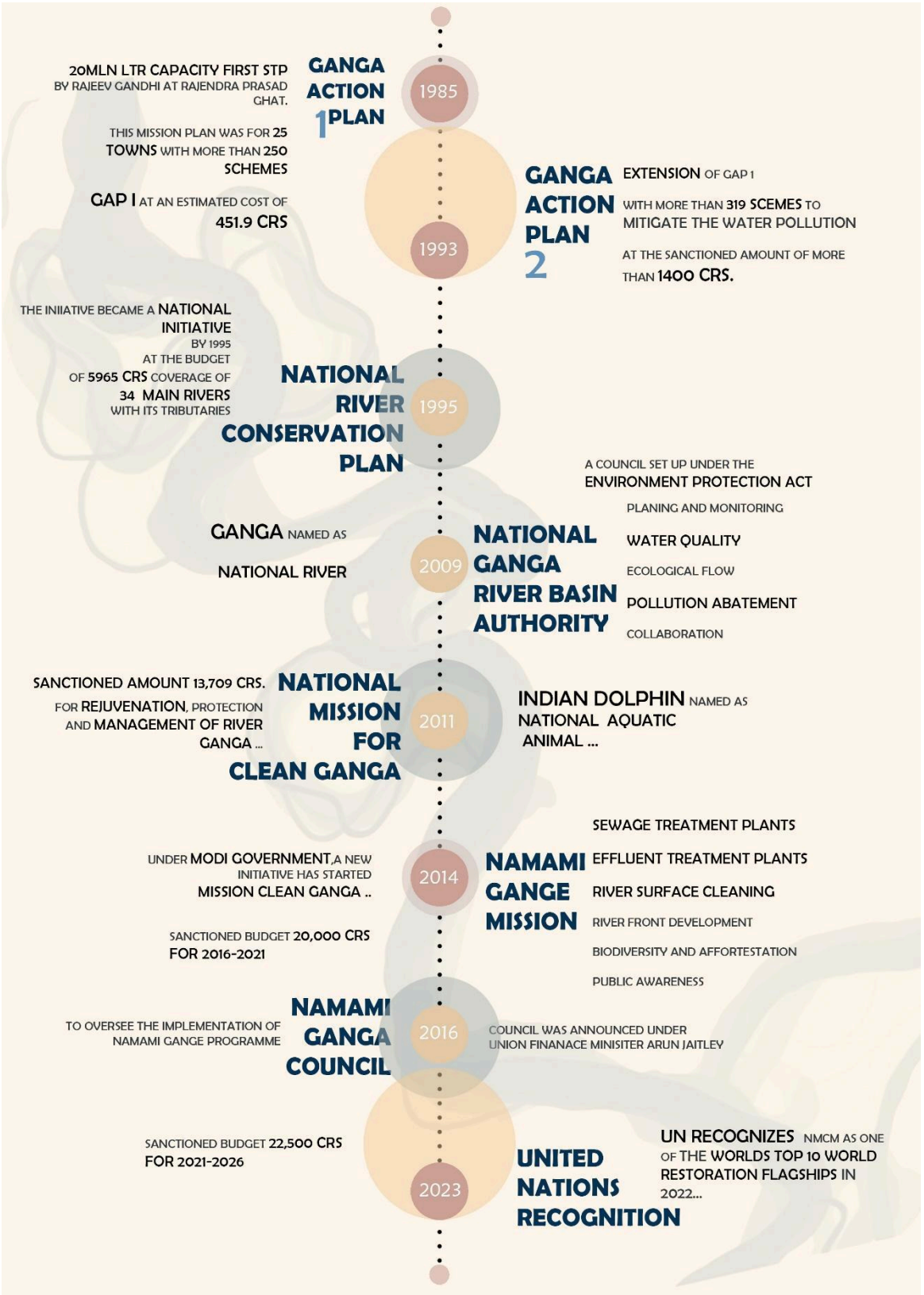

Figure 3 Timeline of Clean Ganga Mission

Source: Author

1.4 Current Scenario

Amount of waste generated in the city of Varanasi increased every year and presently650MT of waste is generated on daily basis. Out of this daily generation of waste on this ghtats is Specifically temples approx. to 3-4 MT. So far, in case of Varanasi, the municipal authorities (Nagar Nigam) has taken multiple initiatives. Under this intiatives, Municipal people clean the ghats twice daily with river surface cleaning twice the day.All of this waste is then dumped to nearest dump house (Kachda ghar) and later, other day morning, Municipal truck takes the waste to Karsada ,an open dump yard that is located 14kms away in the outskirts of Varanasi. But yet, the waste generation in the river is increasing with the touris and ritual festival footfall.

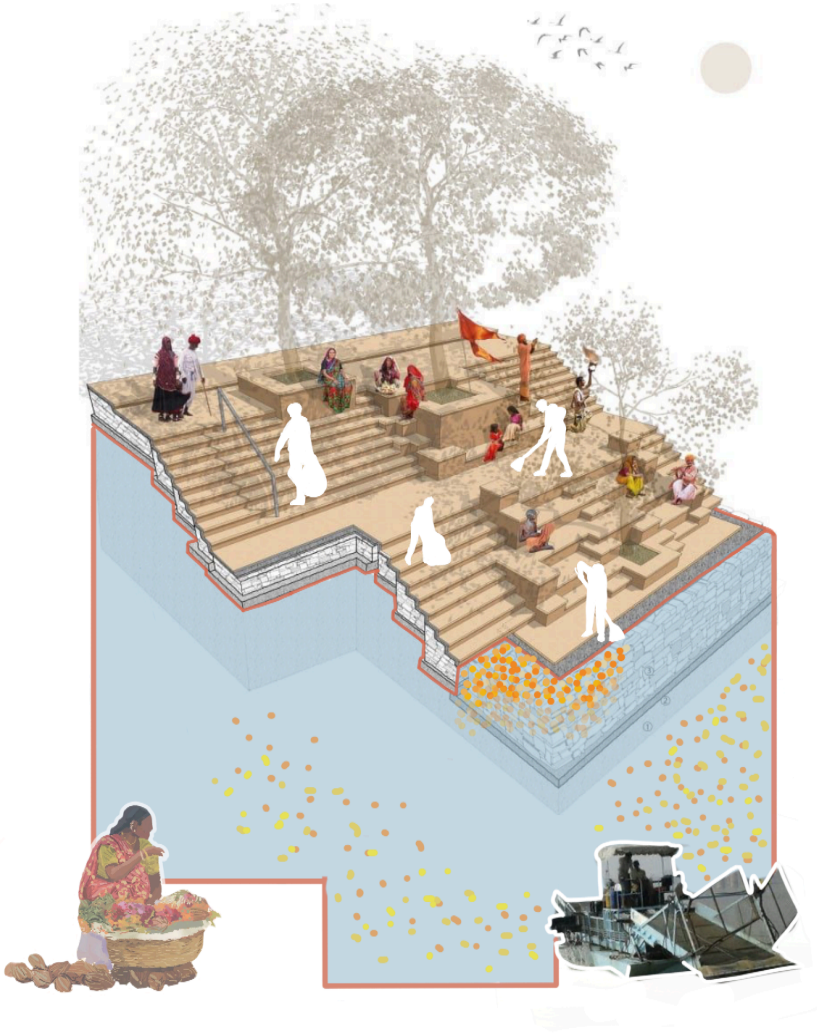

Figure 4 Current Scenario of Waste Management on ghats

Source: Author

1.5 Need of Study

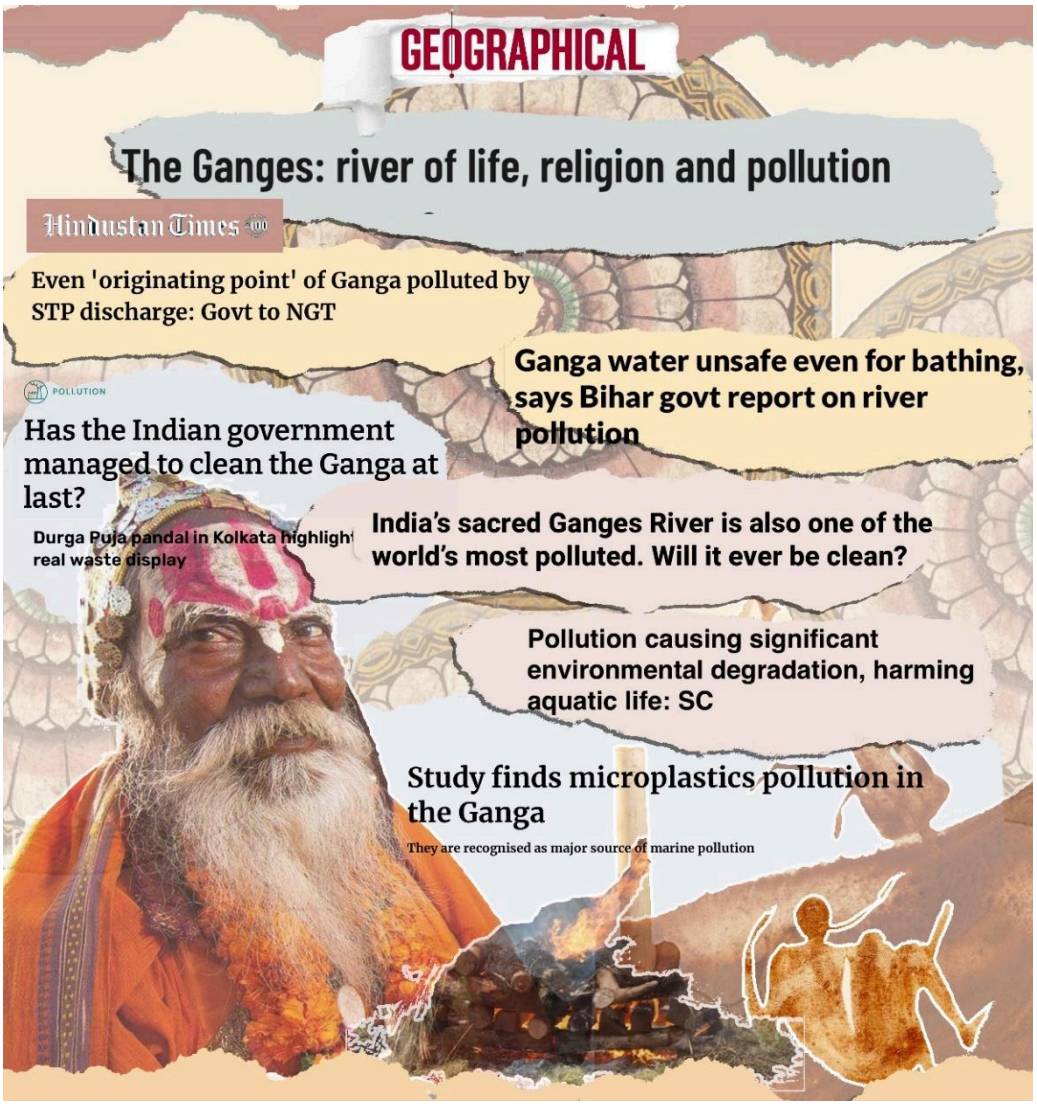

Figure 5 : Collage of Recent Headline of Ganga Pollution

Source: Author

Although **increasing the task force** or **doing participatory activitites** are not showing the fruitful outcomes in terms of waste Generation. **of Inspite** of such highly sanctioned initiatives and **approaches towards the declination of water pollution**, **the water quality standards are tremendously decreasing year by year**. Other than city waste, **Ritual actitives and waste generated from this Activites plays a major role in terms of water pollution**. The growing footfall following the rituals or the generations old traditions are a reason to waste generation as well with the growing speed of life, how relevant is it to perform rituals with the whole river ?.This study is intended to map out the waste generation from rituals and religious activities and to propose holistic approaches and solutions towards mapping out the waste in a more sustainable manner.

1.6 Hypothesis

How relevant it is to wash away the impurities/sins in a river that is revered as the epitome of purity itself?

Research on the **relevancy of rituals and faith is very important in the growing climate changing environment**. **Especially when the river is contributing to 25% of all water resources in the country.** We live in the society which is driven from generations old unlettered beliefs. **Unware about the repercussions of the Activates may lead to larger problem picture.**

1.7 Aim:

The intent of this research is to **identify the types of waste generated on these Ghats** to understand its impact and the strategic ways **to manage this waste with different possible methods within current situations** and contexts. This research would serve as a catalyst to resolve the current waste management situation and **suggest better prospects with tangible solutions.**

1.8 Objectives:

- **To study** the spectrum of human association with rivers, Ghats, rituals, and their belief practices
- **To analyze** different types of waste from a comparative study of various Ghats (most active to least used riverfronts).
- **To propose** possible solutions for the betterment of river and human settlements within the contextual circle and tangible solutions for revenue generating from waste collection.

1.9 Scope and Limitations:

- **Ganga is India's largest river serving 1/10th population of India**. A source in the Himalayas (Gangotri) that passes down to Haridwar, Gangetic plains, Kanpur, Allahabad, Varanasi, Sundarbans and later end in Bay Of Bengal.
- **Varanasi is the main epicenter for practicing human rituals with Maa Ganga**. For this research, the scope of the study is limited to outlining the various Ghats across Varanasi and to channelize the waste generation with better and effective solutions.
- To Examine different types of wastes and conditions to manage them, **the study is limited to only following Ghats –Manikarnika Ghat, Assi Ghat and Dashashwamedh Ghat.**

1.10 Research Methodology

An **Exploratory Research Methodology** has been undertaken to understand the subject in deeper prospects of faith and relation with river resulting its impacts in water pollution. **The primary data was collected through direct field observation, focused group discussion (FGD), face to face interview with a questionnaire survey. Groups that were surveyed were vendors, visitors, localities, authorities from Ganga Task Force (GTF) and cleaners from nagar nigam.** Secondary data that was collected and analysed included different journal articles, newspapers, magazines, books, City Corporation data, GO & NGOs and TV report and documentaries.

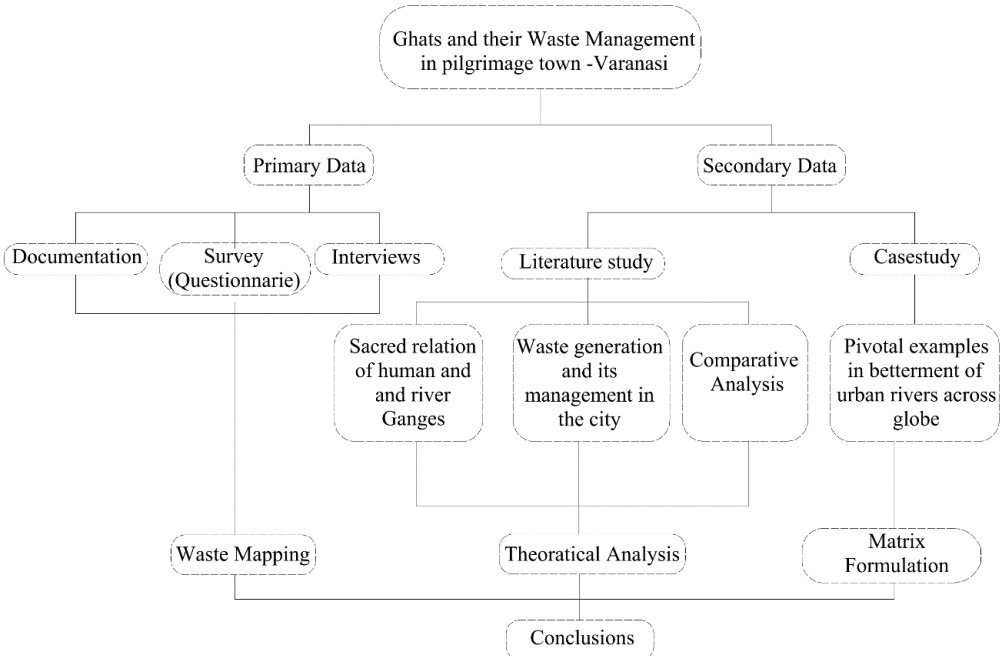

Figure 6 Research Methodology

Source: Author

- Because of its **primary and qualitative nature**, this study can examine the different types of waste by intervening on these area of Ghats and could further draw tangents towards the prospects of waste management.
- This research method would **allow to draw out the observations to mitigate the growing concerns with the pollution in river Ganga**.
- Although, a mandate visit to the Ghats would allow to understand the waste mapping in a logical and rational manner.
- In the last phase of this research, a generic solution **by mapping down the site for waste management within the ritual fabrics of Ganga will be concluded.**

1.11 Research Framework

Sub Objectives	Method	Source of Information
Studying the relationship of rituals with river Ganga.	Primary and secondary	Site visit Articles Research Papers Documentaries
Examining different type of wastes from the ritual activities.	Primary and Secondary	Site visit Articles Research Papers Documentaries
Understanding the susceptibility of river Ganga in the precinct of Varanasi.	Secondary	Namami Ganga annual Reports2019-2023
Comparative Analysis of different water quality standards within the precinct of Varanasi	Secondary	Namami Ganga annual Reports2019-2023
Documenting ritual activities and waste generation	Primary	Site visit
Waste mapping exercise across the three ghats	Primary	Site visit
Interviewing people with regard to current scenario and possible solutions to mitigate the ritualistic waste.	Primary	Site visit
Inspecting the current scenario of waste management on the Ghats.	Primary	Site visit
Examining different approaches from pivotal examples of waste management across the globe.	Secondary	Articles Research Papers Documentaries

Table 1 Research Framework

Source: Author

2.0 LITERATURE REVIEW

2.1 Introduction

Water is perhaps the most sacred symbol of spirituality in India, at once the purifier and the miracle of life. It is the source of mystery and embodiment of the generative principle of life. The sanctity that is assigned to water in Indian ethos and spiritual traditions can be traced back to the Indus valley civilization, whose influence remains unabated even in the present times. The belief that **the divine is embedded in nature is part of the spiritual discourse of the religions of antiquity**. Nature has been worshipped in one form or the other in different cultures of the world. In India, rivers are considered sacred, purifying, life-giving, and redeeming. The corporeality of the rivers is subsumed and often modified by its metaphorical, mystical, and transcendental associations.

2.2 Natural Archetypes

Amita Sinha 2016, 'Landscape In INDIA, Forms and Meanings' stated Indic religions place an immersive value on nature in their belief that **natural elements communicate sacred energies that lead to realization of divinity within.** Natural elements- mountains, caves, vegetation and their combination –holds the potential for becoming axis mundi, **centre of known world,** a point of **rupture where communication with the nonhuman and godly realms is possible**. The river Ganga, Mount Kailash, and the Bodhi tree are all examples of visible axes between the earth, heavens, and underworld. They are valorised as such **Indic Religions and play a crucial role in cultural narratives of mythology and literature**. Their representation in art and literature makes them into cultural icons. Rivers, Mountains, and trees found in other parts of subcontinent are named after them . **Their presence creates a sacred landscape and encourages a secular one to evolve around it**. Hills and rivers, or combination of hills and bodies of water and forest groves, are found in every sacred site in the Indian Subcontinent. **They are also loci of ordinary settlements, gathering religious sentiment and community functions around them**. (Sinha, Landscapes of India , 2016)

They are spatial expressions of the human psyche and all that it considers significant. Since the **human mind has a propensity to translate almost anything into spatial terms, concepts most significant to human existence- such as origins of cosmos, heaven, and hell :social structure, collective and individual identities; myths rituals and fantasies; economic exchanges and political power –can be expressed in built form**.

2.3 Ganga, The Redeemer

Figure 7 Ganga Mai in calm pose

Source: Author

Arpita Chattaraji (Mukhopadhyay) 2021, 'Sacred Water and Cultures of Worship' stated **River Ganga is an eternal presence in the collective consciousness of the Indian subcontinent in the form of myths, legends, and fables**. It is the holiest of the holy rivers and is believed to possess purificatory qualities. Ganga water is held sacred; a dip anywhere in the river cleanses one of all sins and assures mokṣa (salvation) from the karmic cycle of life. **The ritual purity of the river is manifest in its uses in almost every aspect of Hindu life**.

Diana L. Eck 2015, states "**The Ganga as goddess is more than a single river. She functions in India as the archetype of sacred waters**. Ganga remains the paradigmatic sacred river to which they are likened. The River Ganga is not confined to the course she takes across the plains of North India but participates in that spatial transposition that is so typical of Hindu sacred topography, pervading the sacred waters of all India's great rivers.

The article is to locate and understand the patterns of continuity, forms of disruption, paradoxes, exigencies, and essentialisms, as well as the variegated possibilities embedded in these practices, but it also looks at the less-known practices and narratives which bring the negotiations, debates, and tensions between sacred geography, environmental ethics, crises of modernity, and religious ecology to the centre of discussion. (Chattarjee(Mukhopadhyay), 2021)

2.4 Ganga, rhythm of mythological landscapes

Figure 8 Goddess Ganga on Makara (her symbolic vehicle)

Source: Author

In Hindu mythology, **River Ganga is the purest form of Lord Viṣṇu**; she is also the consort of Lord Śiva. It is the river incarnate, occupying the central place in the culture and civilization of the Indian subcontinent. The entire length of the river is marked by sites of pilgrimage or tirtha manifesting the quintessence of the sacred. **The beliefs associated with the river are given shape through practices/rituals reinforcing the 'performance' or embodiment of a 'lived religion.'**

Sudipta Sen 2019, makes an interesting observation regarding the intersection of the mortal and the divine in the deification of rivers with particular reference to the Ganga: "**The relationship between anthropomorphic and naturalistic conception of the Ganga ... has deep roots in Indian culture"**. In the Hindu Tantric tradition, this anthropomorphising of the river is seen in various rituals and bodily practices.

In the Yogic conception of the human body the three channels (Nāḍī s) of life force correspond to the three rivers, Ganga, Yamuna and Saraswati – the solar piṅgala is Yamuna, the lunar iḍā is Ganga and the fiery suṣumṇā is Saraswati. In India, rivers are predominantly worshipped as maternal presences and as female deities. The philosophical **rubric of renewal and rebirth** organic to the Hindu way of living is seen to be ritualistically 'performed' in/by rivers.

Figure 9 Shiv and Ganga as one Spiritual Body

\Source: Author

Ablution in the sacred water of river Ganga, **pitr tarpaṇa**, the invocation of River Ganga in the rituals related to **upanayana, and śrāddha** reflect man's attempts to grasp the intangible through a tangible object – in the case of the Ganga, a river which has been embedded **in the psyche of the civilization that grew around it, to be the ever-flowing nurturer and redeemer**. Ādi Śaṅkarācārya prays in Ganga Stotram [Praise of Ganga]:

"O Bhagavati! Purge me of diseases, sorrows, impediments, sins and ill-intentions. You pervade all the three worlds, you adorn the earth like a necklace. In your flow I find solace and comfort!"

Etymologically, the word Ganga is derived from gam, which means 'to go' – in this sense, **the river represents the flux and fluidity of human life**. There are several myths tracing the descent or avataraṇa of Ganga. According to the Vaishnava version, Ganga is called Vishnupādi or one who emanates from the foot of Vishnu (also spelt as Viṣṇu). In another version of the myth, **Ganga agrees to descend on earth to revive the sixty thousand sons of King Sagara**, who were 171 Humanities Bulletin, turned to ash by the ire of the Sage Kapila when they disrupted his meditation. Bhagīratha, the descendent of King Sagara pleased the gods by his dedicated and rigorous asceticism, and as a reward Ganga agreed to follow him to earth. But the descent of Ganga on earth unchecked would have caused a deluge, which was avoided when Lord Śiva permitted her to descend on his head. **Ganga lost her way in the entangled locks of Śiva until she finally made her way to the plains of Northern India**. **Bhagīratha guided her to the sea in the Sagara island of West Bengal; there she flowed into the underworld to redeem Bhagīratha's ancestors and eventually joined the ocean**. Ganga confers benediction, even in the underworld; the river had pointed the way to paradise.

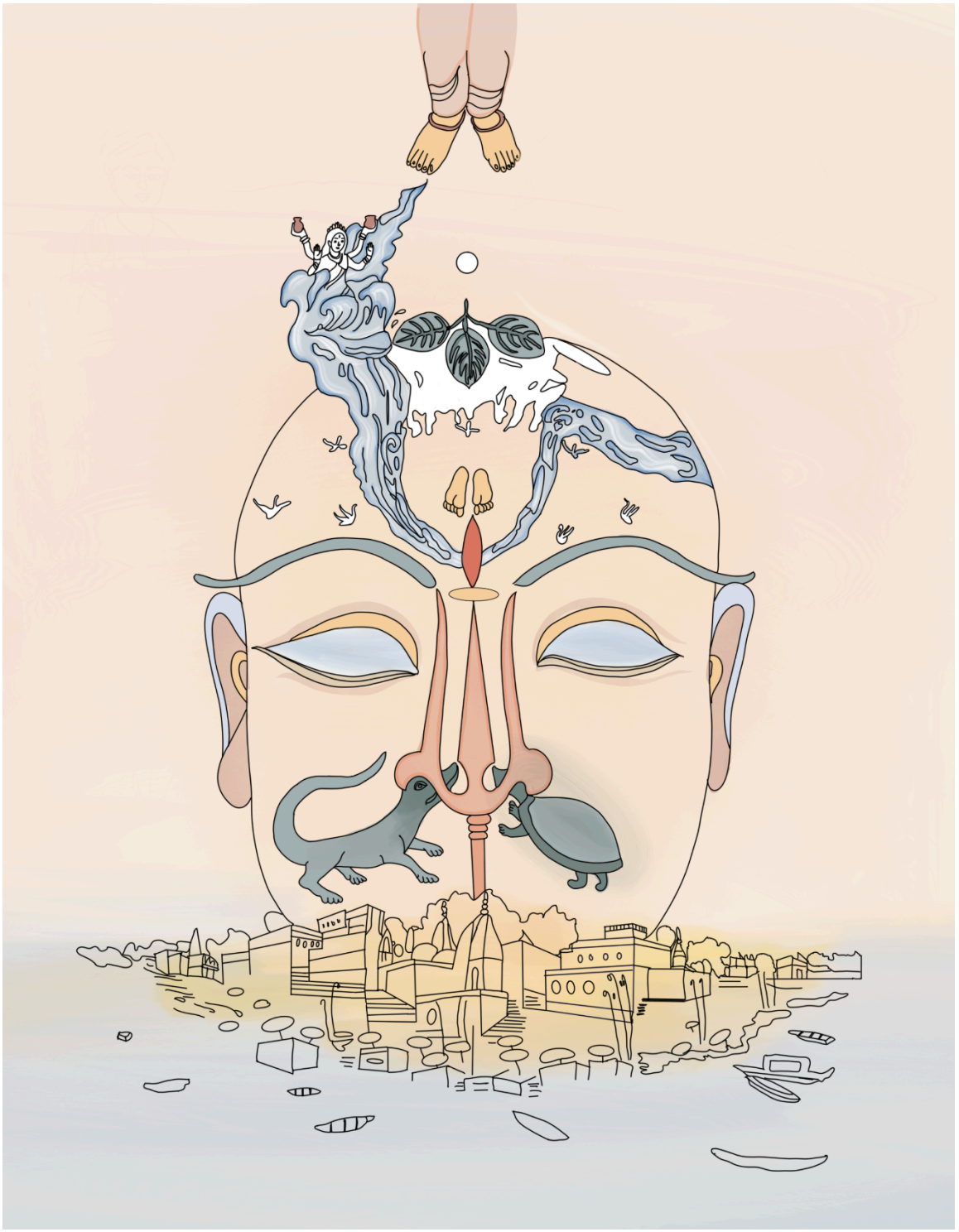

Figure 10 Realisation of Salvation /Moksha

Source: Varanasi Streets

Digitization :Author

This **juxtaposition of a religious-mythical vision** and the cartography of the river from its source in the Himalayas to its flowing into the Bay of Bengal underscores the relationship between human beings, their religious practices, and the earth's living system.

2.5 Heirachy within sacred landscapes

2.5.1 Introduction

PS Ramakrishan 2006, in 'The Sacred Ganga River-based Cultural Landscape' , stated the concept of the 'sacred' has a spatial dimension, ranging at one extreme from the landscape going down through an ecosystem type to the level of the species. Relating to this spatial scale is important for any meaningful consideration of a 'cultural landscape' concept. **In the context of natural resource management**, **the social institutions defining the 'sacred' are often linked to religious myths and a sociocultural belief system**. Such a concept of the 'sacred' has spatial dimensions and specificities. One could conceptualize a broad hierarchy of social institutions or sacred/cultural entities, i.e. 'spatially diffused sacred landscape' (**a landscape in an ecological sense is a set of closely interacting ecosystems**), '**spatially defined sacred landscape', 'sacred groves' and 'sacred species'.** (Ramakrishan, 2006)The existing **separation between natural and cultural landscapes is being challenged, leading to the recognition of cultures as a product of social practices** that take place in historically contingent and geographically specific contexts. It is in this context that the following discussion on the 'Ganga river-based landscape system, as a sacred landscape' becomes significant. Concept of the 'sacred'

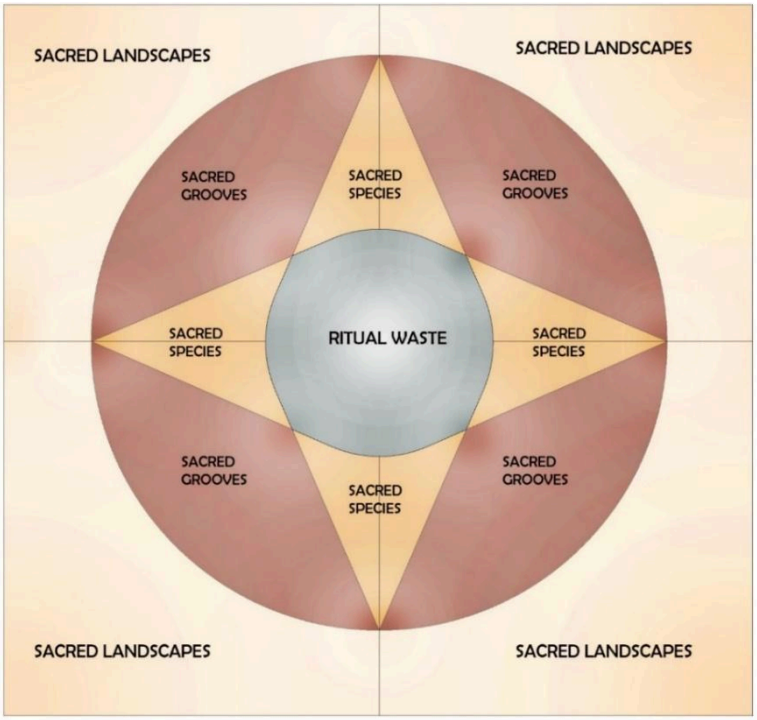

Figure 11 Hierarchy of Sacredness and Interconnectedness

Source : Author

2.5.2 Sacred landscapes along Ganga

In this spatially diffused landscape, there are many sets of interacting ecosystem types, with humans an integral component, Ramakrishnan,1996. The landscape has three major components:

(a) **The Garhwal mountain landscape**,

(b) **The flat Indo-Gangetic alluvial plains**

(c) **The coastal Sunderban mangrove ecosystem**,

One of the guiding principles in demarcating the boundary for such a sacred landscape lies in the identification of the '**zones of influence'**, for not only the local people but also for the vast majority in the Indian sub-continental region. The landscape along the river course is sanctified through holy cities with ancient temples at **Gangotri, Badrinath, Kedarnath, Rishikesh, Haridwar,** along the Himalayan zone, **Varanasi and Allahabad** in the Indo-Gangetic plain. As an ensemble, these represent a set of interconnected ecological systems, bound together by the sacred river itself, as part of a mega-watershed. With intense highland-lowland interaction through flooding and silt deposition, the interconnected ecosystems are in a sense controlled by the course of the sacred river Ganga and its tributaries. (Ramakrishan, 2006)

Figure 12 Zone of Influence Of Ganga River

Source :Article, PM Ramakrishan (2016)

2.5.3 Sacred grooves

Next in the hierarchy of sacred entities, and widely distributed all over the world are the 'sacred grooves' (sacred ecosystems), maintained under very diverse socio-ecological situations. They could remain embedded within a sacred landscape, though they may stand on their own. The **institutional mechanisms that govern these groves could differ widely – e.g. village councils, temple management committees, private ownership rights, etc** (Ramakrishan, 2006)

Here, diffused institutional arrangements linked to the people include a holy dip in the sacred **Ganga for the believers; special festivals such as the 'Kumbh' (ceremonial holy bath)**, held every twelve years when millions of devotees collect at sacred sites for elaborate religious ceremonies and celebrations**; yearly visits to the sacred temples spread all along the course of the Ganga river system starting from Gaumukh,** the high point in the Himalaya where the river originates, and extending right down to the Bay of Bengal. The **cremation ceremony** on ghats of Varanasi , the everyday **Ganga aarti**, the **unlettered rituals** of pouring earthen lamps, flowers ,ashes in the rivers are all activities that creates the grooves in this sacred landscape of Ganga.

Figure 13 Sacred Grooves- Cremetion on Manikarnika Ghat

Source :Author

2.5.4 Sacred species

It is highly heterogeneous and much more complex than the rest, for reasons that are ecological, social and cultural. them being **Kols, Kirats and Khasa**, corresponding to the **Doms, Bhotias and Khasas** of today. Subsequently, **migration of people** from the plains of India drastically **changed the societal structure**, the free-living tribal character of the societies becoming organized on a well-defined caste basis. With the focal point on Shiva, as the main deity with his abode in the snow-clad peaks, a variety of gods and goddesses of the Hindu pantheon are worshipped; the rivers too are worshipped, with the prime position given to the goddess Ganga and Yamuna taking pride of place.

Figure 14 Preist On Dashashwamedh Ghat

Source :Author

2.6 The Dom community of Varanasi (Sacred Species)

From the article -Life at the Burning Ghats of the Dom Community of Varanasi-Rajesh Sharma

The Dom community are **Anti Shudras as per the social strata** of Hindu Caste System , which include **Untouchables who work as sewer cleaners, corpse burner, and leatherworkers**. The Dom are always excluded from our society because of their profession and culture. The Varanasi state of Uttar Pradesh ***Dom community performs an essential task of cremation of Hindus at Manikarnika and Harishchandra Ghat.*** *They are known as the caretaker of the cremation ground in Varanasi and descended of Dom Raja (Parry, 1994).* ***Hindu people believed that the dead man would attain moksha only when the Dom or Dom raja lights the pyres, and rituals are considered to be complete only after this*** *(Eck, 1983).* They are classified as untouchables while being given the sacred responsibility of performing a Hindu's dying rituals.

"The Doms, a scheduled caste of Varanasi pyre-burners, are accustomed to the foul smoke that permeates the air and the ashes that float around with the pyres burning all year long". (Kaushik, 1976)

About 250-300 of them reside around the ghats of Varanasi, cut off from the rest of the city. ***The Dom is among the Dalits' lowest cast members, at the bottom of the Hindu caste system, some work as farmers or weavers, but the majority make they are living in the death industry*** (Rajesh Krishna , 2015)

Figure 15 Nandan Chaudhary (Dom Community)on MAnikarni Ghat

Source: Author

2.7 Waste, A part of Living

2.7.1 Introduction

Amita Sinha 2016, 'Ghats and its waste Management' asserts about **the waste generated from the ritual offerings on the ghats**. A visitor to Varanasi in India inevitably finds her way to the famous ghats (steps and landings) of this holy city where historic palaces, temples, and small shrines sit stop steps and landings along the eleven kilometers stretch on the Ganga **River (Figure 2.3.1.1)**. The ghats are a lively scene with devotees engaged in (sinha, 2016)worship rituals, burning cremation pyres, tourists promenading, small shops and vendors selling food and knick-knacks and people sitting on the steps watching others, among many other activities. The ghats are intensively used for **functions of everyday life such as washing clothes and buffaloes, transporting goods, pumping water and discharge of sullage, that leave their residue in the river**.

.The Ganga **shoreline is littered with sacra and ephemera of ritual offerings, occasionally a human corpse or an animal carcass can be seen floating on the river**, animals eat rotting flowers, fruits, and vegetables, piles of cow dung litter the narrow streets of old Varanasi leading up to the ghats, and **shallow gutters carry dirty water into the Ganga**. (Amita Sinha , 2019) The Ganga in Varanasi**, far from nourishing life, is a source of water borne enteric disease for those who bathe in it and drink its waters.** Around 35 drains and sewers empty untreated wastewater and untreated sewage.The cremation of 32,00 corpseon the ghats every year results in immersion of ashes on a large scale in the Ganga .

Figure 16 Cond rum of Waste at Harshchandra Ghat

Source: Author

2.7.2 Dirt is matter out of place

The ghats clearly have a waste management problem that should deter pilgrims and locals from doing their rituals and engaging with the river. Rituals paying homage to the powers of the **Ganga would be in danger of losing their meaning as cultural beliefs are challenged by all too visible evidence of widespread environmental pollution**. (Eck, 2015) This ought to raise questions about the **Ganga being the ultimate symbol of purity**. Yet devotees throng the ghats for dawn and dusk worship, bathe in the river in thousands on auspicious occasions and pilgrims come from all over India and abroad to carry out rituals for their departed ancestors. **The two contrasting views, 'religious' and 'secular', of Ganga's capacity to self-cleanse and be pure, lead to a conundrum and weaken the political will to take remedial action. The dissonance between material and symbolic purity partially explains the tolerance of waste on the ghats**. To bridge the gap between the two forms of purity in the minds of the faithful, it is necessary to understand the Hindu concepts of purity and pollution.

“ The boundaries between purity and pollution, sacred and profane, waste and utility, appear to be blurred on the ghats.”- Mary Douglas’ (2002)

Figure 17 Nagar Nigam workers During Morning Shift

Source :Author

2.7.3 Waste Generation from ghats

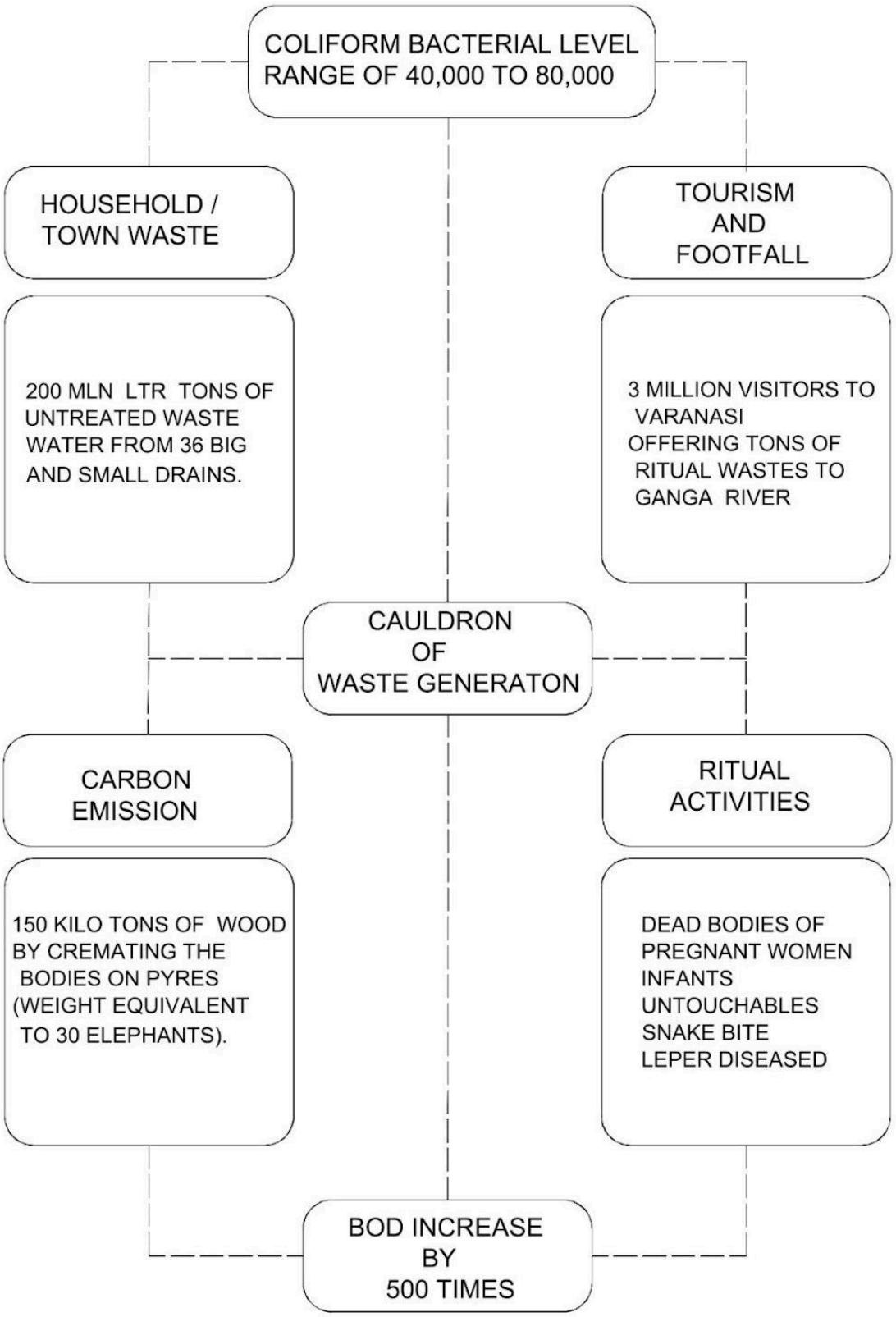

Figure 16: Waste Mapping Diagram of Ghats

Source-Author

2.7.4 Waste mapping activity

"If life feeds on wasting, and life is what we value, then wasting is wasteful when it fails to support life" (Lynch, K, 1990)

Changing perceptions mean that today waste is considered by many to be wasteful as it is polluting the Ganga in ways that exceeds the holy river's capacity to self-cleanse itself. Yet this modern view is not shared by all and mapping waste is a useful tool to disseminate the kind and extent of wastefulness at the ghats. In documenting the five most important ghats viz. **Assi, Manikarnika, Dashashwamedh, Panchganga, and Adi Keshav**, waste was found to be major contributor to local point source pollution in the Ganga. Waste was spatially **mapped by tracing its sources** and its extent and qualitatively categorized in visual taxonomies.**Ritual offerings** by pilgrims and local residents, **cow dung, kitchen waste** from local households and **wrappers, leaves and flowers**, were found to be strewn on the steps and landings. Non-biodegradable waste including **plastic bottles, detergents, and diesel oil** used in boats were found on the shoreline negatively impacting the river ecology. However not all waste is wasted. Boats are being repaired at various ghats; ***As*** (Chaturvedi, B, 2014) ***points out, waste is a public resource for the poor and need not be a problem in Indian cities because of the high recycling rate. Varanasi is no exception.*** Today as the ghats become more crowded with visitors and their activities, and the old city continues to struggle with sanitation issues, it appears that traditional local cultural practices that minimized wastefulness are dwindling and increasing responsibility is being placed on the dysfunctional state institutions to address the problem.

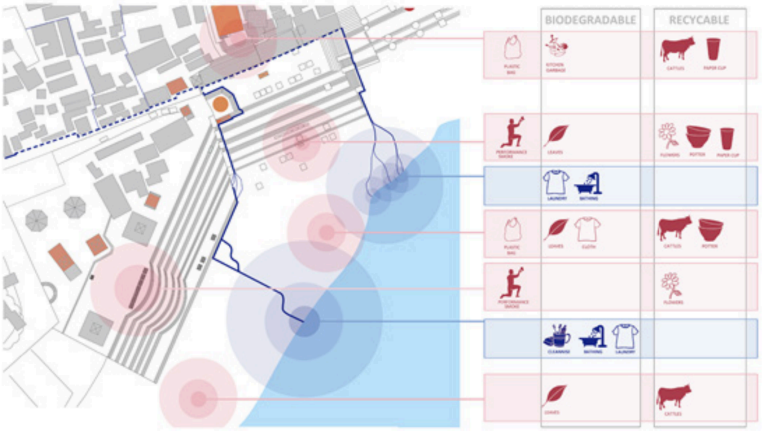

Figure 18 waste mapping activity on ghats

Source: Amita Sinha, Ghats and Its Waste management

2.8 Categorical waste generation data

Varanasi is one of the most famous cities for its riverfronts and religious and cultural activities carried on there in India. There are 86 riverfronts (ghats). This research work assessed the sources, composition, effects, management and disposal aspects of solid waste produced at nine selected most prominent riverfronts of Varanasi. **It has been seen that nine selected riverfronts generated 1880.7 kg waste per day in which flower waste was highest, that is 893.4 kg (47.5%) followed by plastic 499.4 kg (26.55%), paper 305.2 kg (16.22%), cloths 98.7 kg (5.24%) and glass 84 kg (4.46%) wastes.**

Whereas Manikarnika generated 6000 kg ash and Harishchandra 850 kg ash per day, respectively. **At 86 ghats, the number of shops, temples and dustbins is 158, 113 and 244, respectively. To clean 86 ghats, 600 workers work regularly from 6 AM to 10 PM and 20 supervisors supervise** them. Management potentials include the production of vermicomposting, composti ng, extraction of natural dyes, essential oils, biogas generation, incense sticks, rose water and handmade paper. Most of the waste is disposed of at the **Karsada** waste processing plant. (Vijay Krishna, 2021)

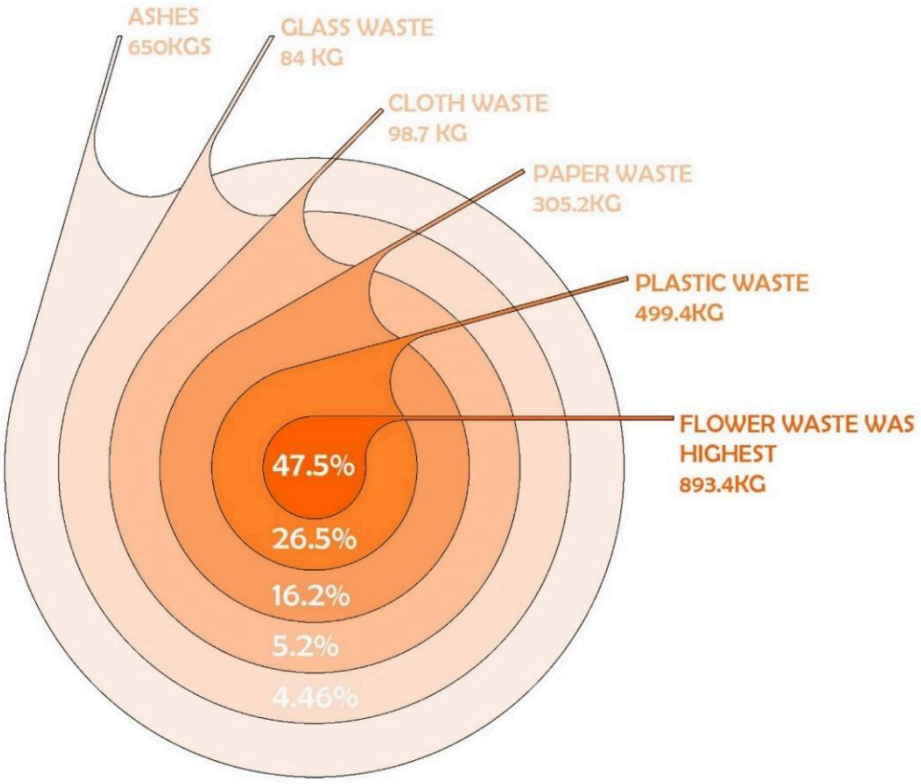

Figure 19 waste Mapping Diagram

Source: (Vijay Krishna, 2021) Infographic: Author

2.9 Role of rituals and culture in waste production \

2.9.1 Beliefs-a womb of dead bodies

Around 32 thousand cementation are done every year. 250 ton unburnt dead bodies are directly thrown into the river. Every year three thousand human and 6000 animal dead bodies are floated and decay in river. **Dead bodies are mostly thrown from Rajghat Bridge or from Vishwa Sundari Bridge**. These dead bodies thrown into the river of generate large amount of Nitrogen, Phosphorus and Potassium that is ultimately dissolved in the water of river. **Situation becomes dangerous when dead body of the persons or animals who suffered from HIV, Hepatitis, or brain disease thrown into the water**.

More than 200 kg. of woods are required for the complete burning of a single human dead body on the ghats. For this, the demand for woods particularly hardwoods are increasing at a steady rate every year, but the quantity of woods is not increasing in the same ratio. **According to an estimate 5-6 million trees are cut down every year which puts a huge pressure on the forest resources besides contributing to air pollution**. To stop the hardwood consumption, the district administration came out with another innovative way of burning dead bodies like gas-fired or electric in **Manikarnika ghat and Harishchandra ghat**. But they are dependent on unreliable sources of energy like electricity and gas and their regular supplies in the city's Ghats were not ensured by the administration. Hence, these methods could not contemplate the problem of wood cutting as most of the people prefer the traditional wood method of cremation instead of electric or gasfired one.

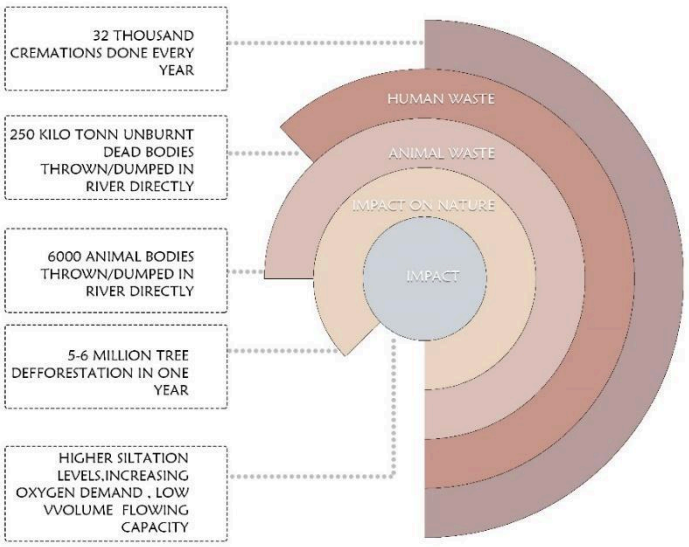

Figure 20 Waste Generatuon on Manikarnika Ghat

Source: Author

2.9.2 Vulnerability of river

Various rituals like **mundanis going on the ghats of Ganga from ancient time**. It refers to the shaving of boy's head, generally being performed between the ages of 1-3 years. The **hairs that obtained from the mundan are dumped into the river which affects the bacteriophage activity (capability to kill harmful bacteria) of the river**. It is one of the unique qualities of Ganga that makes it sacred and unique from other rivers. When human dead bodies are cremated on the ghats and at the end, only ash is left. Popular Hindu belief says that they have to flow ash into the river for the soul to rest in peace. According to one of the respondents, **tonnes of ashes are being dumped into the river every day. It increases the siltation level**, **clogs the flow of the river and reducing the volume carrying capacity.**

Apart from these, **the ashespromote turbidity of the river water which provides a breeding ground for unwanted things and promotes the growth of weeds in the river water**. On the eve of Maha Shivratri and Makar Sankranti devotees gather at Kedar ghat and Haudeshwarnath ghat for **mass bathing.** The mass bathing has several negative impacts on people and the river too**.**

Mass bathing increases AMR (anti-microbial resistance) which is the characteristics of microorganisms such as viruses, bacteria and parasites to resist antimicrobial from working against them. It is one of the main reasons that several antibiotics are not working properly against diseases like tuberculosis and so on. **It is also noted that drug-resistant bacteria are also contaminating the groundwater besides the river as these pathogens have entered into our ecosystem.** (Shahid Jamal , Aakash Upadhyay and Dr. Anjan Sen , 2021)

2.11 Tracing the life cycle of waste

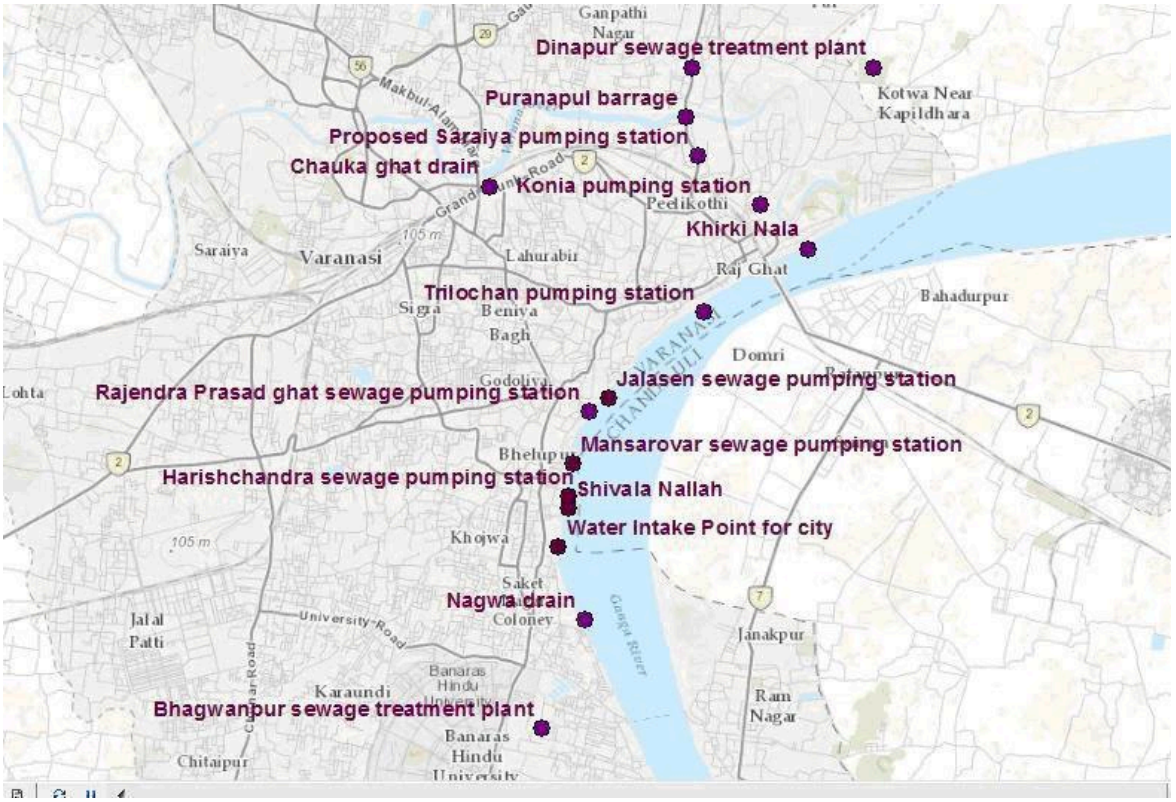

Figure 23 Dumpyards/ Pumping Stations in the precint of Varanasi Ghats

Source :Varanasi Nagar Nigam

Each ghat has cleaners,workers,jalvibhag task memebers assisting the waste generation and its management on the ghats. Waste generated within the vicinity of the ghat gets collected once in the morning shift and once in the evening shift and later that waste is carried to shivalay nallah /shivalay kachda ghar. Its an open waste dumyard for the waste coming fro ghats on this of the river**. Later people from nagar nigam collects the waste from this point and dump it to the kasadra,an open dumpyard somewhere around 20kms away from the city in the outskirsts. Here waste is either dumped in landfills or burnt.**

2.11.1 Identification of major waste dumping spots

From the article-Problems of the sustainable solid waste management, case study of varanasi town by Rajani Srivastawa and Vijay Krishna

(Professor at Lucknow University)

The solid waste management system in Varanasi is managed by Varanasi Municipal Corporation. Till recently, the waste management was being managed by A2Z Infrastructure Private Limited Company Kanpur Uttar Pradesh India. The concessionaire was responsible for door to door collection, transportation, treatment and disposal of solid waste from all wards. However, due to non-payment of past dues by Varanasi Municipal Corporation, the concessionaire has abandoned the project and now the contract has been terminated. Now Varanasi Municipal Corporation is making use of its own resources to collect and transport the solid waste from other parts of the city to the dumping site in addition to street sweeping. Door to door (D2D) collection facility has been withdrawn, due to termination of contract. **Waste is collected from secondary collection points by Varanasi Municipal Corporation and transported directly to dumping grounds**. It has also been found that generation of solid waste was 600 Tons per day (TPD) in 2013. While total waste collected is 480 Tons per day. **Waste collected is disposed of in a landfill site at 'Padav' along Ramnagar road.**. Total manpower available with Municipal Corporation could not manage 600 Tons every day. Most of the waste generated comprises biodegradable, compostable, and recyclable materials. This is due to **the high quantum of religious and vegetable waste** the city generates along with a high amount of plastic waste. Recyclable items include paper, plastics, polythene, glass, metal and other miscellaneous items. **The disposal site is located 20 km. away from the city in Karsada on a 40 acre site.** Currently, the site is not operational as it is still being developed and it is expected. Population growth and solid waste generation in the city has varying trend and correlation between population and solid waste generation of city is not cop with suitable manner. **The solid waste generation in 2041 is expected to be 1206 Tons per day**. This has been calculated for the projected population, with waste per capita increasing from 400 grams in 2013 to 420 grams in 2041. **City has so far adopted only open dumping method for the disposal of waste. Currently, the wastes are not treated in a systematic and scientific manner**.

3.0 EQUATION OF WASTE WITH RIVER

3.1 Fact File of NGCM (2022-2023)

The waste-related data for Varanasi and the river Ganga, from the document, primarily covers issues like drain pollution, solid waste management, and bioremediation activities. Key highlights include:

1. **Drains and Nallahs**: There are 102 untreated drains (nallahs) identified in Varanasi that directly flow into the Ganga, contributing to its pollution. These drains are mapped, and pollution checks are conducted regularly.
2. **Water Quality Monitoring**: Water samples are taken from four designated spots in Varanasi along the river Ganga, as well as from 13 sewage treatment plants (STPs) in the city to monitor pollution and treat wastewater.
3. **Bioremediation Efforts**: There are ongoing efforts to manufacture bio-floats and conduct bioremediation of nallahs (drains) that feed into the Ganga. Endemic species are being used to absorb heavy metals and clean up the water bodies around Varanasi.
4. **Solid Waste Management**: The Namami Gange program also prioritizes solid waste management for river rejuvenation efforts, focusing on preventing solid waste from entering the river and maintaining ecological balance.

This provides detailed statistics and data on water quality in the Ganga River in Varanasi for 2022-23. Key statistics for Varanasi include:

- **Biological Oxygen Demand (BOD)**:The BOD values in the Ganga River at 80 of 97 locations comply with the acceptable level of less than **3 mg/L**
- **Dissolved Oxygen** :DO levels in Varanasi, as well as throughout the entire river stretch monitored in 2022, meet the bathing water quality criteria of > 5 mg/L
- .**Faecal Coliform** :Fical coliform concentrations were above acceptable levels at multiple sites along the Ganga, with 52 of 93 locations found non-compliant. Varanasi's upstream location (Vishwa Sundari Bridge) meets the compliance levels .
- **Faecal Streptococci (FS)**:FS leanasi also show compliance, with 70 of 86 monitoring locations across the river being compliant .
- **pH**:The pH levels at all locations, inclusi, were compliant with the bathing standards (6.5–8.5), with **Varanasi recording a median of 7.3 .**

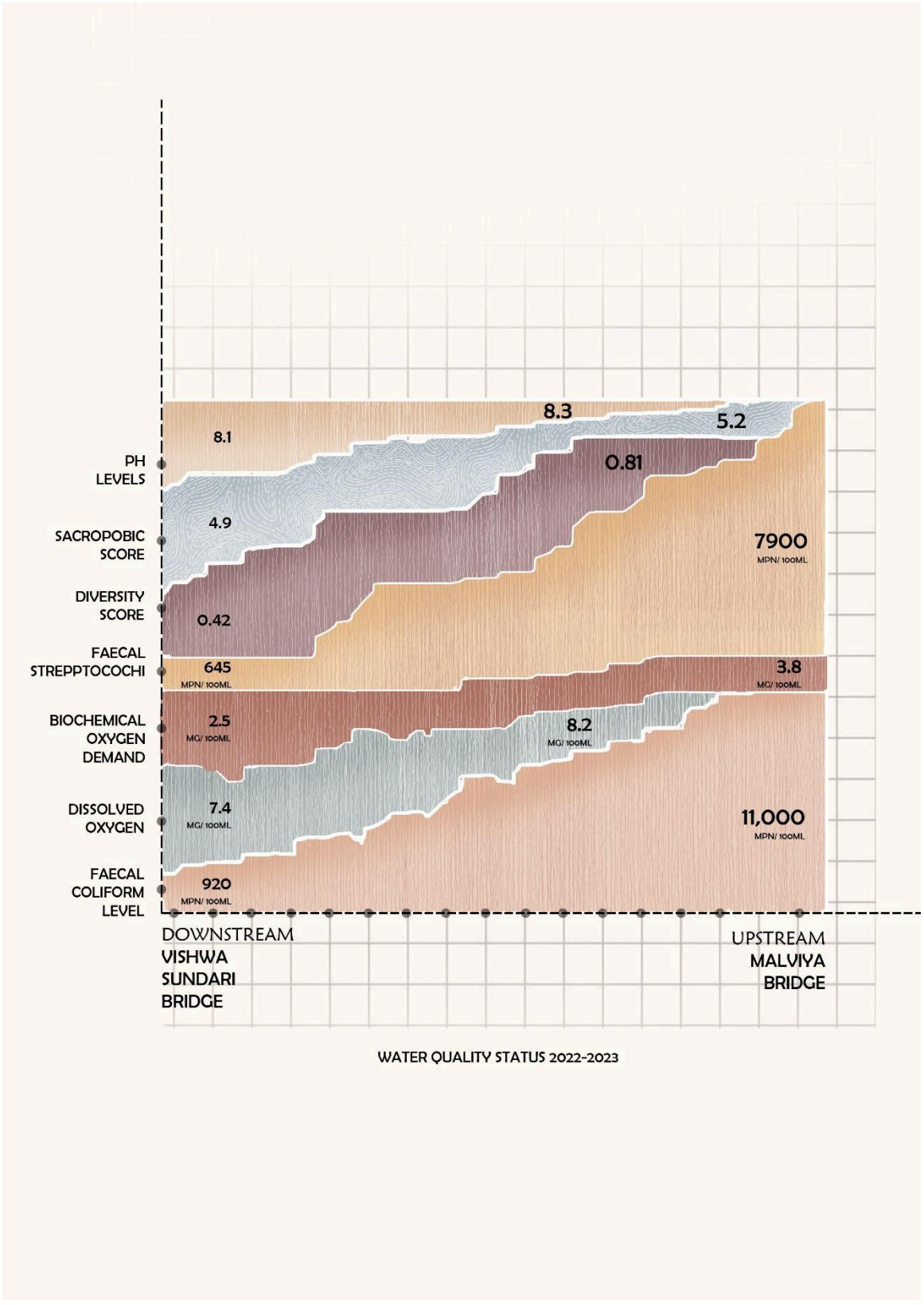

Figure 24 Water Quality Status ,Varanasi 2022-2023

Source: Author

3.2.2Annual report 2021-2022

This comparison shows that water quality at both Malviya Bridge and Vishwa Sundari Bridge generally meets the criteria for safe bathing, though local factors may influence occasional spikes in BOD and Fecal Coliform levels.

Water Quality Parameter	Malviya Bridge	Vishwa Sundari Bridge	Standard Values (Bathing Water Quality Criteria)
Dissolved Oxygen (DO)	≥ 5 mg/L (Compliant)	≥ 5 mg/L (Compliant)	≥ 5 mg/L
Biological Oxygen Demand (BOD)	≤ 3 mg/L (Compliant)	≤ 3 mg/L (Occasional Spikes)	≤ 3 mg/L
pH	6.5 - 8.5 (Compliant)	6.5 - 8.5 (Compliant)	6.5 - 8.5
Fecal Coliform	≤ 2500 MPN/100ml	≤ 2500 MPN/100ml	≤ 2500 MPN/100ml
Turbidity	Moderate	Moderate	--

Table 3 Comparative Analysis of different Water Quality Staus 2021-2022

Source: Namami Ganga Annual report 2022-2023

A. **DO and BOD** at both locations generally meet the required standards for bathing water quality, with occasional minor variations.

B. **pH** values remain within the acceptable range at both sites.

C. **Fecal Coliform** levels at both sites are within the permissible limits, indicating a moderate level of microbial contamination.

D. **Turbidity** (clarity of water) is moderate at both locations, but this parameter is not part of the standard bathing water quality criteria.

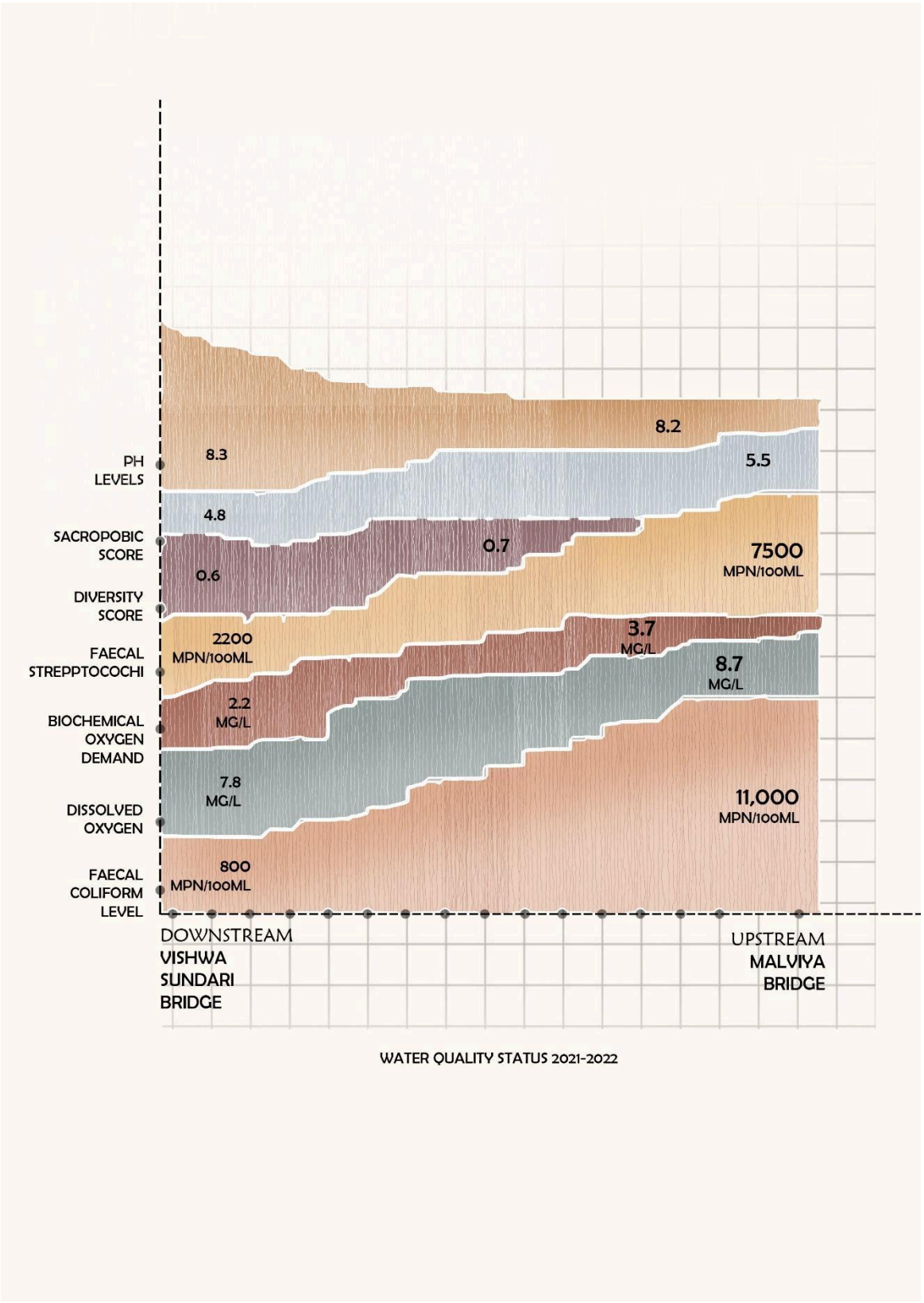

Figure 25 Water Quality Status, Varanasi 2021-2022

Source :Author

3.2.3 Annual report 2020-2021

This comparison shows that water quality at both Malviya Bridge and Vishwa Sundari Bridge generally meets the criteria for safe bathing, though local factors may influence occasional spikes in BOD and Fecal Coliform levels.

Parameter	Malviya Bridge	Vishwa Sundari Bridge	Water Quality Standard
Dissolved Oxygen (DO)	6.9 mg/L	6.7 mg/L	≥ 5 mg/L (for bathing)
Biological Oxygen Demand (BOD)	3.2 mg/L	3.6 mg/L	≤ 3 mg/L (for bathing)
pH	7.4	7.5	6.5 - 8.5 (ideal for aquatic life)
Total Coliform (TC)	4500 MPN/100ml	5000 MPN/100ml	≤ 5000 MPN/100ml
Fecal Coliform (FC)	2500 MPN/100ml	3000 MPN/100ml	≤ 2500 MPN/100ml

Table 4 *Source: Namami Ganga Annual report 2020-2021*

Source: Namami Ganga Annual Report 2020-2021

- **DO and BOD** at both locations generally meet the required standards for bathing water quality, with occasional minor variations.
- **pH** values remain within the acceptable range at both sites.
- **Fecal Coliform** levels at both sites are within the permissible limits, indicating a moderate level of microbial contamination.
- **Turbidity** (clarity of water) is moderate at both locations, but this parameter is not part of the standard bathing water quality criteria.

This comparison outlines the status of the main water quality parameters at the two bridges in Varanasi. Both locations show slight exceedances in BOD and coliform counts above the desired levels for safe bathing water quality, indicating potential pollution concerns.

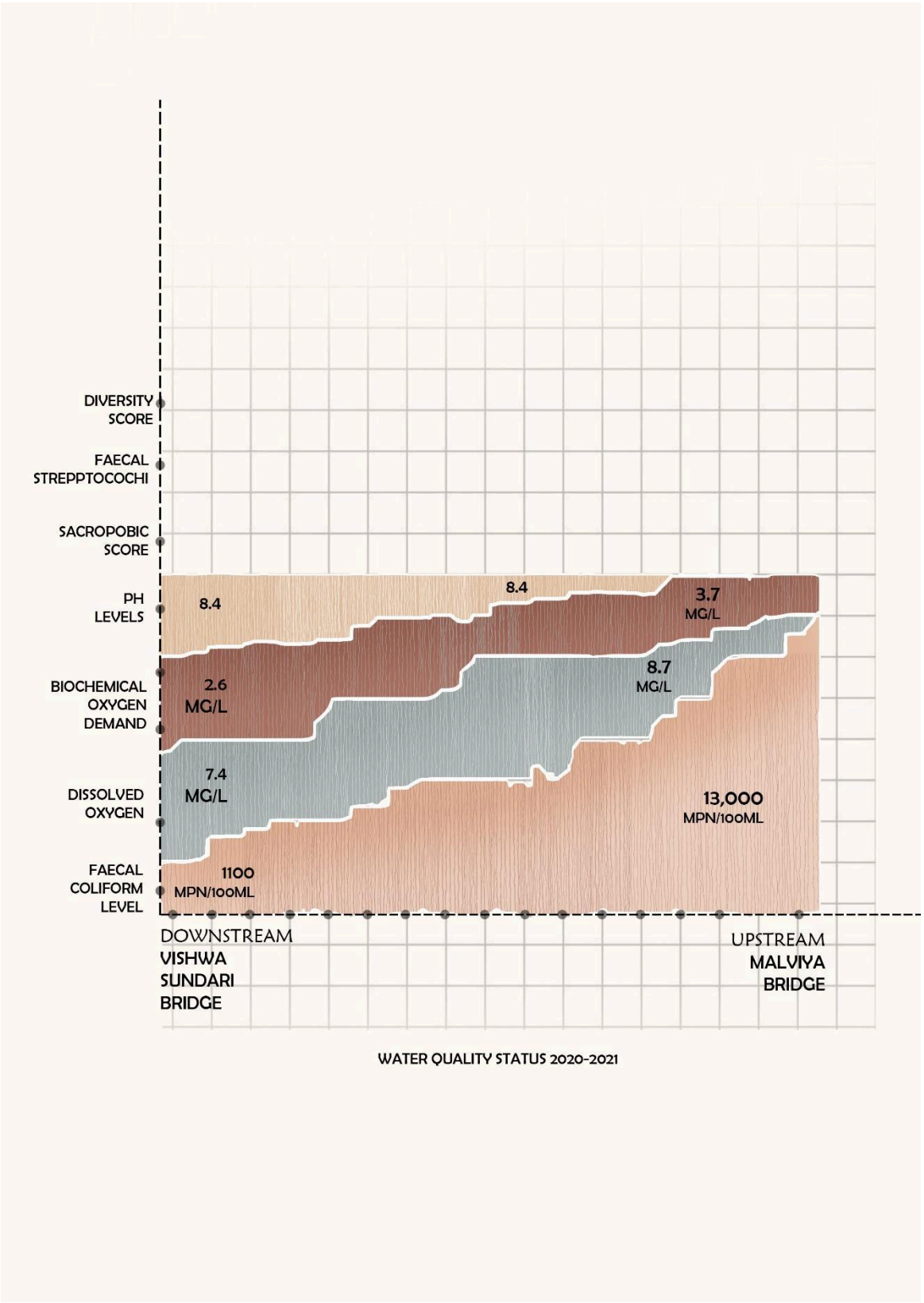

Figure 26 Water Quality Status Varanasi , 2020-2021

Source: Author

3.2.4 Annual report 2020-2019:

This comparison shows that water quality at both Malviya Bridge and Vishwa Sundari Bridge generally meets the criteria for safe bathing, though local factors may influence occasional spikes in BOD and Fecal Coliform levels

A. **DO and BOD** at both locations generally meet the required standards for bathing water quality, with occasional minor variations.
B. **pH** values remain within the acceptable range at both sites.
C. **Fecal Coliform** levels at both sites are within the permissible limits, indicating a moderate level of microbial contamination.
D. **Turbidity** (clarity of water) is moderate at both locations, but this parameter is not part of the standard bathing water quality criteria.

Parameter	Malviya Bridge	Vishwa Sundari Bridge	Standard Limit
Dissolved Oxygen (DO)	7.5 mg/L	7.2 mg/L	≥ 5 mg/L
Biological Oxygen Demand (BOD)	2.5 mg/L	3.0 mg/L	≤ 3 mg/L
pH	7.8	7.6	6.5 – 8.5
Chemical Oxygen Demand (COD)	18 mg/L	22 mg/L	≤ 25 mg/L
Ammoniacal Nitrogen (NH4-N)	0.5 mg/L	0.6 mg/L	≤ 1 mg/L
Fecal Coliform (FC)	1800 MPN/100ml	2200 MPN/100ml	≤ 2500 MPN/100ml

Table 5 *Source: Namami Ganga Annual report 2019-2001*

Source: Namami Ganga Annual Report 2019-2020

This comparison illustrates that both locations generally meet the water quality standards for DO, BOD, and pH, but slight variances can be noted, especially in COD and Fecal Coliform, **with Vishwa Sundari Bridge slightly more polluted**.This comparison outlines the status of the **main water quality parameters at the two bridges in Varanasi**. Both locations show slight exceedances in BOD and coliform counts above the desired levels for safe bathing water quality, indicating potential pollution concerns.

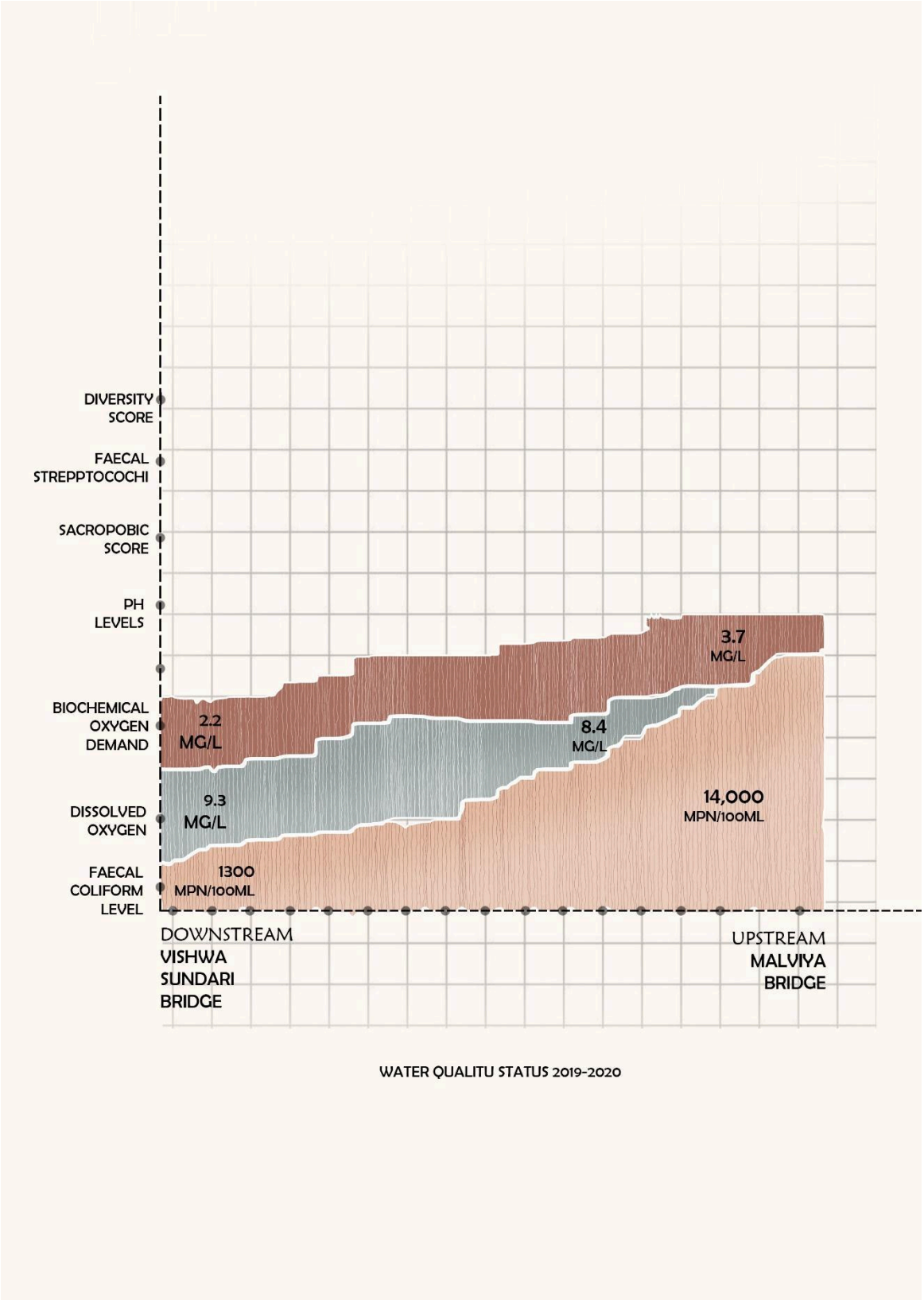

Figure 27 Water Quality Status, Varanasi, 2019-2020

Source: Author

3.6 Interpretation of waste generation and scope of opportunities

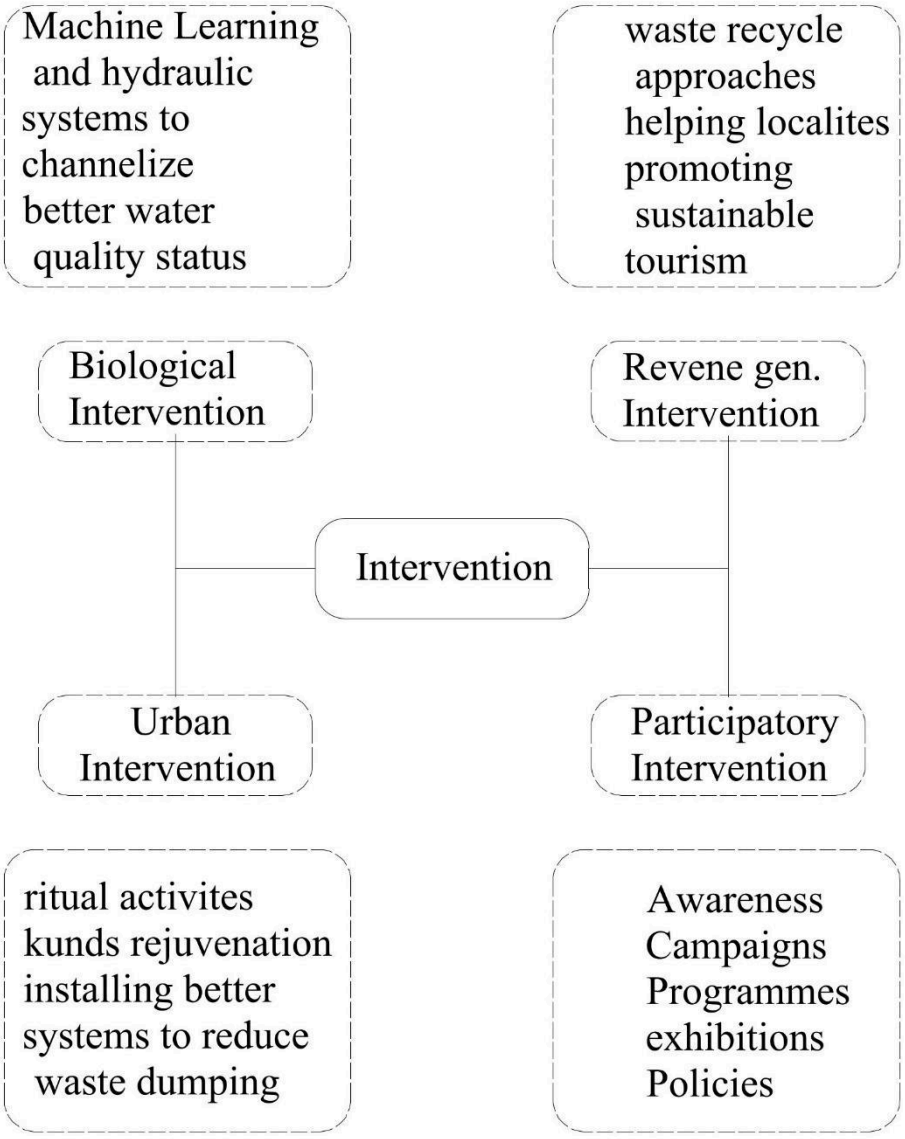

Figure 33 Scope of Opportunities from interepretation of waste generation in Varanasi

Source: Author

4.0 DATA COLLECTION AND ANALYSIS

4.1 Assi Ghat

Figure 34 Morning aarti (Subah e Banaras) Assi Ghat

Source: Author

The morning aarti is called Subah-E-Banaras and is considered the ideal way to begin a morning in Varanasi. **This was an initiative by the State Government of Uttar Pradesh that began in 2014**.It begins with Vedic verses and is followed by the Ganga aarti. **A tribute is also paid during the aarti to the four basic elements that comprise everything in this universe: earth, water, sky, and fire.**

The history of Assi Ghat goes back thousands of years. **There is a mythical tale that describes how the river Assi originated**. **It is believed that while the goddess Durga was fighting the demon Shumbha and Nishumbha**, her sword struck the ground when she destroyed them, resulting in the formation of a stream, today known as the river Assi. **After achieving victory over the demons Shumbha and Nishumbha, Durga went to rest at Durga Kund, which is located in close proximity to Assi Ghat. As a result of the ghat's location on this bank of the Ganges, which is where the Assi River meets up with the Ganges, it was given the name the Assi Ghat.**

4.1.1 Ghat Activities

Figure 35 symbolic offerings by devotees

Source: Author

Worshipping ganga with flower and an earthen pot has been a symbolic ritual to devote Maa Ganga with utmost repect. Millions of people come every year to offer their devotion and wash their sins by taking a dip in river Ganga .On this visit to Assi ghat,Varanasi, Inspite of the flood/over water flow, several devotees worshipped Maa Ganga with the symbolic offerings.

Few people were seen offering flowers with an earthen lamp to River either by praying with hymns directly into the river or else kept on the Steps/Ghats. On this observatory trip various perceptions were observed and learnt by interviewing multiple people regarding rituals and faith in general as a devotion to Ganga.

Rituals are subjective to each Individual and hence the questionarrie was made to decode the general perception of any layman with the offerings they offer and the larger impact which most of the Laymen are unaware of.

Ganga has always been an Emotion to many, no rules or policies can Intervene the faith of any individual. More than the plastic**, quatum of waste regarding rituals was observed along with bodies and ashes thrown in the river at every time of the day.**

4.1.2 Assi Ghat waste mapping

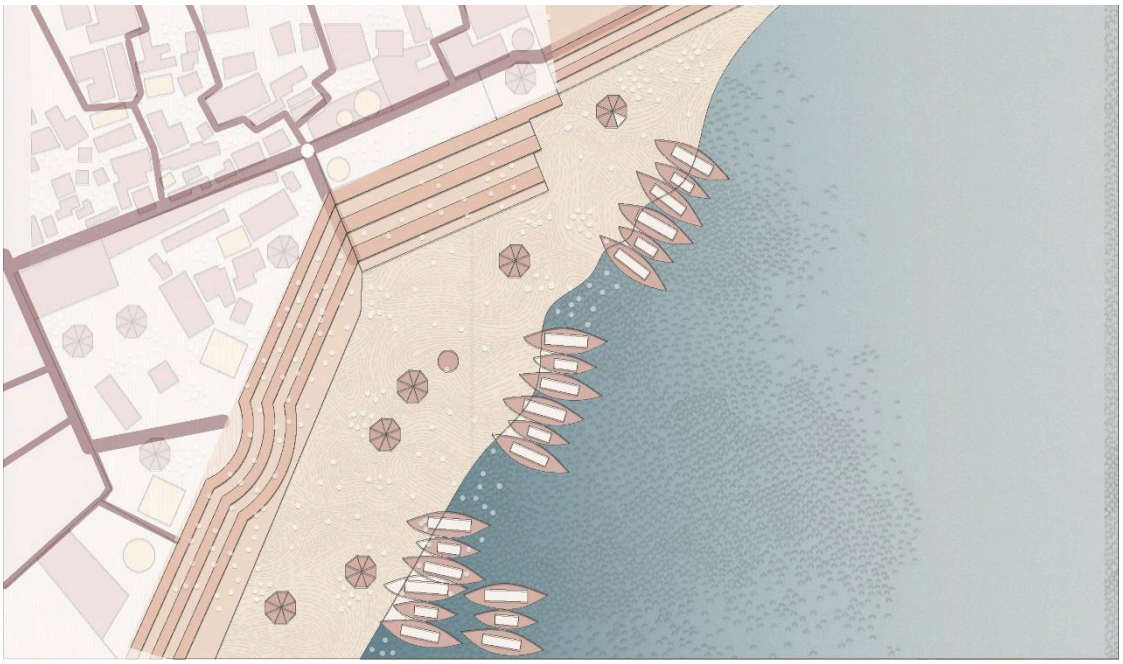

Figure 36 Abstract map of assi ghat

Source: Author

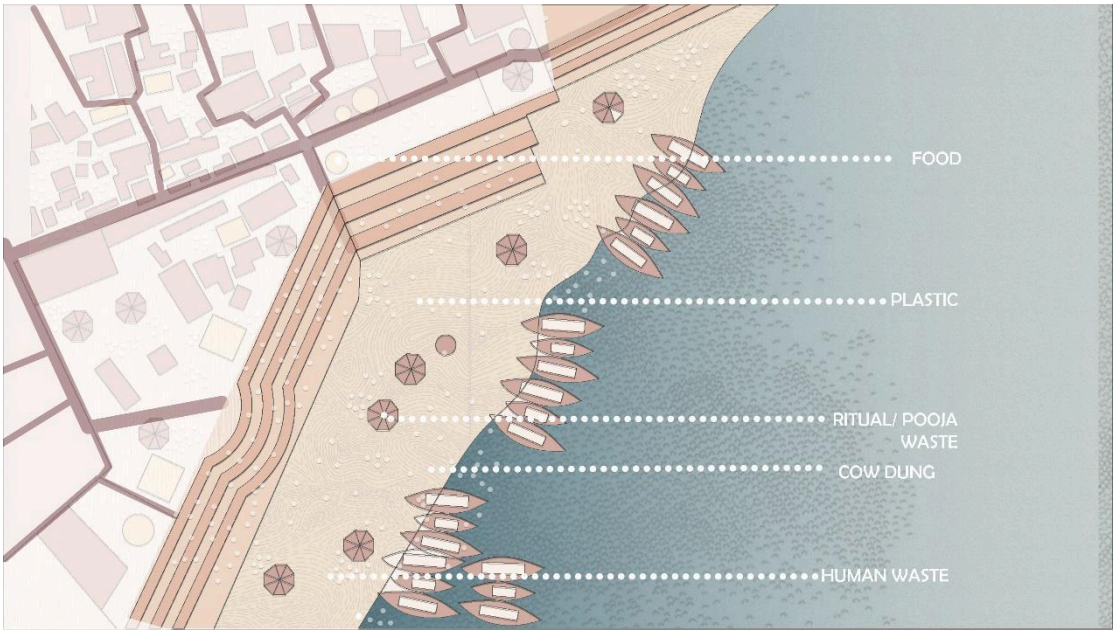

Figure 37 abstract map of assi ghat

Source: Author

4.1.4 Key Findings

- 4 times a day a boat comes to remove or take away the waste flowing in river Ganga.
- 2 batches of 6 am to 2 pm and 2 pm to 10 pm are allotted at each ghat with avg 6-8 cleaners.
- This cleaners collects the waste present on steps and later gather it one point and then 2 times a day Their vehicle comes to pick the waste and later throw it at nearby waste hours.
- Nearer Kachdaghr that is Shivalay taka.
- Later, next morning Their vehicle comes and dump these waste to Kasariya, a 20km for dumping site from the city.

4.2 Dashashwamedh Ghat

Figure 50 Vendor Seller on Dashashwamedh ghat

Source: Author

Dashashwamed Ghat is a ghat on the Ganges River in Varanasi, Uttar Pradesh, India. There are many stories about the ghat's history.

According to Hindu mythology, Brahma created the ghat to welcome Shiva after he defeated Tripurasura, a demon. Brahma performed a yagna (sacrificial ceremony) where ten horses were sacrificed, which is how the ghat got its name. The current structure of the ghat was built in 1748 by Peshwa Balaji Baji Rao. In 1774, Ahilyabai Holkar, the Queen of Indore, rebuilt the ghat. The ghat has been a hub of religious and cultural activity for centuries, and has witnessed the rise and fall of many dynasties and rulers. It's also mentioned in the Matsya Purana as one of the five major pilgrimages of Kashi.

4.2.1 Ghat activties

The most vibrant ghat of all ghats is Dashwamedh Ghat.A series of pale pink building leads to the narrow streets of ghat that later opens to the hustle and bustle of people coming and going across the ghat.the shown images belowe= are from the Monday evening before and after the aarti time.

Figure 51 *Various Activites seen druing the MAhaarti time in the evening*

Source: Author

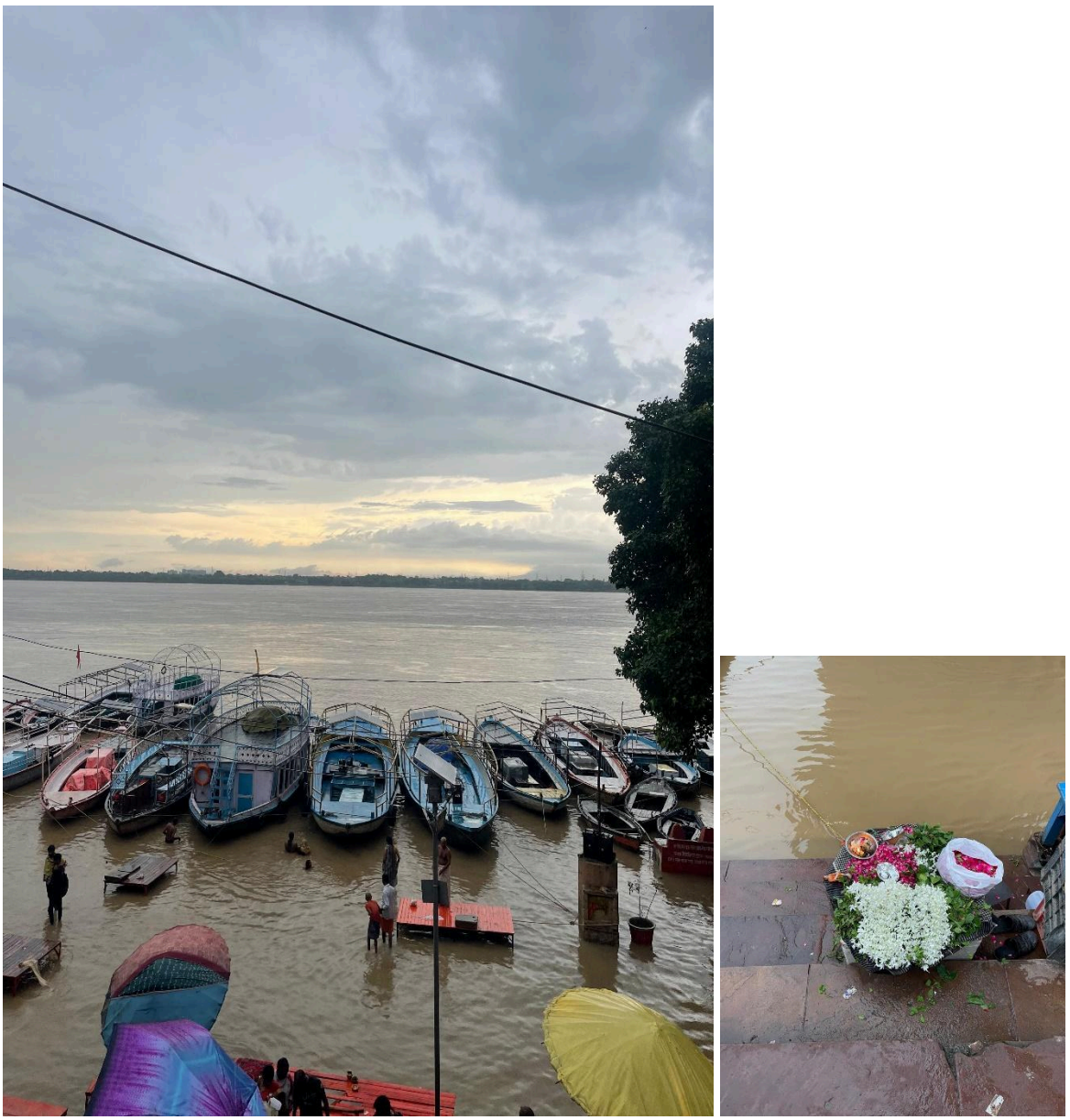

Figure 52.*Various Activites seen druing the mahaarti time in the evening*

Source: Author

4.2.2 Dasashwamedh Ghat Waste Mapping

Figure 53*: abstract map of Dashashwamedh ghat*

Source: Author

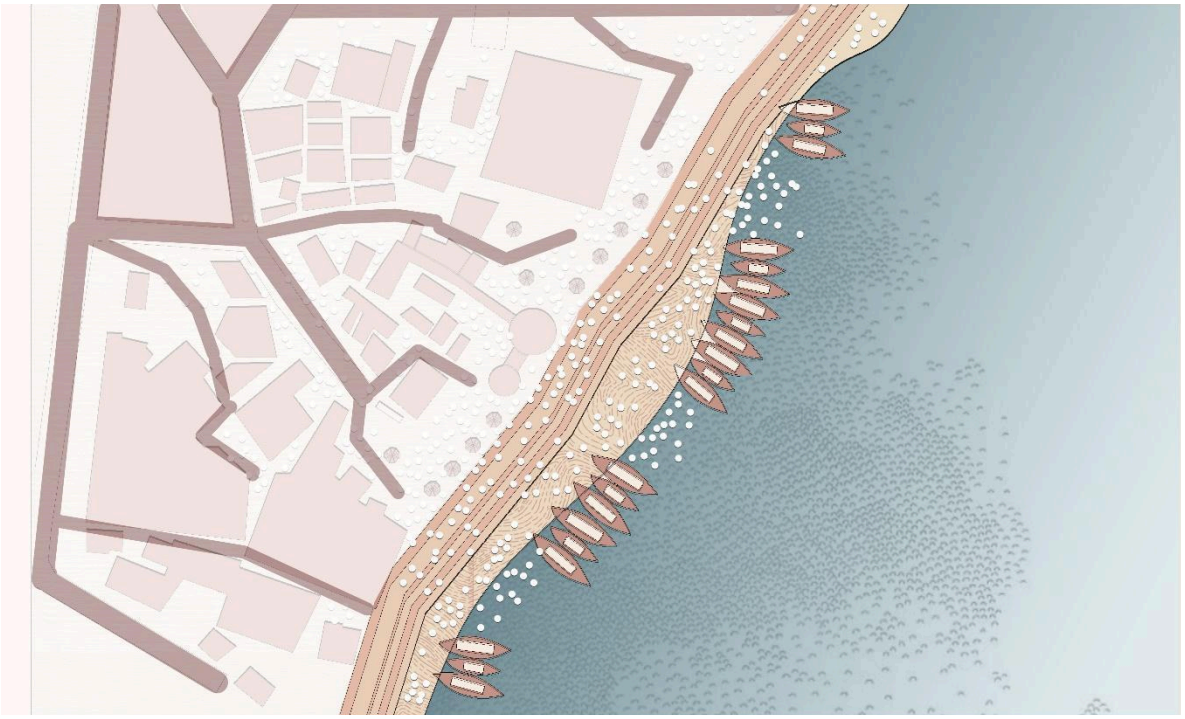

Figure 54 *pedestrian way to the ghat*

Source: Author

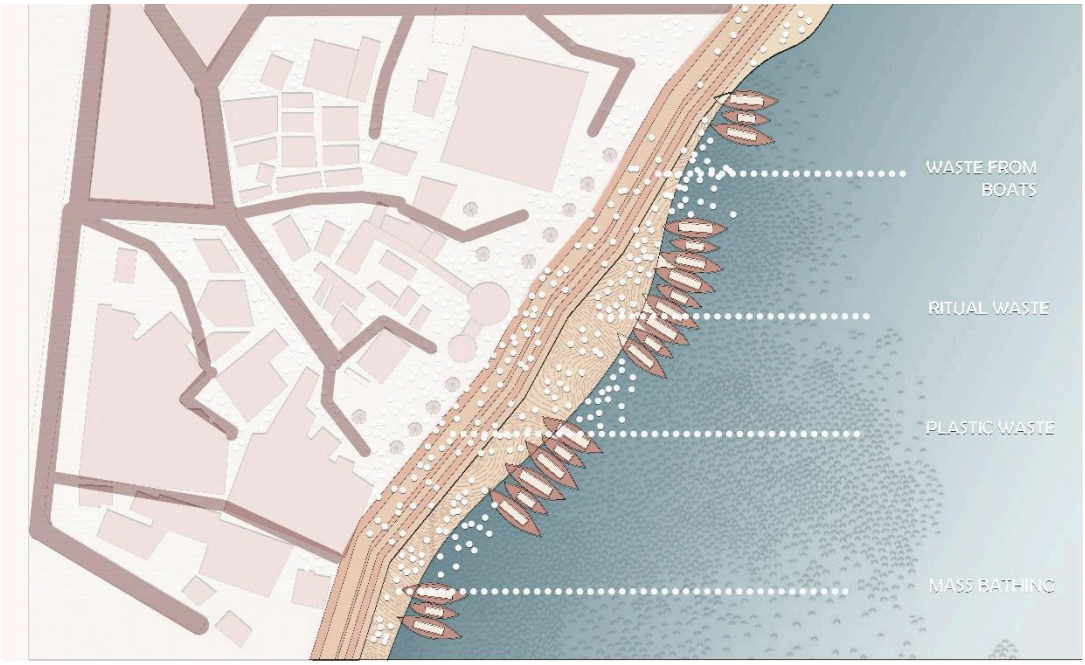

Figure 55*: waste mapping*

Source: Author

4.2.5 Waste mapping from ghat to dumping yard

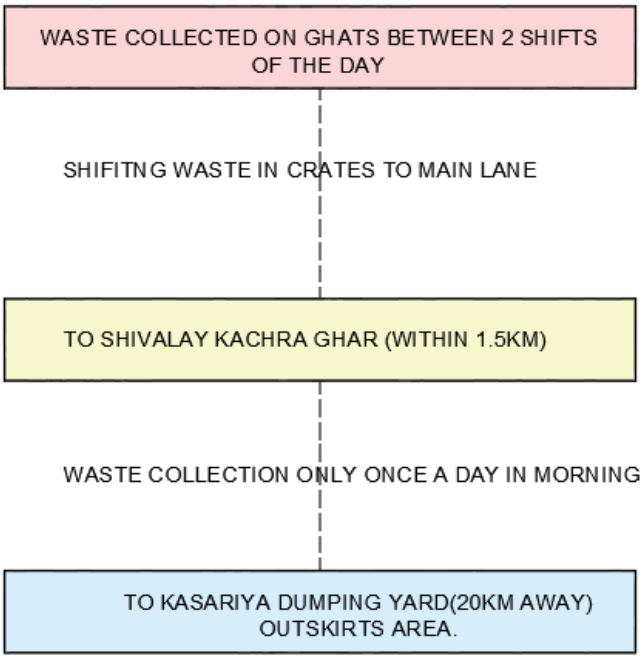

Figure 68 *Waste mapping diagram*

Source: Author

4.3 Manikarnika Ghat

Figure 69 *The Burning Ghat*

Source: Author

On an average, 120- 250 bodies comes for the cremations. Bodies arrive from far cities places, remote villages in patna jarkhand,marastra and locals. For a body to burn, one must require 200kg of wood that is 5 mun. if the weight of body is above 50 kg then 7 mun which is 280 kg of wodd is required.

The price for 1 mun is 500-600 rupees based on rates which we ourchase from, this wood comes from near by forests and from Madhya Pradesh. Kafan Kapda with sandalwood powder is also required. **Price for this cloth varies from 60 too 300 rupees. White cotton is for 300 while chanderi is for 60-80 rupees.**

Even today, people who died from snake poison, pregnant women infants and people with leprosy are dumped directly into Ganga. Considering this bodies as already got salvation. In a nutshell if we consider **200 bodies getting burned daily, 4000kg of wood is getting burned on this ghat 24x7. more shocking facts are, a piece of flesh or bone remaining on the last minutes is taken and thrown into the river directly considering ganga will wash all of his/her sins**.

4.3.1Manikarnika Ghat Activities

Figure 70 *1washing its sins before cremating the body*

Source: Author

Figure 71 *dom community man burning the body*

Source: Author

Figure 72 *Dom community man shaving head of a man*

Source: Author

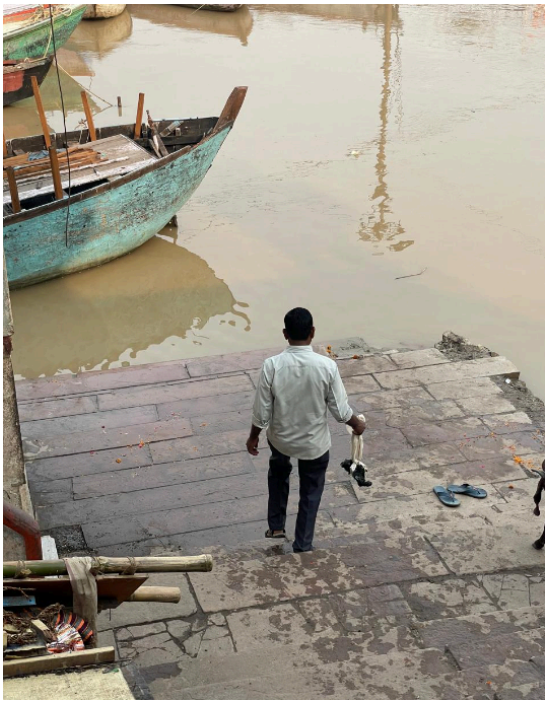

Figure 73 *a man throwing flesh bone of a dead body in ganga river*

Source: Author

Figure 74 *dead body with infection of leprosy is dumped directly in river*

Source: Author

4.3.2Manikarnika Ghat Waste Mapping

Figure 75*: abstract map of Manikarnika Ghat*

Source: Author

Figure 76 *Pedestrian way on MAnikarnika Ghat*

Source: Author

Figure 77 *Pedestrian way on MAnikarnika Ghat*

Source: Author

5.1 Synopsis of field Observations

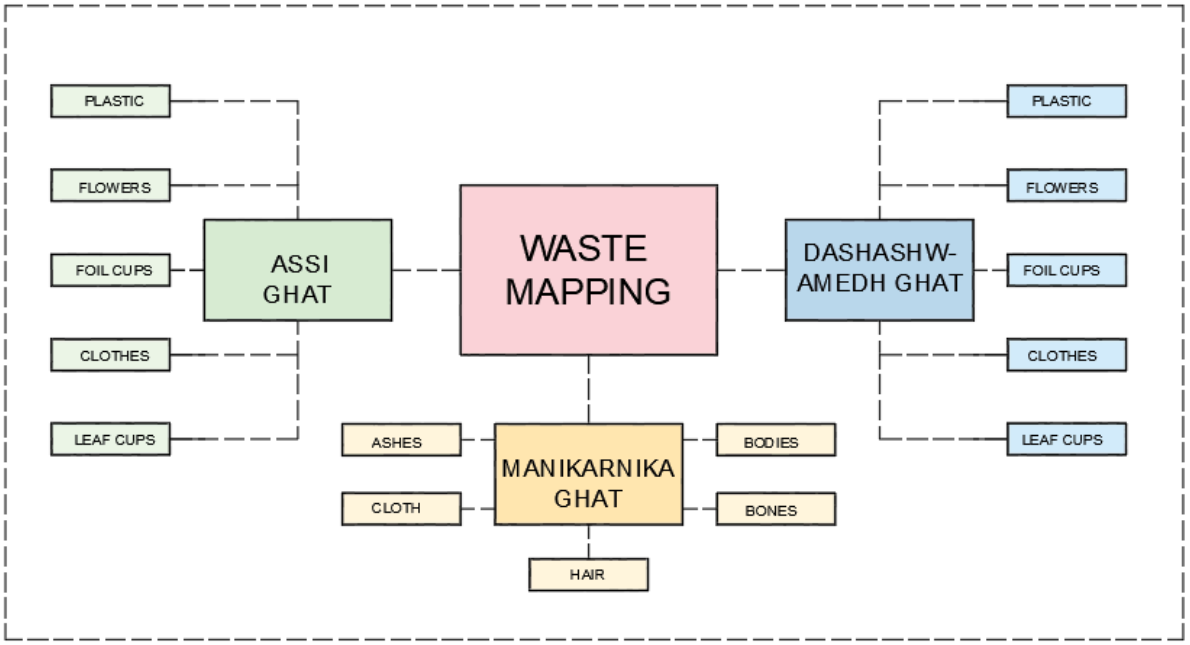

Figure 78 Types of waste on three Ghats

The **Ganga River** holds immense spiritual, cultural, and religious significance in India, particularly in Hinduism, and is often associated with various rituals, prayers, and ceremonies, commonly known as **Pooja**. Considering the time frame and the Academia requirement.,area of interest limits to only three major ghats,those are assi ghat,Manikarnikaghat or burning ghat and Dashashwamedh Ghat.The Ganga is regarded as the most sacred river in India and is deeply intertwined with the spiritual life of millions of people. **This sacred bond of Human and River has its own multi dimensional impacts which needs urgent attention**.The foremost step Begins with the mapping out the waste generating on the ghats.More than the plastic,waste of aluminium foils,flowers and other degradable waste was observed. Each ghat has its own sacred influence with their own mythological stories that are deeply entangled with the stands of human civilization.

Floral waste, collected from the spiritual sites mostly biodegradable, often ends up in landfills or water bodies, causing health hazards and harming aquatic life. **According to a UN Climate Change report, the river Ganga alone absorbs over 8 million MT of flower waste annually.**

7.0 CASE STUDIES

7.1 Fecal Coliforms

Fecal coliforms are thermotolerant bacteria that are indicators of fecal pollution and pathogenic factors in water bodies (Jayakody et al., 2015**). These bacteria are excreted from the intestines of humans and warm-blooded animals into soil and water** (Cabral, 2010). **It contaminates water bodies through runoff from contaminated soi**l (Molina et al., 2014) and resuspension of fecal-contaminated sediments (Pachepsky and Shelton, 2011). Fecal contamination of water remains a significant public health issue, prompting the need for rapid development of swift and dependable methods to detect contamination and safeguard against human exposure (Holcomb and Stewart, 2020). However, extreme weather events such as heavy rainfall and floodings exacerbate the risk of contamination by increasing runoff which make even more critical to develop and implement estimation model. Fecal coliform contamination in rivers presents serious health risks, particularly during the summer months when recreational activities such as water skiing and swimming are prevalent. **Direct contact with or ingestion of contaminated water can lead to waterborne diseases, including diarrhea, typhoid, cholera, and dysentery** (al., 2021)Given the significant public health risks associated with fecal coliform contamination, it is essential to implement strict regulatory standards to mitigate these dangers (Suh, 2024)**.**

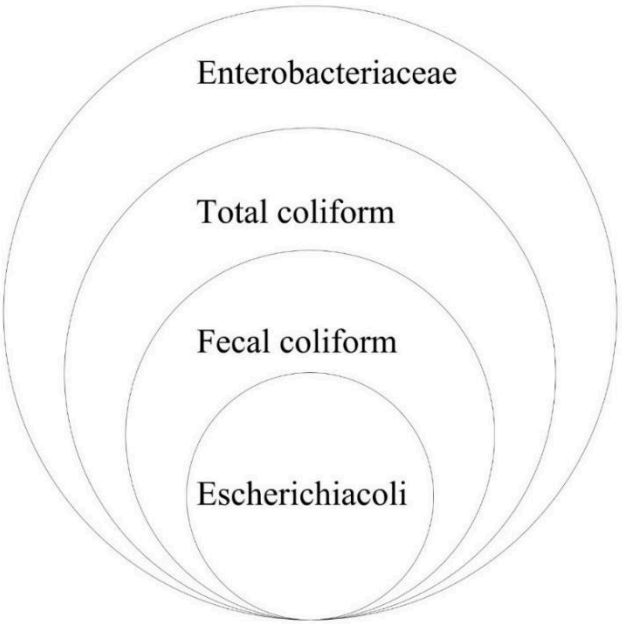

Figure 79 Hierarchy of coliforms

10 Way Forward

Sustainable Approach to ritual Activities :

One body requireds approx. 200-280kg og wood.Everyday nearly 200 bodies are getting cremated on the ghat which would require about 4000kg of wood. Annually 55-6 million tons of wood is getting deforested for one ritual act.

Along with this, 3-4 million tons of flower is getting waste in the town.! Ton of waste can produce upto 400-600 kWatt of electricity by the process of Incarnation.

If a Setup of converting floral waste into electricity and then later uses it for electric cremation, a sustainable approach would be seen without disturbing or interfering the rituals of people.

Wastewater Treatment Expansion: A critical focus has been on increasing wastewater treatment capacity, especially in heavily industrialized areas. In the Pearl River Delta, for instance, wastewater treatment facilities were built to treat both domestic and industrial effluents, which had previously been discharged untreated into rivers. These facilities treat pollutants before they enter the waterways, helping to improve water quality and reduce pollution.

Ecological Restoration Projects: For example, China has used ecological engineering, such as the construction of **artificial wetlands**. These wetlands filter out pollutants and provide habitats for local wildlife, which helps to restore the ecosystem. An example of this is the Baima Canal project in Fuzhou, where artificial wetlands transformed a heavily polluted waterway into a clean, healthy river system.

Plastic Waste Capture Systems: Projects like **River Cleaning Systems** involve the use of floating devices that intercept plastic waste in rivers. These systems are scalable and environmentally friendly, using the river's current to collect waste without requiring external energy sources. The waste is then transported to storage areas for recycling.

Wastewater Treatment Expansion: A critical focus has been on increasing wastewater treatment capacity, especially in heavily industrialized areas. In the Pearl River Delta, for instance, wastewater treatment facilities were built to treat both domestic and industrial effluents, which had previously been discharged untreated into rivers. These facilities treat pollutants before they enter the waterways, helping to improve water quality and reduce pollution.

Urban Redevelopment and Resettlement

Resettling Riverbank Communities: Informal settlements along the riverbanks, including slums and squatters, were resettled into organized housing with proper sanitation facilities. This reduced the indiscriminate dumping of waste into rivers.Hawkers and street vendors were relocated to **hawker centers** equipped with proper waste management systems.

Urban Redevelopment: The areas surrounding the rivers were revitalized, creating parks, promenades, and recreational spaces that both beautified the riverbanks and reduced the likelihood of further pollution.

Other Innovative Solutions to Waste Reduction, Recycling, and Treatment:

- . **Waste Reduction:** Innovative waste reduction strategies include product redesign, packaging efficiency, and the promotion of circular economy ideas. Businesses are developing eco-friendly alternatives to single-use plastics, such as biodegradable packaging and reusable containers, to help reduce plastic pollution in rivers and oceans.
- **Recycling:** New recycling technologies, such as chemical recycling, closed-loop recycling systems, and upcycling, improve the efficiency and sustainability of recycling processes. These developments allow for the recovery of valuable materials from waste streams, reducing the requirement for virgin resources and lowering environmental pollution.
- **Waste Treatment** New waste treatment technologies, such as improved oxidation processes, membrane filtration, and electrochemical treatment methods, provide effective options for treating contaminated water
- and wastewater. These methods remove pollutants, pathogens, and microplastics from water bodies, thereby improving water quality and protecting river ecosystems.
- **The Role of Community Engagement and Public Awareness**
- Community engagement is essential for establishing sustainable river management techniques because it encourages stakeholder participation, raises awareness, and builds consensus around common environmental goals. Local communities, non-governmental organizations (NGOs), and grassroots organizations play critical roles in lobbying for river conservation, organizing cleanup operations, and carrying out restoration projects.

Individuals and communities are educated through public awareness campaigns on the value of rivers, the effects of pollution, and the benefits of adopting sustainable habits.,

11 Conclusions

The research on "Ghats and their Waste Management: Case of Pilgrimage City – Varanasi" provides critical insights into the intricate relationship between faith, culture, and environmental sustainability. The Ghats of Varanasi, a microcosm of India's spiritual identity and heritage, are profoundly intertwined with the cultural and religious practices of millions. However, the very practices that celebrate the sanctity of the river Ganga—ritual offerings, cremations, and ceremonial bathing—have become significant contributors to its pollution.

Varanasi generates approximately 650 metric tons of waste daily, with the Ghats accounting for a substantial share due to ritualistic activities. Organic offerings such as flowers, earthen lamps, and ashes, combined with non-biodegradable waste like plastics and untreated sewage, strain the river's ecosystem. This pollution manifests in declining water quality metrics, including elevated Biological Oxygen Demand (BOD), reduced Dissolved Oxygen (DO), and high levels of Fecal Coliform, posing risks to aquatic life and human health.

Despite government-led interventions like the Namami Ganga Mission, which focus on reducing pollution and enhancing waste management systems, the challenges remain daunting. Infrastructure limitations, inefficient waste disposal systems, and a lack of community awareness hinder the progress of these initiatives. For example, while efforts have been made to clean drains and manage solid waste, untreated sewage from over 100 drains continues to flow into the river, exacerbating its vulnerability.

The research identifies several potential strategies to address these challenges. Converting floral waste into eco-friendly products like compost, biofuels, and incense sticks presents a dual opportunity to reduce pollution while creating economic benefits for local communities. Similarly, encouraging alternatives to wood-based cremation, such as electric or gas crematoria, can conserve natural resources and lower emissions. However, the success of such interventions depends on community participation and a shift in cultural attitudes toward sustainable practices.

The study also emphasizes the need for a deeper integration of traditional wisdom with modern ecological principles. Rituals and cultural expressions at the Ghats must adapt to contemporary environmental realities, balancing spiritual devotion with ecological responsibility. This involves fostering public awareness campaigns, promoting community-led clean-up drives, and equipping local authorities with the necessary resources to implement sustainable waste management practices effectively.

12 Citation

Chaturvedi, B. (2014). *A Waste of Wealth: How Indian Cities are Ignoring the Recyclers but Asking for Recyclin.* Environmental Justic.

M. S. Waghmode1 • A. B. Gunjal2 • N. N. Nawani3 • N. N. Patil1. (2016). *Management of Floral Waste by Conversion to Value-Added.* Springer Science+Business Media Dordrecht 2016.

al., J. S. (2021). *https://www.sciencedirect.com/science/article/pii/S0043135413007239.*

Amita Sinha . (2019). Waste Management on the Varanasi Ghat. *LAndscape Journal* .

Chattarjee(Mukhopadhyay), A. (2021). Sacred Water and Cultures of Worship: .

Eck, D. (2015). Ganga: The Goddess Ganga in Hindu Sacred Geography. *An Anthology of Writings on the Ganga: Goddess and River in History,*.

Lynch, K. (1990). *Wasting Awa.*

Rai, P. K. (2018). *Problems of Sustainable Solid Waste Management in Urban Area: A Case Study of Varanasi City of India.* Varanasi : Europhean Graphical Justice .

Rajesh Krishna . (2015). Life at the Burning Ghats A Sociological Study of the Dom Community of Varanas. *Research gate* .

Ramakrishan, P. (2006). Sacredness and its Interconnectedness . *Sacred LAndscapes* .

Shahid Jamal , Aakash Upadhyay and Dr. Anjan Sen . (2021). Ganges, Pollution and Culture: An Assessment of Pollution on Ganga River in Banaras City, Uttar. *Indian Journal of Spatial Science*, 47.

Sinha, A. (2016). *Landscapes of India .*

Suh, S. (2024). *Improving fecal bacteria estimation using machine learning and explainable AI in four major rivers, South Korea.* SOUTH KOREA : Department of Environmental Engineering, Pusan National University, Busan 46241, Republic of Korea.

Vijay Krishna. (2021). waste generation figures . *Generation, Composition And Management Of Waste Generated Along The Riverfronts (Ghats) Of River Ganga In Varanasi City, India*.

13 Bibliography

ARTICLES

https://www.researchgate.net/figure/Solid-Waste-Generated-In-Developed-and-Developing-Countries_tbl1_263036923

https://www.sciencedirect.com/science/article/abs/pii/S0921344909002353

https://www.researchgate.net/publication/327418392_The_Performative_Landscape_of_Dashashwamedh_Ghat_Varanasi

https://lj.uwpress.org/content/37/2/65.short#sec-2

https://vastushala.in/illusionism-in-architecture/#:~:text=One%20of%20the%20major%20illusions,weren't%20angled%20at%20all

https://www.newyorker.com/magazine/2016/07/25/what-it-takes-to-clean-the-ganges

https://www.youtube.com/watch?v=yFnjYPgl3Ts&t=239s

https://www.youtube.com/watch?v=pH0fhLBr-Mg

https://www.youtube.com/watch?v=sDbPtcDD4co

https://nmcg.nic.in/Annual_Reports.aspx

SWM-plan-24th-march-2019.pdf

https://solve.mit.edu/challenges/resilient-ecosystems/solutions/50762

https://www.mdpi.com/2227-9717/9/11/2058

https://www.sciencedirect.com/science/article/pii/S0048969723005478

https://iwaponline.com/wpt/article/19/4/1099/100433/Assessing-the-water-quality-of-River-Ganga-in#3668495

https://www.youthkiawaaz.com/2019/09/ganga-pollution-open-drains/

https://www.indiatoday.in/india/story/ganga-river-water-unfit-for-drinking-bathing-1538183-2019-05-30

https://documents1.worldbank.org/curated/en/823241618991659221/pdf/India-Sustainable-Solid-Waste-Management-in-Mountain-Areas.pdf

https://pib.gov.in/Pressreleaseshare.aspx?PRID=1541298

https://www.e-ijep.co.in/41-9-1046-1053/

https://varanasi.nic.in/service/nagar-nigam-varanasi/

https://en.wikipedia.org/wiki/Varanasi_Municipal_Corporation

https://vdavns.com/gallery/ghats-of-varanasi

DOCUMENTARIES

https://www.youtube.com/watch?v=n_LwI2OQHh8

https://www.youtube.com/watch?v=JB7kfnDKPEw

https://www.youtube.com/watch?v=L-2MUmGTkDA

https://topdocumentaryfilms.com/varanasi-india-beyond/