ನಗರ ಪ್ರವಾಹ
Nagara pravaha

The Story of Waste Pickers' Resilience Amid Urban Flooding

ಹಾಸಿರು ದಳ
Hasiru Dala

Hasiru Mane
the housing initiative of Hasiru Dala

About Hasiru Dala

Hasiru Dala (meaning Green Force in Kannada) is a social impact organization that has worked with waste pickers and other waste workers for more than a decade in varied capacities to ensure a life with dignity. It works towards ensuring that its members receive continuous access to livelihood security and social protection measures provided by the state and other relevant institutions. Its interventions also include enhancing the educational opportunities for the children of waste pickers, focusing on access to public housing for waste pickers, both locals and migrants, and providing health benefits to the waste workers.

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About **Hasiru Mane**
A housing Initiative of Hasiru Dala

'Hasiru Mane' literally means a Green home. The housing vertical works towards supporting the waste pickers to realise their dream of a home in an affordable and sustainable way. Today Hasiru Mane works in the cities of Bengaluru, Mangaluru, Chikkaballapura, Mysuru, Chamarajanagar, Tumakuru, Davanagere, Hubli, Chitradurga and Dharwad.

The initiative operates on five main themes:

- *Access to Public Housing*
- *Reducing Ecological Footprint*
- *Facilitating the Construction and Repairs of DWCC,*
- *Climate Adaptation*
- *Action-based Research*

ACCESS TO PUBLIC HOUSING

REDUCING ECOLOGICAL FOOTPRINT

FACILITATING THE CONSTRUCTION AND REPAIRS OF DWCC

CLIMATE ADAPTATION

ACTION-BASED RESEARCH

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Acknowledgement

Foreword

Flooding or waterlogging in cities is often seen as a physical phenomenon. Increasing intensity of rainfall events, the building in low lying valleys and floodplains, the concretization of surface leading to increase in run-off, the inadequate design of road infrastructure which blocks storm runoff and non-existent or badly designed stormwater drains which fail to carry away flood waters quickly are all seen as causes of flooding.

However, at its core flooding is a socio-hydrological phenomena. It affects the poorest and most marginalized of urban society disproportionately higher. Waste pickers, migrants and people earning a living in the informal sector are impacted. Inadequate access to quality land and housing, the forced necessity to occupy vulnerable and marginal spaces in the city, inadequate infrastructure services such as drains, water supply, sanitation and solid waste management causes the water logging impacts to amplify manifold impacting lives, livelihood, health and economic burden of these people the most.

In the city of Bengaluru, with its three major valleys and its nature of human made lakes dotting the landscape, a waterscape of vulnerability emerges for many. Flooding becomes a generic but also a localized phenomenon with its causes, impacts and solutions becoming micro-localized. Both mitigation and adaptation then become a hyper local solution also depending on the socio-economic context of those impacted in that particular area.

While we have upped our understanding of urban weather and climate with more than a hundred automatic weather stations dotting the city landscape and providing minute-to-minute weather data, an app which also tracks rainfall, intensity and flooding locations real time, urban hydrology models with a better understanding of rainwater flows in major stormwater drains, we need to now focus on the social phenomena of floods and provide solutions to the challenges of the current and future vulnerable populations of our city. This will give the marginalized a fair and decent living and livelihood opportunity, improve quality of life for all citizens, and make the city just and economically vibrant.

The right to land, adequate and safe housing, and a well planned city is the states obligation to all of its citizens.

This study—with its granularity and detail—draws the attention of researchers, citizens and authorities to this section of society in various pockets and places in the city, most vulnerable and impacted by an almost annually recurring event. It provides the first step in understanding the impact of floods and a way forward to find solutions which are permanent.

It is a pleasure to commend this study as well as future studies that should occur to find those permanent solutions for a burden that society can least afford.

Vishwanath Srikantaiah
Director and Co-founder of Biome Environmental Solutions

Preface

Urban flooding, driven by rapid urbanization and exacerbated by the increasingly erratic impacts of climate change, poses a critical challenge for cities worldwide. In Bengaluru, this issue is particularly acute for informal settlements, where inadequate housing, poor infrastructure, and limited access to essential services leave residents vulnerable to the rising frequency and severity of floods. Among the most at-risk are waste pickers—informal workers who play a significant role in the city's waste management system but face compounded social and economic challenges, particularly during environmental disasters.

This study, conducted by Hasiru Mane, the housing initiative of Hasiru Dala, examines the specific vulnerabilities of waste picker communities in Bengaluru's informal settlements, particularly during monsoon seasons and extreme weather events. These communities grapple with extreme poverty, lack of basic services, and insecure land tenure, which heighten their susceptibility to the adverse effects of flooding. This situation exacerbates their daily challenges, and despite their remarkable resilience in adapting to these circumstances, their struggles often go unnoticed.

Through this research, we aim to provide an in-depth understanding of the flood risks faced by waste pickers in Bengaluru, exploring the impacts of these risks on their lives and livelihoods. The study employs a mixed-methods approach, combining qualitative and quantitative data collection techniques to capture a comprehensive picture of the challenges faced by these communities. By analyzing current coping mechanisms, the multifaceted impacts of urban flooding, and community-level responses, the research seeks to identify actionable strategies to enhance resilience and empower these vulnerable populations.

The objectives of this study extend beyond data collection; it represents a step toward developing an inclusive framework for climate resilience that prioritizes the specific needs of marginalized communities. The findings will inform community-driven, pragmatic strategies for flood risk mitigation and create a platform for learning that can catalyze systemic changes in urban planning and disaster preparedness. We hope this study will contribute to advancing a just and sustainable transition to climate adaptation in urban environments.

Aligned with the Bengaluru Climate Action Plan, this work is a call to action and an opportunity for all stakeholders—governments, NGOs, urban planners, and civil society—to collaborate in creating urban spaces that are resilient, inclusive, and responsive to the needs of their most vulnerable residents. Only through such collective efforts can we ensure the safety, dignity, and well-being of waste pickers and other marginalized populations in the cities of tomorrow.

Akbar Allahbaksh
Director - Programme Design + Initiative Head - Hasiru Mane
Hasiru Dala

Executive Summary

Urban flooding is an escalating challenge in Bengaluru, intensified by climate change, rapid urbanization, and inadequate infrastructure. This report examines the impacts of flooding on waste picker communities residing in informal settlements, highlighting their vulnerabilities, coping mechanisms, and the need for comprehensive flood management strategies. The study aimed to assess the extent of flood risks in waste picker settlements, document the coping mechanisms employed by residents, analyze the socio-economic, health, housing, and livelihood impacts of flooding, and propose community-focused flood management strategies to enhance resilience. Using a **mixed-methods** approach, data was collected through surveys conducted across 23 waste picker settlements, **GIS** mapping of stormwater drains and topography, Focus Group Discussions **(FGDs)** with community members, and Key Person Interviews **(KPIs)** with stakeholders.

The findings reveal that flooding is primarily caused by heavy rainfall, poor drainage, and unfavourable topography. Settlements face **frequent inundation**, with water levels reaching up to **6 feet** in some areas. The impacts of flooding are severe and multifaceted. Health challenges include waterborne diseases, exposure to pests, and limited access to healthcare. Housing structures, predominantly makeshift, are highly vulnerable, leading to frequent damages and **high reconstruction costs.** Livelihoods are significantly affected as floods disrupt waste pickers' work schedules, damage collected materials, and increase expenditure on essentials. Communities adopt temporary measures such as **building bunds, clearing drains, and elevating household items**. They rely on informal networks and ad-hoc solutions for immediate relief, but access to sustainable resources and institutional support remains limited.

In response to these challenges, Hasiru Dala has taken proactive measures to enhance community resilience like flood training programs that were designed for impacted residents in vulnerable communities as a flood preparation and mitigation strategy. This training, tailored to the needs of both migrant and local communities, equips residents with practical strategies to reduce risks prior to catastrophic flooding.

Additionally, Hasiru Mane has constructed temporary relief shelters, including **two permanent** and **ten makeshift units**, serving as emergency relief shelters during disasters and community centres. To address prolonged inundation, **four rainwater harvesting recharge** pits have been built across three vulnerable communities to improve water management and reduce future flooding risks. The report recommends **upgrading drainage systems**, reviving traditional water channels, and developing flood-resistant housing. It emphasizes **integrating informal settlements** into flood management plans, ensuring timely compensation for flood victims, and enhancing coordination among NGOs, government agencies, and communities.
Community engagement is key, leveraging local knowledge, early warning systems, and participatory planning to boost preparedness. Climate-resilient urban planning should prioritize sustainable development, green infrastructure, and the inclusion of informal settlements in city-wide flood strategies.

This report addresses urban flooding in Bengaluru through equitable and inclusive strategies, ensuring that the voices of marginalized communities, who are mostly at the receiving end of such flooding, are central to policy and planning efforts.

Contents

Chapter 1
Introduction

Urban flooding has become a common, yet severely growing phenomenon in Indian metropolitan cities. Every year, severe damage to life and property occurs due to unprecedented rain. Bengaluru, known as the lake city of India, also suffers significantly from urban flooding. This flooding is a consequence of increased impermeable catchments and rapid urbanization and climate change (Ramachandra, Shivamurthy, & Aithal, 2017). Water tends to flow to lower grounds without percolating at the point of incidence. Unplanned and haphazard growth has changed the usual direction of water flow, causing larger empty spaces like roads and basements to flood in low-lying neighborhoods, posing various civic challenges.

India experiences intense monsoon rainfall, which distinguishes it from many other countries. Coastal towns and cities are particularly vulnerable to the impacts of storm surges. Additionally, weather patterns are changing due to global climate change, leading to more high-intensity rainfall events that occur more frequently and over shorter periods. Furthermore, rainfall over metropolitan areas has increased as a result of the urban heat island effect, where urban areas experience higher temperatures than their rural surroundings due to human activities. Bengaluru, which receives rainfall for over 9 months a year, faces significant challenges due to urban flooding .

Urban flooding has emerged as a significant disruptor of daily life, particularly in the Global South, where informal settlements bear the brunt of its destructive consequences. The inadequate housing conditions, coupled with poor infrastructural facilities, further amplify the distress experienced by residents of these settlements. Without formal support systems, these communities are compelled to develop their own mechanisms as survival strategies.

In Bengaluru, informal settlements are particularly vulnerable. These areas are often characterized by poor housing conditions, inadequate drainage systems, and limited access to essential services. Residents, many of whom are waste pickers, face severe challenges during flooding events. Waste pickers play a crucial role in the city's waste management system but live in precarious conditions that make them highly susceptible to the adverse effects of flooding.

This report aims to explore the capacity and limitations of waste picker households residing in the informal settlements of Bengaluru in addressing and coping with flooding conditions. By analyzing data from surveys and key person interviews conducted in these settlements, we will demonstrate the types of coping and adaptation methods used by the waste pickers to reduce distress during flooding events. These households employ various adaptation strategies, ranging from structural measures to financial and behavioral related practices.

Finally, drawing insights from the findings of the study, we will conclude by addressing the need to understand the current nature of local flood management practices in informal settlements. This understanding is crucial to devising community-focused flood management strategies that effectively mitigate the inequalities experienced during flooding events. By focusing on the specific challenges and responses of waste picker communities, this report aims to contribute to more equitable and effective flood management policies.

Ramachandra, T. V., Shivamurthy, V., & Aithal, B. (2017)
Frequent floods in Bengaluru: Causes and remedial measures.
https://doi.org/10.13140/RG.2.2.17517.90088

1.1 URBAN FLOODING:
CONSEQUENCES OF CLIMATE CHANGE

Urban flooding is a multifaceted challenge, stemming from both natural and anthropogenic causes. Natural causes, such as higher rainfall, storm surges, and groundwater depletion, contribute to the vulnerability of urban areas. Anthropogenic factors, including encroachments on drainage areas, climate change-induced disruptions, water pollution, illegal mining, and dam mismanagement, further escalate the risks associated with urban flooding.

The consequences of urban flooding are particularly severe in densely populated urban areas, where residents in high-risk locations face the immediate threat of losing their lives. Beyond the initial flooding event, secondary infections add to the misery, causing loss of livelihoods and, in extreme cases, fatalities. India's vulnerability to urban flooding is distinctive due to its intense monsoon rainfall, which affects coastal towns with the potential for storm surges.

Global climate change is altering weather patterns, resulting in more frequent and intense rainfall events, exacerbated by the urban heat island effect over metropolitan areas. The transformation from natural landscapes to developed catchments through urbanization significantly amplifies the impact of flooding. This process raises flood volumes by up to six times and flood peaks by 1.8 to eight times, making urban flooding distinct from its rural counterpart due to its rapid onset, often occurring within minutes.

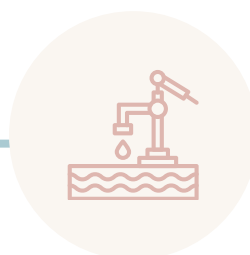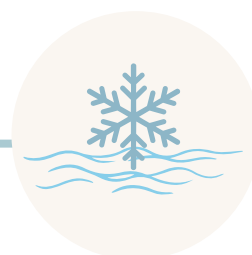## Natural Causes:

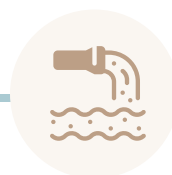| HIGHER RAINFALL | STORM SURGES | DEPLETING GROUNDWATER | HEAVY MELTING OF SNOW |

Anthropogenic Causes:

| DRAINAGE ENCROACHMENTS | CLIMATE CHANGE | WATER POLLUTION | ILLEGAL MINING | UNPLANNED DAM RELEASE | POOR FLOOD GOVERNANCE |

Urban flooding in India is further complicated by the rapid pace of urbanization. As cities expand, the natural landscapes are transformed into developed catchments, increasing the impermeable surfaces that prevent water from percolating into the ground. This rapid urbanization not only increases the volume of water that must be managed during rainfall events but also shortens the time it takes for flooding to occur. In densely populated urban areas, the impact is magnified as infrastructure is often insufficient to handle the increased water flow, leading to widespread flooding and significant damage to property and lives.

The impacts of urban flooding extend beyond immediate physical damage. Flooding disrupts the socio-economic fabric of communities, particularly in informal settlements where infrastructure is already weak. In these areas, flooding can lead to prolonged waterlogging, disrupting daily life and economic activities. Additionally, the stagnant water becomes a breeding ground for diseases, leading to secondary health crises. The loss of livelihoods due to flooding further entrenches poverty, creating a vicious cycle of vulnerability and hardship.

Given the multifaceted nature of urban flooding and its severe consequences, there is an urgent need for comprehensive flood management strategies. These strategies must address both natural and anthropogenic causes, incorporating climate resilience into urban planning and development. Effective flood management should also prioritize the needs of vulnerable communities, ensuring that they have the resources and support necessary to cope with and recover from flooding events.

1.2 WASTE PICKER:
BATTLING THROUGH FLOODING IN INFORMAL SETTLEMENTS

The significant issues that marginalized people experience, such as extended floods, poor housing, and limited access to key services, highlight the serious concerns about the global impact of climate change and fast urbanization on informal settlements. An estimated 1 billion urban residents live in informal settlements around the world, which are characterized by inadequate housing and a lack of adherence to formal laws on land ownership. These communities are inadequate to deal with the growing threats associated with climate change. Residents in these settlements are more vulnerable to floods, landslides, and extreme weather events due to inadequate infrastructure and poor housing.

In informal settlements, deficient drainage systems lead to prolonged floods and the spread of diseases, compounded by substandard housing that exacerbates health challenges. Insufficient sanitation and waste management further contribute to health risks during flooding, while residents lack access to social security and healthcare, intensifying their vulnerability during climate disasters. The impacts of floods, coupled with compromised livelihoods and a lack of social protection, perpetuate poverty. Urbanization amplifies environmental challenges through the urban heat island effect, heightening climate change-induced heatwaves. As temperatures rise beyond 1.5°C, the cumulative effects become increasingly unbearable, underscoring the imperative for inclusive and sustainable strategies that address the intersection of urban growth, climate change, and the well-being of vulnerable communities.
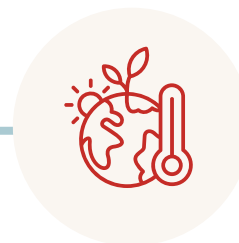
Urbanization & Climate Challenges:

**SUSTAINABLE STRATEGIES**

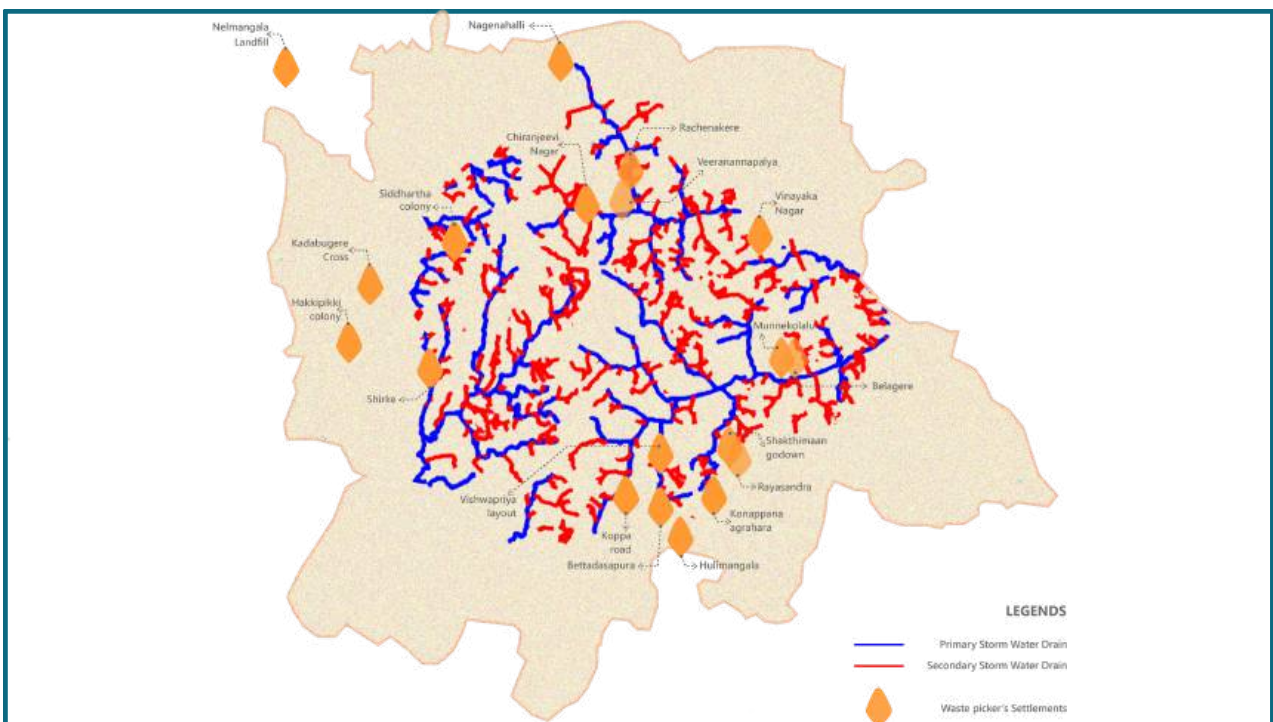**URBAN HEAT ISLAND EFFECT**

VULNERABLE COMMUNITIES

CLIMATE CHANGE

In the specific context of Bengaluru, the interplay of unclear land tenure and deficient urban planning significantly contributes to the vulnerability of the region, particularly evident in the escalating impacts of rapid urbanization. This urgency is underscored by the convergence of climate change and swift urban development, exposing informal settlements to heightened risks. A substantial proportion of the city's residents, numbering 74%, rely on the informal sector for their livelihoods, amplifying the challenges faced by communities grappling with both socio-economic and environmental factors. The absence of transparent land tenure arrangements and effective urban planning further obstructs the implementation of climate-resilient infrastructure, leaving these areas susceptible to adverse impacts.
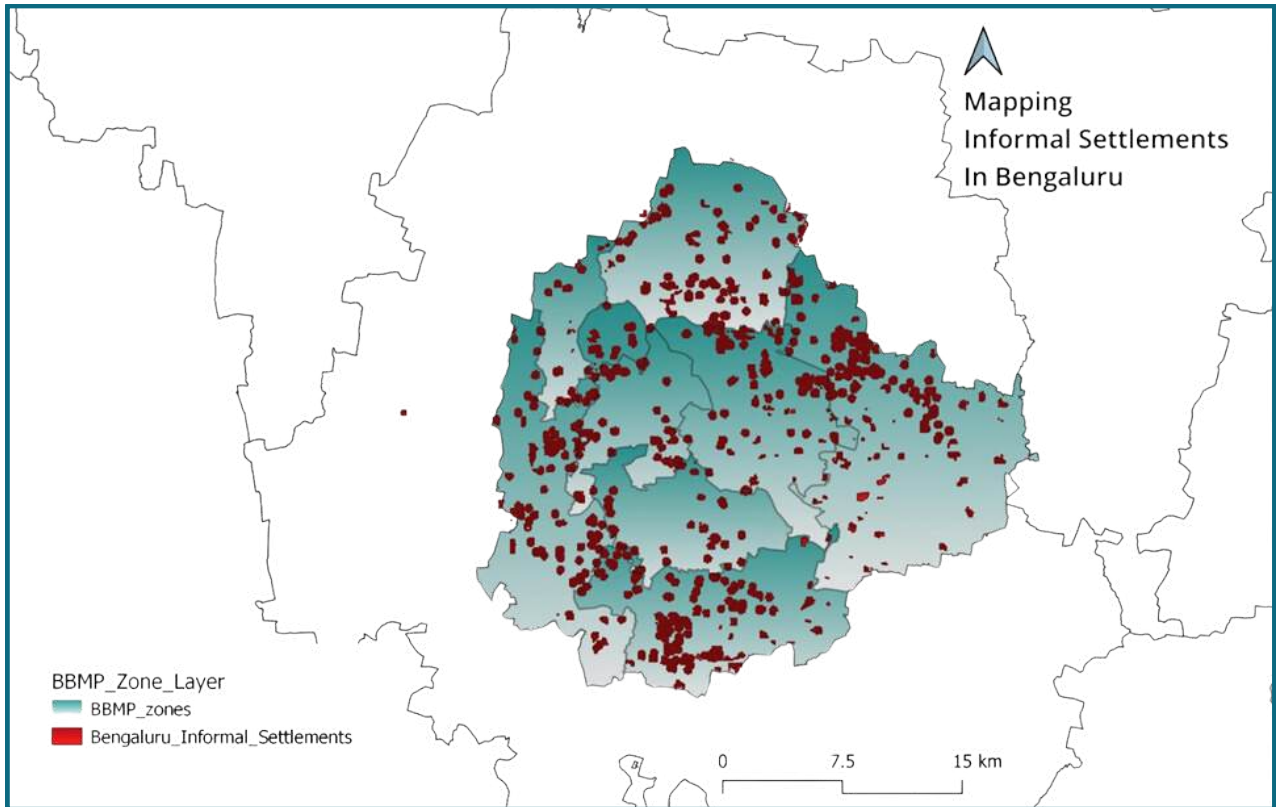
The transformation of Bengaluru into a concrete-heavy landscape exacerbates the urban heat island effect within informal settlements, subjecting residents to elevated temperatures. This intensified environmental stress is particularly concerning for socially vulnerable populations, including migrants and those experiencing poverty, as they bear disproportionate impacts. Inadequate government services compound the challenges faced by these communities, as emergency response, disaster preparedness, and other essential services struggle to meet the escalating demands. The environmental degradation resulting from rapid urbanization adds another layer to the multifaceted vulnerabilities experienced by informal settlements in Bengaluru.

In essence, the urgency emanates from the critical need to address the complex interplay of deficient urban planning, unclear land tenure, and the adverse impacts of rapid urbanization on informal settlements. Comprehensive strategies must be urgently implemented to enhance resilience, improve socio-economic conditions, and mitigate environmental risks for the vulnerable populations residing in these rapidly evolving urban landscapes. In order to ensure the resilience and well-being of vulnerable populations globally, it is essential to develop comprehensive and immediate strategies to address the complex intersection between informal settlements, urbanization, and climate change.

Flood Vulnerable Locations (by BBMP)

BBMP_Zone_Layer
- BBMP_zones
- Flood_Vulnerable_Locations

0   7.5   15 km

LEGENDS

— Primary Storm Water Drain
— Secondary Storm Water Drain

◆ Waste picker's Settlements
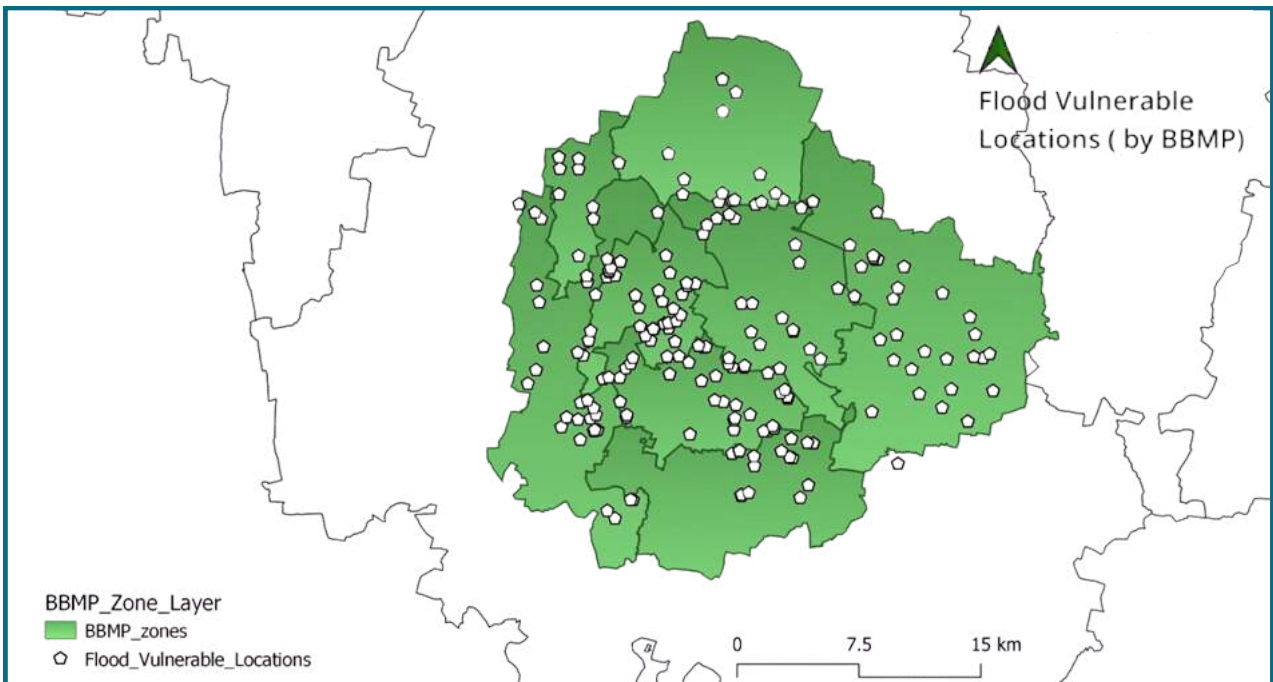
Chapter 2
About the Story

2.1 STUDY AREA :
WASTE PICKERS SETTLEMENTS IN BENGALURU

This section on study area focuses on the settlements selected for this study, providing insights into their socio-economic details, and settlement characteristics. As part of the flood assessment survey, 43 communities were initially identified through discussions with Hasiru Dala field coordinators and by cross-referencing with an existing database. During subsequent reconnaissance visits, it was observed that many of these communities had relocated.
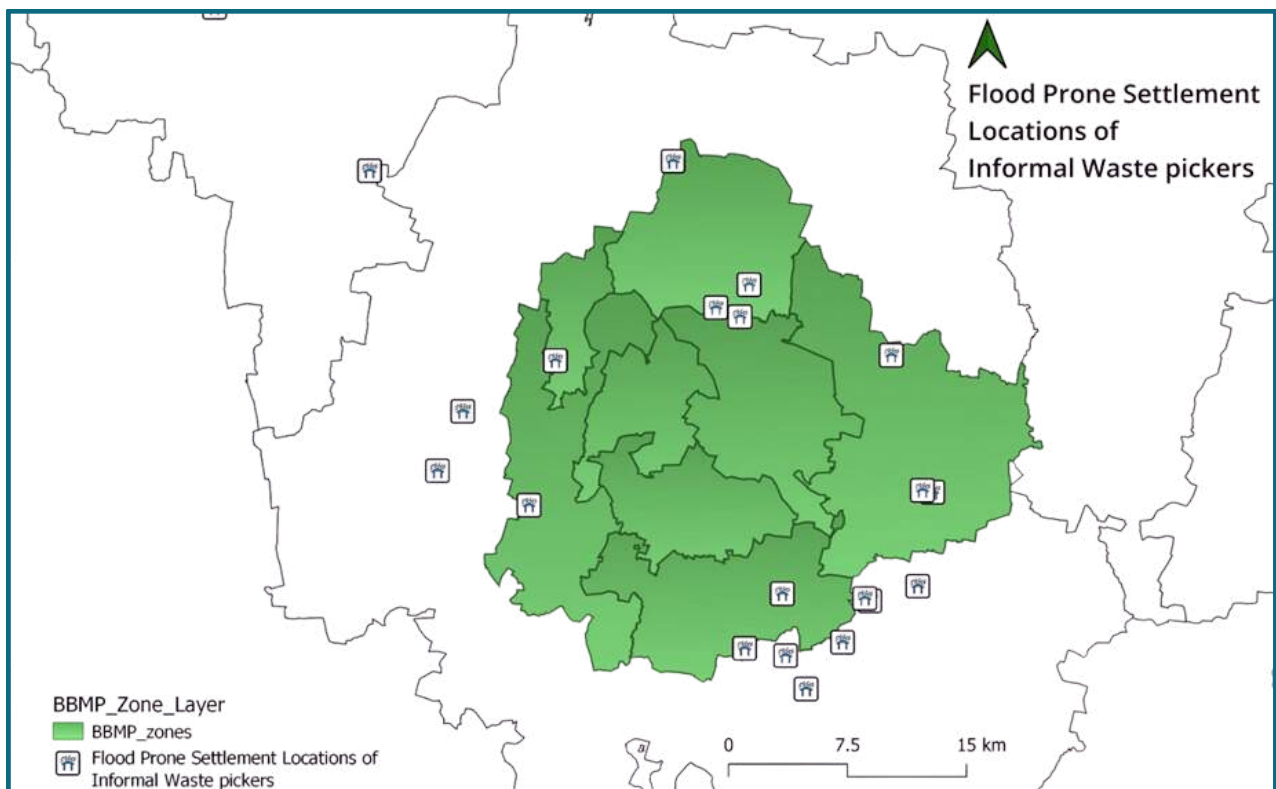
Hence, surveys were conducted in 22 communities. They are: Siddhartha colony, Nelamangala landfill, Thyamagondlu, Kadabagere, Shirke - KHB quarters, Hakki pikki colony, Konappana Agrahara, Rayasandra, Shakthiman godown, Nagenahalli community, Rachanakere, Veeranapalya, Vishwapriya layout, Hullimangala, Venkatesh godown - belagere, Bettadasapura, Vinayaka nagara, Koppa road - Sanjab Ali godown, Ajay Godown (194 DWCC) Begur, Vinayaka nagara, Munekollalu, and Kodthi. These surveys aimed to gather detailed information on the causes of flooding, the challenges faced by the communities, and their coping mechanisms and responses during emergencies.

Settlement characteristics:

Two distinct types of settlements were extensively surveyed: **the local communities**, comprised of native families possessing social security documentation and evidence of long-term residence in the specific settlement, who also communicate in local languages; and **the migrant communities**, which consist of individuals who have relocated from various regions of the country to Bengaluru in pursuit of improved living conditions and income. These migrants typically lack social security documentation and land tenure rights related to their settlement and predominantly speak Hindi, Assamese, Bengali, and other languages.

The majority of the communities studied, **over 70%**, belong to **unidentified settlements**. These settlements lack official recognition and often face significant challenges in accessing basic services and infrastructure. Only a few of the studied communities fall into the **notified and recognized categories**, which generally have better access to amenities and legal protections.
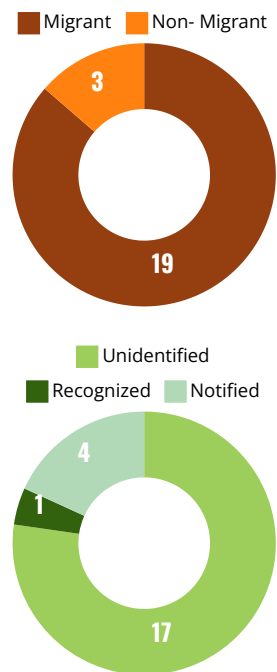
Services in the settlements:

In the communities surveyed, it was observed that water was primarily sourced from **external providers** such as tankers or rented from neighboring units or vendors. Only a few communities had **access to public water supply**, which was generally available to native communities with documentation proving their residence in the city. Among the surveyed communities, approximately **31% (7 communities) had access to groundwater sources** like borewells or wells in the vicinity.
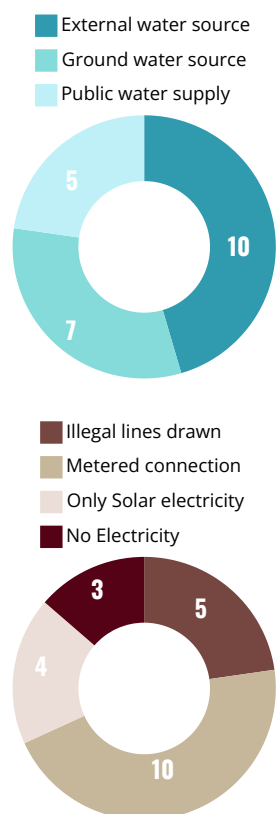
Regarding **electricity,** about **22.7% (5 communities) did not have legal access** and resorted to drawing illegal lines from nearby electric poles. In contrast, **45% (10 communities) had access to metered connections**, although these were often communal rather than individual, with one meter serving the entire community and managed by the takedars who owned and rented out the spaces. **A small number of communities had access to solar-powered lighting**; in some instances, only a few households within a community had solar access, while others had no electricity connection at all.

Household Composition and Senior Citizen Population:

The surveyed settlements exhibit a diverse range of household sizes, typically varying from **3 to 7 members**. The highest average household size is noted in **Rachanakere,** where families tend to have around **7 members**. In contrast, smaller communities like **Nelamangala** landfill have an average of **4 members** per household.

Senior citizens form a minimal proportion of the population in these settlements. For instance, in Nelamangala landfill, there is only one elderly person across the entire community. In larger settlements like Venkatesh godown and Bettadasapura, approximately **4-5% of the population** comprises senior citizens.

Religious and Caste Composition

The settlements are predominantly inhabited by **Hindus and Muslims.** Notably, settlements like Munekollalu and Kodthi have a mixed population of Hindus and Muslims. Caste-wise, the settlements mostly comprise **Scheduled Castes (SCs) and Scheduled Tribes (STs)**, with some places consists people from **Other Backward Communities (OBCs)**

Languages and Gender

A multilingual environment is evident across the settlements. **Kannada, Telugu, and Tamil** are the most **commonly spoken languages**. However, settlements like **Rayasandra and Rachanakere** show a **linguistic diversity** with languages such as **Assamese, Bengali, and Hindi** being spoken by the residents.

Urban flooding **impacts** community members differently by **gender**, as women face additional burdens **managing household needs, childcare**, and the **safety of vulnerable family members**. Women in both **native** and **migrant communities** handle **immediate flood responses**, often setting up **temporary shelters** and **securing essentials** under unsafe, unsanitary conditions. **Pregnant women**, in particular, experience **heightened health risks**, sometimes needing **relocation to hospitals.**

The **FGD (Focus group Discussions)** highlights distinct roles, with **men** focusing on **structural preparation and external support** while **women** manage day-to-day responses, facing heightened **physical and emotional strain.** Communities expressed a need for **gender-sensitive interventions,** such as access to **durable shelter, sanitation, and emergency healthcare**, to support women's roles and enhance overall resilience during floods.

Insights from the FGD:

The recent Focus Group Discussion (FGD) provided a comprehensive look into the lived experiences of urban flooding among native and migrant communities. Participants from communities like Siddhartha Colony, Vinayaka Nagar, Thyamagondlu, and Konappana Agrahara shared their encounters with frequent floods, which often lead to **loss of life**, **injuries**, and **damage to property**. Structural issues, such as **poorly built walls**, **narrow drainage systems**, and **inadequate housing**, exacerbate these impacts, highlighting the vulnerabilities faced by residents, especially in low-income neighborhoods situated in low-lying areas. These accounts underscore how systemic infrastructure deficits compound the seasonal hardships that these communities endure each monsoon.

For instance, participants from Vinayaka Nagar recounted a tragic incident where a **poorly constructed wall collapsed** after days of heavy rain, resulting in the **death** of an **elderly woman** and **injuries** to several **children**. This incident underscores how **structural failures** can **amplify the risks** during floods, posing direct threats to residents. Similarly, in Thyamagondlu, homes made from **mud** are particularly **susceptible to collapse** when water accumulates, forcing families to abandon their homes for temporary shelters in sheds. These shared narratives reveal that while flooding itself is a natural hazard, the impact is often intensified by **inadequate construction** standards and **poor maintenance**, which remain unaddressed.

In response to recurring flooding, community members described the **collective yet limited measures** they take to prepare for floods. In Vinayaka Nagar, residents take proactive steps like **reinforcing tarpaulins**, **filling potholes**, and **repairing walls** in anticipation of the monsoon. In contrast, migrant communities such as Konappana Agrahara often rely on **makeshift solutions**, using **tarpaulins** and building **ad hoc channels to guide water** away from their homes. Given the lack of formal flood preparedness measures, these residents have **developed** their **own strategies** to **protect** their homes and **ensure the safety** of their families, particularly for **vulnerable groups** such as children, the elderly, and pregnant women. For example, in Vinayaka Nagar, residents fortify shelters and keep food and important documents on shelves to prevent damage. They also take specific precautions, such as building **elevated sleeping arrangements** on cots and using **stones** to **block rodent** entry, to **safeguard** children and elders.

Healthcare access remains **limited**, and the **health impacts** of flooding are **severe**, with many communities reporting **illnesses** due to **stagnant water**, **lack of sanitation**, and **exposure** to **contaminated sources**. Participants from Thyamagondlu reported that drainage blockages worsen flooding and create an environment where **water stagnates** for days, heightening **risks** of **waterborne diseases**. Moreover, the **costs** of **medical care** are prohibitively **high**, and floods frequently **delay access** to **healthcare facilities**. For many residents, particularly those from migrant backgrounds, **inadequate sanitation** and the **lack of clean water** further **intensify health risks** during the rainy season.

While some **government aid** exists, the support is often **inconsistent**, leaving communities reliant on organizations like Hasiru Dala for essential relief, such as food and temporary shelter materials. This inconsistency has led to an overwhelming desire among residents for **sustainable infrastructure** improvements, like **stronger drainage systems** and **sturdier housing**. Residents from Siddhartha Colony highlighted the need for **wider drains** to better **manage rainwater**, while those from Konappana Agrahara emphasized the importance of **maintaining** nearby **drainage systems** to prevent overflow. In sum, the FGD sheds light on how urban flooding is **not merely** an **environmental issue** but a **complex interplay** of **social**, **infrastructural**, and **policy challenges**. The experiences shared across various communities reflect the **pressing need** for **infrastructural interventions** and **targeted policies** that address the unique **vulnerabilities** of these urban populations.

2.2 OBJECTIVES OF THE STUDY

With the onset of the monsoon season in Bengaluru, which resulted in substantial rainfall and posed significant challenges for waste picker settlements, Hasiru Dala initiated a project aimed at mapping flood-prone areas and assessing their impact throughout the city. This initiative, referred to as the "**Flood Assessment Project**," was managed by the Hasiru Mane Vertical of the organization. The primary objective of this project was to identify the issues associated with flooding in waste picker communities and to develop effective mitigation strategies to enhance their capacity to manage these risks.

The study aims to understand the following aspects of urban flooding:

1. *The extent of flood risk in different waste picker settlements.*
2. *The current coping mechanisms employed by the residents.*
3. *The multifaceted impacts of urban flooding on waste picker settlements*
4. *Strategies for community engagement and capacity building to enhance resilience.*

By addressing these objectives, we hope to develop a **comprehensive** understanding of the flood risks faced by waste picker communities and create **effective, community-focused flood management strategies.**

SURVEYING

UNDERSTANDING THE STRATEGIES

ANALYSIS

DEVELOPING SOLUTIONS

BUILDING CAPACITY
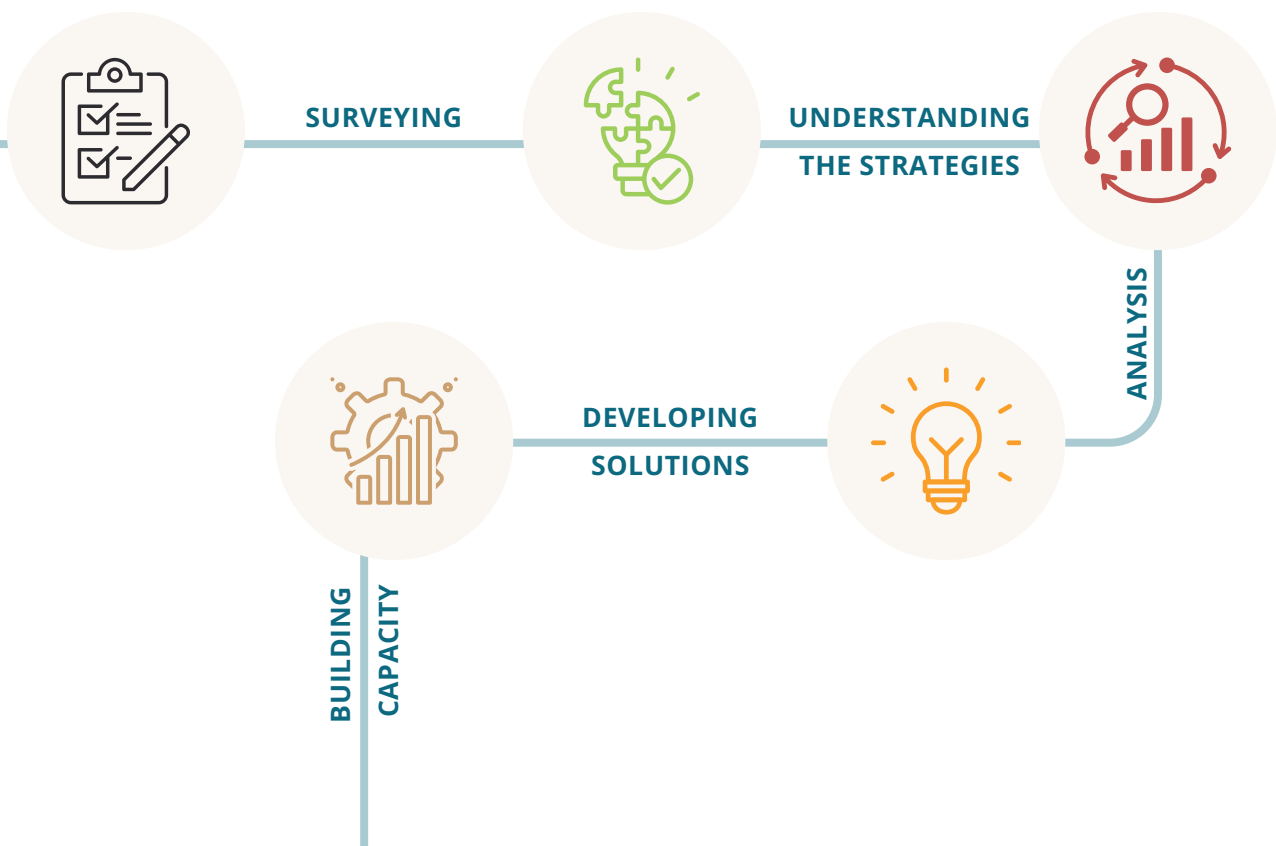
2.3 RESEARCH METHODOLOGY

This section intends to explain the methodological aspects connected with this research work. Our research employs a mixed-methods approach, combining both qualitative and quantitative data collection techniques. This allows for a comprehensive understanding of the study.

Community engagement for Flood risk management:

FIELD VISITS

SETTLEMENT SURVEY

FGD - COMMUNITY MEMBER [1]

GIS MAPPING

KEY PERSON INTERVIEW
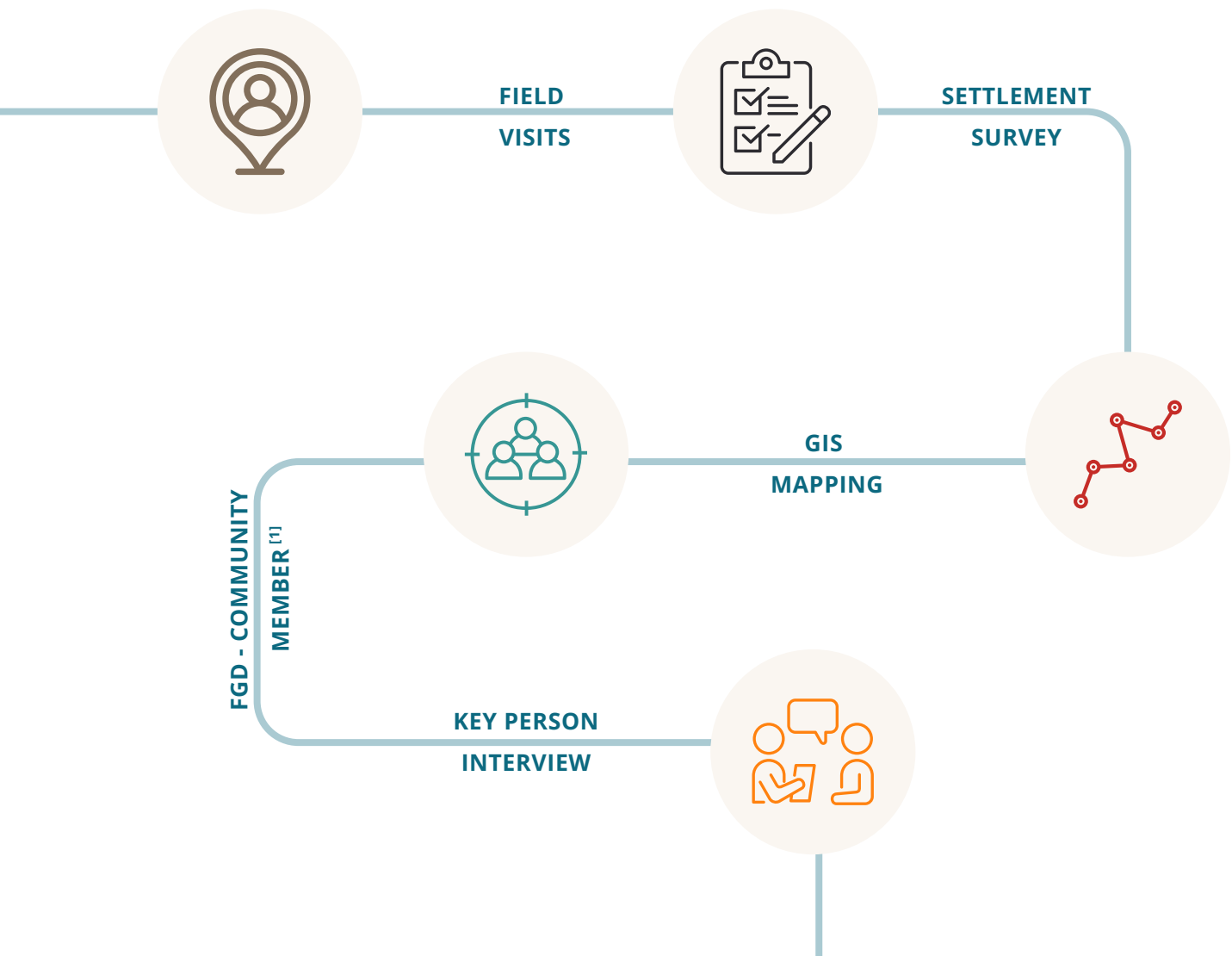
2.3.1 STEPS INVOLVED IN DATA COLLECTION

a. Settlement survey

- **Target Group**: Waste picker households in informal settlements across Bengaluru.
- **Sample Size**: 22 Communities,
- **Data Collection Instrument**:

    - Survey: Structured close-ended questionnaires that cover aspects such as housing conditions, flood experiences, adaptation strategies, and socio-economic impacts.

    - In-person Interviews: Structured interviews were conducted with 6 Thekedars, as Thekedars are typically present only within migrant communities. Among the 22 communities identified, a significant majority comprised migrant populations. However, due to considerations of availability and logistical convenience, the research team was able to interview 6 Thekedars.

b. Mapping

- **Mapped stormwater drains in 22 communities**
- **Mapped the rainfall pattern of the area ()**
- **Mapped the topography of the communities**

c. Focus Group Discussions (FGDs)

- **Participants:** Groups of 8-10 waste pickers from different settlements.
- **Number of FGDs:** 2 sessions.
- **Discussion Topics:** Community experiences with flooding, collective adaptation strategies, and suggestions for improved flood management

d. Key Person Interviews (KPIs)

- **Target Group:** Academia, Journalist
- **Number of Interviews:** 2
- **Interview Guide:** Semi-structured with open-ended questions to explore deeper insights into flood management practices and community responses.
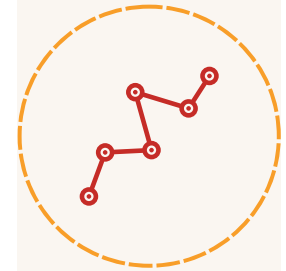
2.3.2 SAMPLING STRATEGIES

a. Convenience sampling

- **Informal settlements identified based on flooding risk zones from the existing database from Hasiru Dala**
- **Selection Criteria:** Flooding events and socio-economic vulnerability.

b. Purposive Sampling

- **Used for selecting key informants and FGD participants to ensure representation of diverse perspectives and experiences.**

2.3.3 DATA ANALYSIS: QUALITATIVE

- **Method: T**hematic analysis.
- **Techniques:** Identification of key themes, patterns, and insights from semi-structured interviews and FGDs, triangulating with existing data and secondary data for a holistic view.

Chapter 3:
Findings and Impacts

3.1 When Waste picker's Settlement Floods

Majority of the waste picker settlements surveyed reported a **multitude** of reasons that **cause flooding** in the settlement. The **prima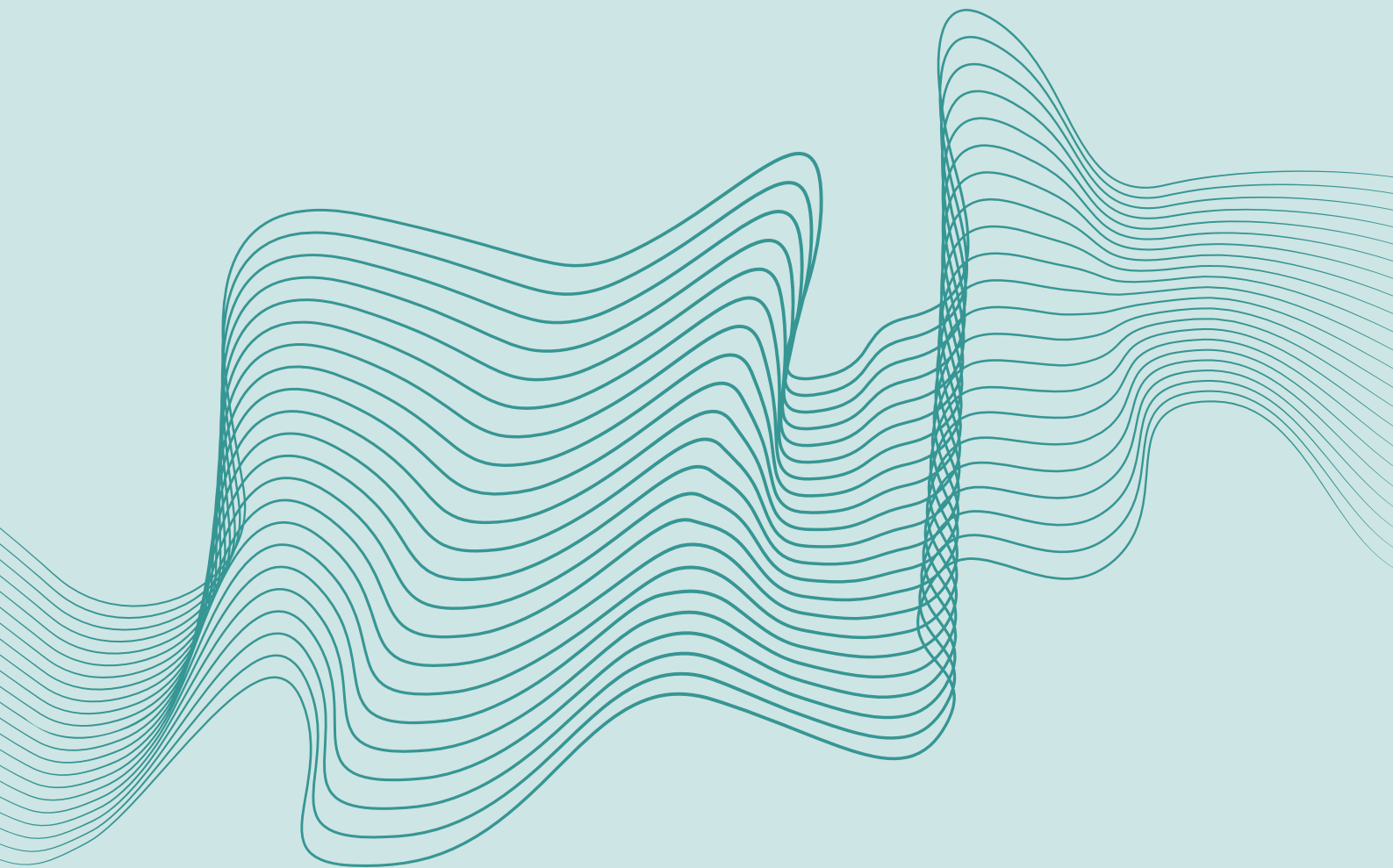ry** cause of flooding that many agreed is **heavy rainfall**, particularly **during the monsoon** season. In some settlements, **inadequate drainage systems** exacerbate the problem. For instance, in **Konappana Agrahara**, flooding occurs when the nearby **drainage** system **overflows**. Similarly, **Rayasandra** experiences flooding during **heavy monsoon rains**, which significantly **impacts** both the **workplace and housing** areas. Certain settlements, such as **Vinayaka Nagara** and **Koppa Road** - Sanjab Ali Godown, are located in **sloped regions** where water naturally **flows towards** the **community**, increasing the **risk of flooding**.

In order to understand the causes of flooding in the waste picker settlements, we asked a question to understand their perspective. We received various responses which largely categorized into **drainage issues**, **heavy rainfall**, and **topography**. Almost **all settlements** reported that they **face flooding** during the **heavy rainfall** highlighting the challenges of managing intense downpours. While **10 settlements** reported **drainage issues** and **Topographical factors**, indicating areas with **inadequate or blocked drainage** systems contribute to flooding. Below graph shows the responses

Legend:
- Improper drainage
- Monsoon rains
- Topography

4
6
12
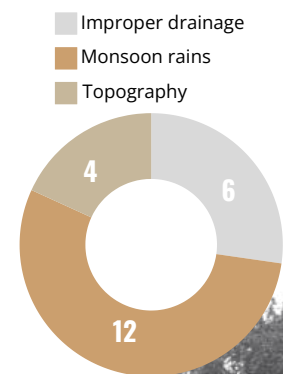
"When asked about the causes of the flooding in the Konappana Agrahara community, whether it is due to rain or drainage overflow. They showed the places around from where water comes. They mentioned water comes out of the chamber (drainage) as well. They showed a house which gets affected a lot due to flooding.

It happens a lot !!

"Only during rains, the water from these drain (charandi) fills up and overflows in front of the house. Only during rains the drain fills up, the houses in lower areas (down iro manegalu) get filled up with water draining from the elevated houses (Up iro manegalu) , that time we have to carry kids and stand until water drains off, nothing can be done"

- Resident from Hakki Pikki Settlement

TEMPORARY HOUSING

Frequency and Duration of Flooding

Flooding in these settlements is generally seasonal, with most occurrences tied to the monsoon rains. The frequency varies, with some settlements experiencing floods annually, while others face them only during particularly intense rainfalls.

Rayasandra

Reports inundation lasting up to a week in the workplace and a day in the residential areas.

Koppa Road

Sanjab Ali Godown faces 8-10 days of flooding during heavy monsoon rains, with water rising above **ankle length.**

Vinayaka Nagara

Endure the most prolonged flooding, with water lingering for up to a month after heavy rains.

Munekollalu

Experiences prolonged flooding, with water remaining at **waist level** for up to a month.

Severity of Flooding

The severity of flooding, measured in terms of water levels, is a major concern in many of these settlements.

In order to understand the severity of the flooding in the **settlement**, we asked about the **inundation**. From their experience, it is noted that depending upon the severity of flooding, the inundation changes. **Siddhartha Colony** experiences water levels ranging from **2 feet** to a **maximum of 6 feet** during floods. **Konappana Agrahara** saw the **highest flood levels** in **2022**, when the area remained **inundated** for **2-3 days**. In **Kodthi**, the community faced severe flooding with **water levels** remaining high for **10-15 days**, significantly affecting daily life.

Legend: 2-Hours, 1-Hour, 4-Hours, More than 1 day, 1 day, 1 week, 2 weeks
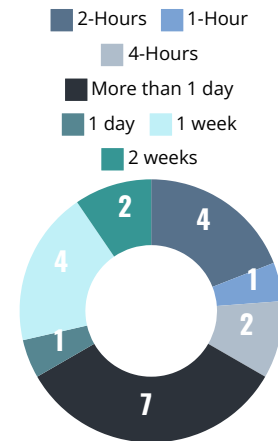
Mitigation and adaptation measures:

When we tried to understand how they handle flooding situations, we received various levels of preparedness that they do as a result of coping for the short-term period.

- Shifting household items to **higher shelves** or **temporarily vacating to nearby shelters**.
- **Repairing roofs** and structures, building mud walls or barriers.
- **Clearing nearby drains** to improve water drainage.
- Stocking up on **essential supplies** and preparing to **move to higher ground.**
- Changing the buying patterns
- Constructing **Short bund** for flood preparation
- **Extension of drainage canal**
- Seeking **Flood Compensation**

Varying Levels of Preparedness:

- Some settlements, like **Siddhartha Colony and Thyamagondlu**, have implemented proactive measures such as **shifting belongings to higher places** and **digging trenches.**
- Others, like **Shakthiman godown and Vishwapriya layout**, have shown a **lack of preparedness**.

Common Response Strategies:

- Most settlements **prioritize protecting people** and belongings by moving to **higher ground** or **covering them with tarpaulins.**
- Creating **drainage channels** or **digging trenches** is a common immediate response

Recovery Efforts:

- **Cleaning debris, drying belongings**, and **repairing damaged structures** are essential recovery steps.
- Some communities, like **Thymagondlu and Kadabagere**, focus on **improving drainage systems** to prevent future flooding

Challenges

The severity of flooding, measured in terms of water levels, is a major concern in many of these settlements. For example:

Lack of Uniformity:

The level of preparedness and response varies significantly between settlements.

> They mentioned that there is nothing more to prepare, we have tried everything. Rajakaluve has been built up with concrete walls, we can't put holes into that wall, as it is illegal. Pigs, snakes and other animals come inside.

> We will be scared during the night, we won't get sleep thinking about what if it rains at night. Mostly it rains during the night, we would have come from work and slept, but it would rain

Limited Resources:

Many communities rely on basic measures like tarpaulins and manual labour, indicating a lack of proper infrastructure and equipment.

> During the rains, the tarpaulins of the house themselves start moving in the air.

> We bring the building demolition material in a BBMP vehicle and put it in place.
>
> Wall materials are purchased from scrap shops, no new ones are bought, and tarpaulins are bought from the market

> The floor of the house is made of mud and mat is spread over it, tarpaulin is used for walls and roof, carton boxes and tarpaulin are used for doors, there are no windows in the house. To build a house, all these materials are bought from the shop, it takes one day to build a house

Dependency on Weather:

The effectiveness of these measures is often dependent on the intensity and duration of the flood.

> We don't do anything when it's raining, we sit inside the house, it keeps raining and raining and it only stops. It has become hard to protect and look after children. How many times should we put mud and cement? Water keeps coming inside even after putting cement and mud so many times.

> At the time of rain, Water goes through the houses, we have elevated the place, all the water from the road reaches their house, The entire water from the road enters our house. Water fills up the entire house

> Due to heavy rain and winds their houses get damaged and the tarpaulins get blown off along with the poles

Long-term Impact:

While immediate actions are taken, the community did not have had long term recovery plans

> It gets hard for the community to even go to the toilet, fetching water gets difficult, fetching food gets difficult.

> Yes sir, 2-3 kids were washed away, we went and brought them back. Due to this fear we had left our kids at our hometown. The flooding will be so much even we will get washed away.

> They said we don't do anything, we don't know anything, engineers should come and tell us. Then they told us that, earlier they used to make trenches and let the water flow, but since there is space for water to drain off, it just stays wherever it has been. So kids, elders and everybody will have to walk through the same flooded path.

Did they receive any kind of flood relief/support from the government/BBMP during the floods?

17
YES

5
NO

3.2 WASTE PICKER'S NAVIGATE FLOODING (CASE STUDY)

Responding to the Flood events: Understanding the Formal and informal Flood management strategies practiced by the waste pickers in the Siddhartha Colony

Logics in managing and unmanaging

The Settlement **Siddhartha Colony** comes under the Peenya Industrial area ward, and is located at 77.501° N - 13.016° E in the **Dasarahalli Zone**. The Settlement is identified as **Notified slum** and consists of nearly **100 families** of minimum **5 Individuals** per dwelling. Most of the population are **Kannada speaking** Individuals who are internally migrated from **Yadgiri** District of Karnataka. Apart from those, a small population of **Telugu, Hindi and Tamil speakers** also resides in the Settlement. Since the settlement is present in a Industrial area, the majority of people work in the **informal sector** with low paying Jobs with no or less social security benefits. For instance; **Men** go to the nearby factories/godowns to work or work as **Construction workers**. Almost all the **women** from the settlement go for **waste picking** and some engage as sorters in the nearby centers. Though the settlement is notified, it is still devoid of the basic infrastructural facilities. Nearly all the infrastructure connections are **off-grid**. The **water supply** for the residents are availed through **two public water taps** present at both the ends. The **electricity supply** is not provided to the residents and they rely on the **off-grid arrangements**. Living with a high vulnerability, the people of the settlement are left strangled everytime the flood hits. The social disability adjoins the other vulnerabilities in reacting and responding to the flood events.

> During the first flood, I had gone out for a purchasing ration. The kids were at home. Due to a sudden downpour, the water rushed inside the houses and washed away their belongings. We went to the nearby factory to escape from the flood

Monamma - her first memory of the Flood

This has been the condition of the settlement for the past few years. Even though the residents hardly remembered the year of the first flooding event in their settlement, they were sure of it happening for more than four years. Some people are of the opinion that the construction of the sewage manhole adjacent to the drainage canal being the reason for flooding.

During the monsoon times, within the 10 minutes of continuous rainfall the settlement floods with water rising to 6 feet maximum. The settlement floods and washes away everything on the way. Additionally the open drain attached also tends to overflow during monsoon and brings in all the sanitary waste into the houses. In these havoc situations, the nearby factories act as informal disaster relief shelters to the residents of this settlement, which is also restrained to enter sometimes by the factory owners.

As a result, severe damages to the property has become a norm in the settlement. The household assets are washed away in the flood water, including their identity cards and savings. Along with the belongings, their Government documents also deteriorate in the flood. This pushes them to spend money on getting these documents, which is rarely addressed in the compensation discourses.

Several reasons that can be attributed to the cause of the flooding in the settlement. Firstly, the **physical precarity** of the settlement. Topographically, the region is situated in the slope which leads to **water accumulating** during the monsoon. Simultaneously, it also gets affected by the attached open drain. The open drain, when filled up, overflows to the settlement creating havoc and hindrance to the living community. Since all the housing units are built adjacent to each other with a common wall, there is any scope for individuals to rebuild or renovate their housing unit.

Coping with the uncertainty :

One of the basic and most important strategies in flood risk management is Flood prevention. The settlement land belongs to the **Karnataka Industrial Area Development Board (KIADB)** - a statutory body established to promote the industrial growth and development of other infrastructural facilities in the Industrial areas of Karnataka. Since the region is physically vulnerable to inhabit, the Karnataka slum development board (KSDB) has identified it as **'Notified Slum'** and started the resettlement process. Nevertheless, the frequency of the land allotments and the land rights remain a foremost hindrance for the community to resettle. Few of them were offered land in the Laggere area without the land entitlements. Nonetheless, the majority of the **community resists not moving out of the settlements, unless they are given "Hakku Pathra"**. The fractured governance system has increased the precarity of the people residing in the settlement.

"**Now that it has become normal to us, we have become accustomed to it"**, says Raju. It is true to a larger extent since the community has seen the worst effects of the flooding and its damage to their belongings. It has impacted the settlement in all levels from building a **short bund** for Flood preparation to **changing the buying patterns** to reduce the risks. Moreover, the fear imbibed by the flooding events can be seen through the ways of **flood mitigation strategies developed** by the **people**. One such flood induced behavior is the purchase of the ration on the weekly basis during the monsoon. The flooding has also **impacted** their **access to water and electricity**. The mitigation strategy has its impact on the housing characteristics as well. A short height **bund** was **constructed** at the **entrance** to everyone's house to **avoid flood** water entering the houses. It is basically Compacting the floor with construction waste and leveled the surface with concrete, stone boulders(Jelly) and cement dust to then oxidize the floor for finish. One of the resident shared how the whole community built the height bund's at the same time putting their own resources. All these incidents opened up a **new arena** of **exploring** the **flood resilience methods** and tactics, especially in the Global South.

> "Adu namge normal agbittide ivaga, namge abhyasa agbittade"

The recent **construction** of a **drainage wall** by the **BBMP** serves as an **important flood prevention measure**. Initially, the drainage canal was quite low, but its height was increased by building a stone wall around it. According to a resident, the **issue** of water **overflow** began **six to seven years** ago when **sewer manholes** were **constructed** next to the **canal**. Since then, the settlement has been affected by flooding. For years, residents have been requesting repairs to the drainage canal. During election campaigns, the local MLA and other political leaders visited the area, and households requested that the height of the drainage wall be increased. After **continuous efforts** with **civic authorities**, the BBMP finally surveyed the area in **April 2023** and **began work** to raise the height of the drainage canal to reduce the risk of flooding. This extension will also help prevent garbage from being dumped into the canal. Additionally, **BBMP** has initiated the **reconstruction** of **two roads** leading to the community (from the front and rear) as well as work on the drainage canal itself. While there has been no recent flooding, the **improved drainage** system will **help prevent** future **overflows**. The entire **canal** has been **cleaned**, with debris removed, and the **retaining wall's height** has been **raised**.

Post-flood strategies:

The **post-flood scenario** in Bengaluru usually begins with the announcement of **compensation** to the flood-affected households from the Chief Minister of the State. Likewise, this settlement has received compensation **twice** in all these years. The narratives of the compensation practices reflect uncertainty and the absence of legal framework with respect to the Compensation. Usually, the residents of the settlement approach their Constituency MLA (Member of the Legislative Assembly) to address the flood problems. The MLA will ask the Municipal authorities to look after the issue, although the civic issues can be addressed straightway to the Municipal Administration. Upon saying that, approximately 5 years back, they remember their first compensation received from the Government side. A amount of **Rs.10,000** was sanctioned and distributed to the households with the flood damages. The officers from the Municipal corporation visited the settlement and collected the **required documents** such as Aadhar Card and passbook photocopy from the individual to initiate the compensation amount. Approximately, a year back, **Rs.25,000** was sanctioned and distributed to the households as a compensation for flooding in the settlement. During their Second compensation, the residents shared the flood situation with the authorities. They visited the settlement and promised to give some compensation. A sum of Rs.25,000 per household was promised to be given as a compensation within the period of 1 month, but credited only **after 4 months**. For some people, it even took **6 months** to credit in their accounts. However, many people **did not even receive** the compensation. Even after multiple follow-ups, and visits to the MLA's office for the amount, there isn't any progress. Other than compensation, no other aid was provided as a relief to the settlement. This reflects that the bureaucracy becomes fractured when responding to the disenfranchised communities.
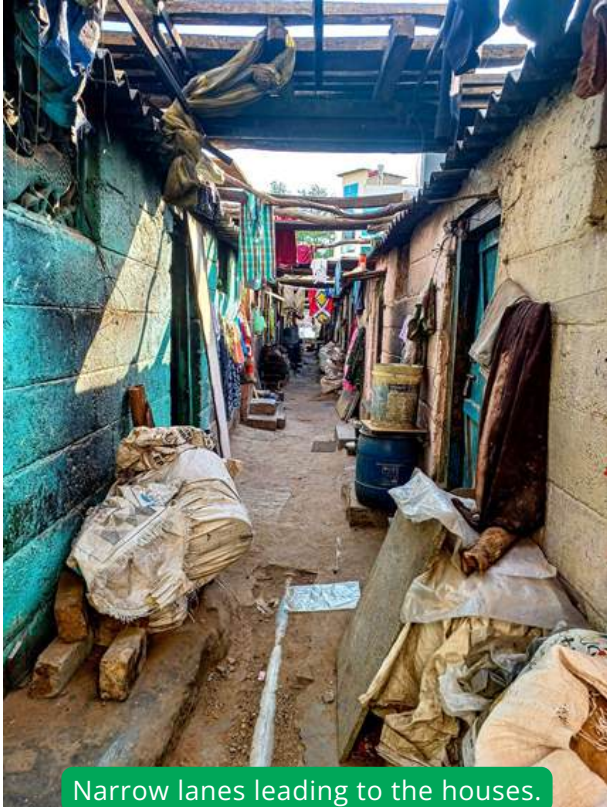
Narrow lanes leading to the houses.

Narrow lanes leading to the houses.

Bunds built to prevent flooding in homes.

Public water taps for community access to daily chores.

3.3 IMPACT ON HEALTH

Waste pickers, who often reside in the informal settlements with **inadequate infrastructural** arrangements, are **exposed** to **severe health hazards** in the **event** of **flooding**. The health implications during the flooding episode are **severe**, **affecting all age groups**, especially **children** and the **elderly**. Many factors attribute and **affect** the **health** and **well-being** of the waste workers ranging from their **socio-economic** condition which **exposes** them to a **noxious environment** to the political positioning which gate keeps the accessibility to quality health services.

From our findings, the health challenges faced by waste pickers during floods highlight the **increased prevalence** of **common colds**, **coughs**, **viral infections**, and **fevers**. The presence of contaminated water further increases the risks such as **typhoid**, **dengue**, and **malaria**. Floodwaters often carry sanitary waste into their homes, resulting in an **unhygienic environment** that can cause **infections**, **eye irritations**, and the spread of disease. Moreover, they are exposed to additional health risks, dealing with the presence of **snakes**, **crabs**, **rodents**, and **other pests** in their **neighborhoods**.

Our **analysis** also **identified limited access** to **healthcare** as a **major concern**. Waste pickers often **visit** nearby **hospitals** and **doctors** for **common ailments**, but the **costs** of **medical consultations** and **treatments** pose a **significant financial burden**. This financial strain further **compounds** the **struggles** of the community, **emphasizing** the **urgent need** for **improved healthcare services** and **preventive measures** in **flood-prone** areas.

Health issues faced by waste pickers during flooding

Almost all waste pickers settlements reported the prevalence of health issues varying from **common ailments** to **serious infections** during the events of flooding.
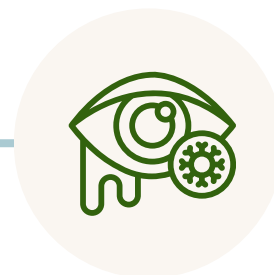
Common ailments:

COLD

COUGH

**FEVER & FLU**

Infections:

TYPHOID

DENGUE

EYE INFECTION

Navigating health care during flooding:

The **affordability** and **availability** of medical care services during flooding events **significantly impact** the **health** outcomes of waste pickers. To understand their health-seeking practices during such emergencies, we asked residents where they go for medical assistance.

■ Private ■ Government

13

9
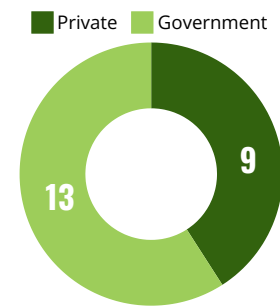
"The community usually visits the nearby hospital and the doctor if there is a common cold or cough and it usually costs about Rs 2000 -Rs 3000. But, usually, the doctor suggests taking tests and consulting again. If it's a serious illness like typhoid, dengue, etc., it costs about Rs 8000-Rs 9000"

The **data indicates** a **significant** reliance on **government healthcare facilities**, with the majority of residents seeking treatment from these institutions. **Government hospitals** often provide the most **accessible** and **affordable** care, especially for common ailments and general medical needs. However, there are challenges such as long wait times, **overcrowded facilities**, and **limited resources**, which can **impact** the **quality** and **immediacy** of care. Despite these limitations, for many residents, especially those facing financial constraints, government healthcare remains the most viable option.

At the same time, **private healthcare** providers also play a **vital role** in the **community's health** strategies. Residents who can afford it, or who **need** more **specialized** or **urgent care**, turn to **private clinics** or **hospitals**. These facilities often offer faster treatment, better infrastructure, and more personalized care. However, the higher cost associated with private healthcare means that only a portion of the community can consistently access these services.

This **mix** of reliance on both **government** and **private** healthcare highlights the community's **adaptive strategies** to **navigate** the **strengths** and **limitations** of each system. For many, healthcare choices are **shaped** by a **balance** between **cost**, **accessibility**, **wait times**, **previous experiences**, and the **perceived quality of care**. Following the flooding, these factors become even more critical, as residents face not only the usual healthcare challenges but also the increased risks of infections, injuries, and diseases brought on by the disaster. The floodwaters often leave the community more vulnerable, forcing residents to make quick and sometimes difficult decisions about where to seek care in the midst of such emergencies.

Responses from the community

Cold, cough, fever is very common during the flooding. It gets hard us to even go to the toilet.

When monsoon comes kids fall sick one after the other. One or the other health issue will be there.

Ellru kannella hengagide nodi, ondu maneyalli mooru nalku mane avru malkondidivi night time alli.

3.4 IMPACT ON HOUSING

Housing is a crucial component of livelihoods and remains a significant aspiration for many individuals. During devastating disasters, housing is often one of the most affected components, playing a vital role in protecting people's lives. In analyzing flooding in vulnerable communities, surveys and interviews were conducted with waste picker communities to understand their housing typologies, construction styles, and their impact on urban flooding.

Housing typologies and construction styles:

The study **observed** that these communities **predominantly** have **kuccha houses**, which are **temporary** structures made from **locally** available **materials** which make the communities more vulnerable and precarious to flooding. The most common construction materials include **wooden supports**, **tarpaulin** or **cement sheets** for roofing, and **cement blocks** or stones for walls. **Migrant communities** often use materials such as **cloth**, **carton boxes**, and **metal or tin sheets** for wall construction.

Further, migrant communities typically construct their houses in a **linear pattern**, attaching units together to save materials and time, given the **space constraints**. These **linear constructions** often **lack windows** or **ventilation**, with each unit having only **one** opening used as a door, usually made of **metal or tin** sheets. In contrast, local communities often use **wooden doors**.

Local communities generally **do not** use their household spaces for **work-related activities**, except for a few where **collected hair** or **waste** needs to be **stored** before selling. **Migrant communities**, however, often set up housing units **adjacent** to waste collection and storage godowns due to **space constraints** and the **high cost** of living in cities like Bengaluru.
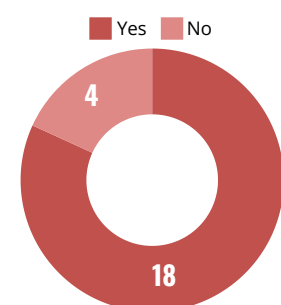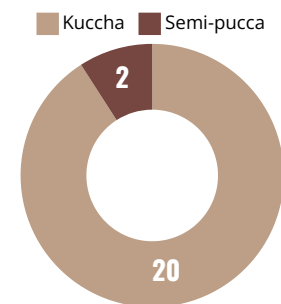
The typical house comprises a kitchen, common living and bedroom space, and a bathroom. These units are constructed by takedars and, in some cases, rented out to laborers working in the godowns.

ENTRY	*ENTRY*	*ENTRY*	*ENTRY*	*ENTRY*
HOUSING UNIT 1	HOUSING UNIT 2	HOUSING UNIT 3	HOUSING UNIT 4	HOUSING UNIT 5

Storage on upper level used during flooding

Masonry wall built with locally available materials

Metal sheets used for walking system- majorly used in migrant communities

In some communities, doors are made of wood or metal sheets, while in other, a cloth curtain serves as the door

LIVING & BEDROOM SPACE

TOILET

KITCHEN

Structural vulnerability and Repairs

A **disadvantage** of the **interconnected units** is that if there is structural damage, such as a timber pole needing replacement, the repair can only be done from the exterior to a **limited extent**. **Replacing** it requires **dismantling** the entire **unit**.

During heavy, continuous rains, these units are **highly vulnerable** to disasters and tend to **collapse**. **Common damages** include roofing and walling sheets being blown away by **heavy winds** and **rain**. Additionally, issues like rodents and reptiles entering the houses during flooding are prevalent.

Rebuilding these shelters requires significant effort and resources, taking anywhere from **1-2 days** to **1-2 months**. Major materials replaced post-disaster typically include **tarpaulin sheets** and **timber poles**. In some cases, leveling the ground is also necessary.

1 Week   1 - 2 Days
2 - 3 Days
1 - 2 Months

4
8
3
7
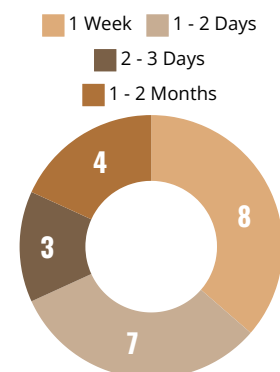
3.5 IMPACT OF FLOODING ON LIVELIHOOD

The settlement survey reveals that nearly all waste pickers have raised concerns about the severe impact of flooding on their livelihoods. Flood episodes **disrupt** their **work schedules**, **damages** the collected waste materials, which thereby leads to **loss in income**, exacerbating their **financial vulnerability**. This chapter delves into the challenges faced by the waste pickers highlighting the multifaceted repercussions of floods on work, income, and expenditure.

"It takes the whole day to dry the water, the water remains for 2 days, sometimes it remains for more than a week, when it rains every day, it becomes difficult to go outside, one cannot even go to work"
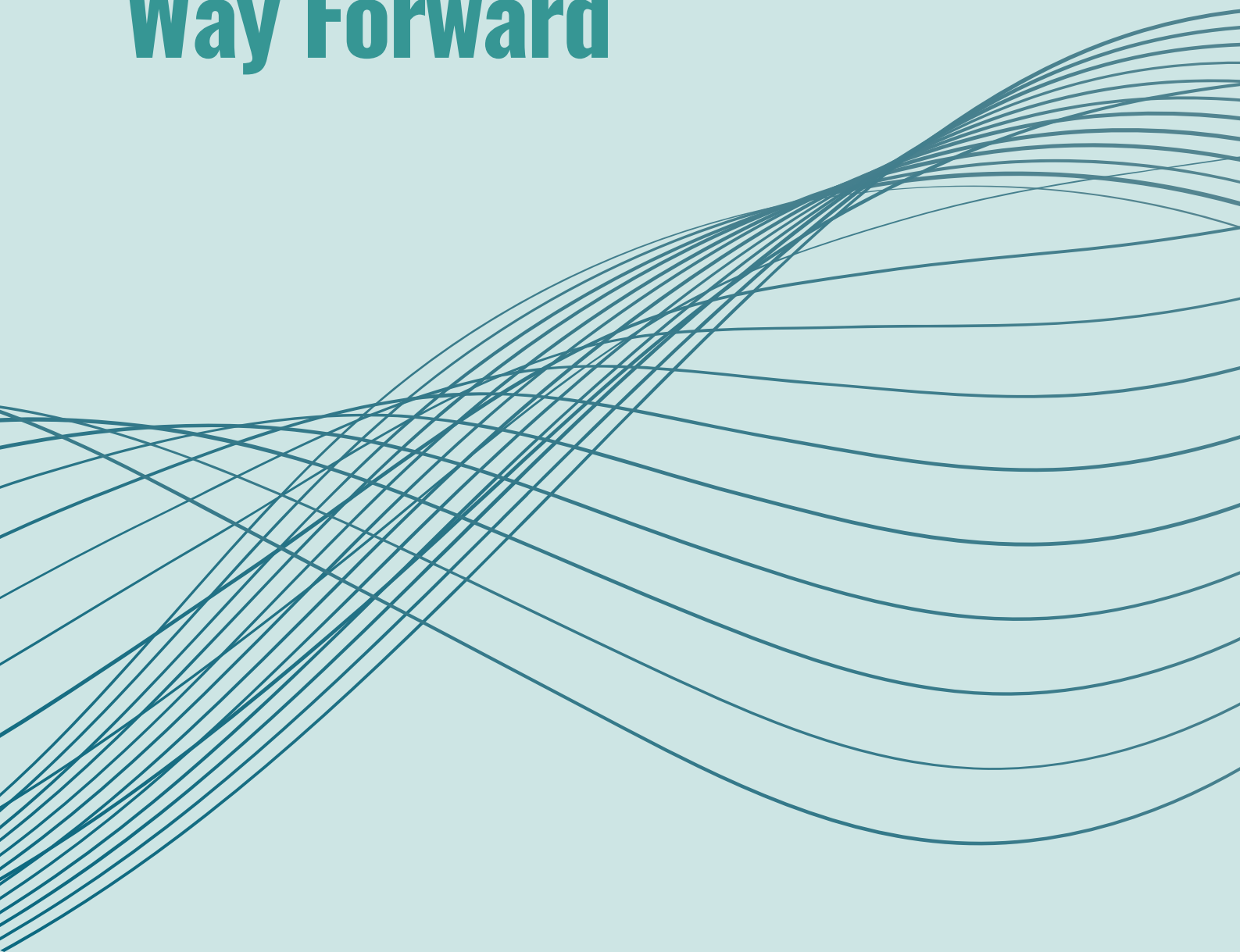
 - Migrant Waste picker from Belagare

"Last year (before last year's Eid) we faced more water problem. Every item gets wet,earlier we used to stock the goods, now we don't stock goods in the rainy season, now we sell them immediately after sorting"
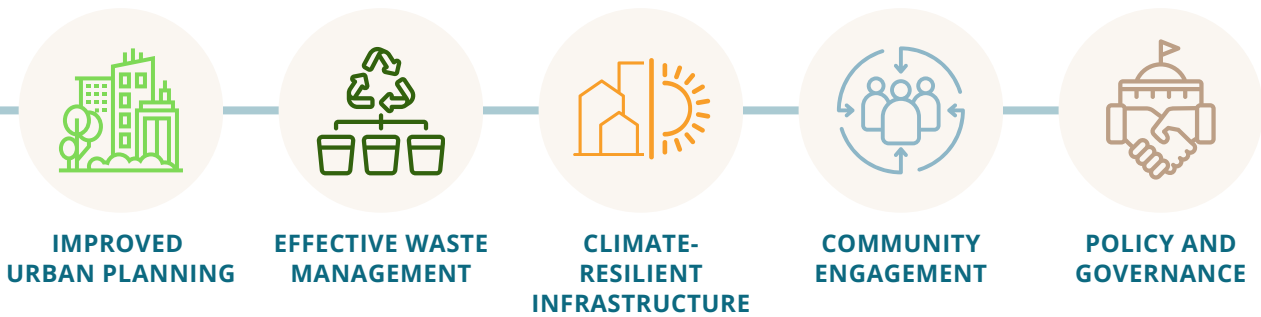
Chapter 4:
Recommendations & Way Forward

4.1 RECOMMENDATIONS

To mitigate the risks associated with urban flooding, it is crucial to adopt a holistic approach that includes:

| IMPROVED URBAN PLANNING | EFFECTIVE WASTE MANAGEMENT | CLIMATE-RESILIENT INFRASTRUCTURE | COMMUNITY ENGAGEMENT | POLICY AND GOVERNANCE |

Moving towards a Comprehensive Flood Risk Management Strategies:

The risks of flooding is demonstrated throughout this report which shows an urgent need for attention from the Policymakers to look into the existing implementation scenario of disaster management guidelines. We have tried to highlight the need to create a holistic framework with diversification, coordination and alignment of different stakeholders. **Flood Risk Management Strategies (FRMS)** such as Flood risk prevention, Flood defense, Flood risk mitigation, Flood preparation and Flood recovery are unraveling in the ground without any proper mechanism.

To mitigate the impact of floods, the state needs to develop and adopt **comprehensive** Flood Risk Management Strategies that do not just involve the mere technical step of building flood defences and developing flood warning systems but also consider it as a matter of societal transformations and successful governance approaches (Peter P J,). This approach provides a space to move towards a resilient Flood risk Governance, which is crucial for informal settlements.

Climate change poses severe challenges, with urban heat island effects, poor urban planning and urban flooding intensifying the existing condition. The informal settlements living in marginal areas face the brunt of these disproportionate impacts due to their limited access to essential services.

The urban flood assessment report drafted with significant surveys, interviews from experts coupled with the findings and case study highlight the critical need for drafting key flood management strategies.

Improved Urban Drainage System

Informal settlements often lack proper stormwater drainage systems and connections to citywide water discharge networks. This absence leads to waterlogging and worsens the flooding situation. The original drainage systems in Bengaluru relied on interconnected lakes and channels, but rapid urbanization, poor planning, and expanding infrastructure have disrupted this system. Climate change and increased rainfall have compounded these challenges, creating an urgent need to upgrade the stormwater drainage network. Recommendations include:

Localised Drainage Design:

Plan and develop drainage systems at the ward or community level to manage waterlogging, factoring in the topography and watershed characteristics of each area.

Traditional Drainage Revival:

Restore and preserve the traditional tank ecosystem and rajakaluve channels (drainage channels between tanks) to improve water flow and mitigate flooding, especially in areas with slower drainage due to flat terrain and clay-rich soils.

Road and Cross-Drainage Infrastructure:

Improve cross-drainage infrastructure on roads to prevent water buildup in low-lying areas. Prioritize robust stormwater drainage in secondary and tertiary channels to prevent overflow and localized flooding.

Mitigation Strategies for Informal Settlements

Low-income and migrant communities often occupy flood-prone areas, making them more vulnerable to waterlogging and associated health risks. Mitigation strategies should include:

Temporary Relocation and Emergency Shelters:

Develop plans for temporary relocation to higher ground during floods. Identify and prepare accessible shelters with basic facilities to protect residents.

Access to Essential Services:

Post-flood recovery must prioritize access to clean water, sanitation, and healthcare services. Quick sanitation solutions, such as fumigation, chlorination, and vector control, can minimize the health impacts of waterlogging, preventing outbreaks of waterborne diseases and infections.

Customised Flood-Resistant Housing Solutions:

Encourage construction of flood-resistant structures, such as houses on stilts, where feasible. For informal settlements near water sources, implement temporary physical modifications like raised plinths to reduce flood exposure.

Community Engagement and Knowledge Integration

Local knowledge and community participation are essential to developing effective, location-specific flood mitigation strategies. Key recommendations include:

Leverage Local Knowledge:

Integrate the lived experience and insights of residents who are familiar with local flooding patterns, drainage bottlenecks, and other vulnerabilities in the design of flood mitigation plans.

Community Preparedness and Awareness:

Equip communities with early warning systems, such as the MeghaSandesha app, which provides rainfall alerts. Distribute emergency kits that include items like torches, ropes, mosquito repellents, and chlorine tablets to enhance community preparedness and safety during floods.

Empowering communities:

This involves actively engaging residents in participatory planning processes to ensure their voices are heard and their unique needs are addressed. This approach includes developing adaptation and mitigation strategies that are led by community members, with necessary technical and financial support provided by external agencies. Additionally, localized grievance redressal systems should be introduced to promptly address drainage and flooding issues, fostering a sense of ownership and resilience within the community.

Multi-Stakeholder Collaboration

Effective flood management requires a collaborative approach among NGOs, government bodies, civic groups, and private developers. Recommendations include:

Engage Diverse Stakeholders:

Local organizations and NGOs can act as intermediaries between communities and the government. Additionally, the collaboration between NGOs, government bodies, and civic groups should focus on flood preparedness, response, and recovery strategies. The rainwater harvesting by-law, which mandates on-site rainwater retention, is an example of an initiative that can reduce stormwater runoff at the source.

Ward-Level Planning and Community Involvement:

Ward committees should be empowered to develop and implement local flood management strategies, involving both the victims of flooding and the contributors to stormwater flow (e.g., private landowners) in a coordinated, ridge-to-valley watershed management approach.

Enhanced Private Sector Responsibility:

Mandate or incentivize private developments to retain or detain stormwater through rainwater harvesting, recharge wells, and detention basins. Reducing runoff from private properties can alleviate the strain on public drainage infrastructure.

Flood Risk Management and Governance

Addressing flood risk in Bengaluru requires a comprehensive approach that integrates technical, social, and policy-based solutions. Key recommendations include:

Comprehensive Flood Risk Management:

Move beyond technical fixes to address root causes such as inadequate land use policies and lack of equitable access to flood-safe land for informal settlers. Prioritizing flood risk governance will help build resilience, especially in vulnerable communities.

Inclusive Policy Development:

Policies should support equitable urban planning, ensuring that informal settlements are integrated into city-wide flood management strategies. Addressing inequities in resource distribution and access to safe land is crucial for sustainable, inclusive flood resilience.

Dual Strategies of Retention and Detention:

Implement stormwater retention (e.g., through rainwater harvesting) and detention (e.g., detention ponds) across private and public sectors. This approach slows runoff, reduces flooding risks, and supports groundwater recharge.

Strengthening Disaster Preparedness and Recovery

Improving flood resilience requires targeted investments in emergency response infrastructure and tailored disaster preparedness plans for each community.

Community-Specific Plans:

Tailor disaster management plans to address each community's unique geographic, infrastructural, and socio-economic factors. Combining local knowledge with technical expertise ensures that flood responses are relevant and effective.

Invest in Emergency Response Infrastructure:

Ensure that flood shelters, accessible evacuation routes, and early warning systems are available in vulnerable areas. To avoid nighttime fatalities from building collapses during heavy rain, emergency infrastructure should be prioritised in low-lying neighbourhoods.

Rapid Health and Sanitation Interventions:

After floods, deploy quick-response teams to affected areas to implement fumigation, chlorination, and vector control measures. Provide communities with mosquito nets, repellent, and clean drinking water to reduce health risks from stagnant water.

Urban Resilience Planning:

- Incorporate informal settlements into broader urban planning frameworks.
- Ensure connectivity to citywide drainage and infrastructure networks.
- Use geographic information systems (GIS) to map vulnerable areas and plan targeted interventions.

Sustainable Relocation Plans

In cases where relocation is the only viable solution, ensure that it is conducted respectfully and equitably:

Safe and Secure Relocation:

Engage communities in relocation planning to build consent and identify locations that provide better living conditions. Ensure that relocated areas have resilient infrastructure to prevent future vulnerability.

Temporary Shelters and Safe Zones:

Identify and establish safe zones on higher ground within or near vulnerable communities for temporary relocation during floods. This helps minimise disruption to residents' lives while protecting them from flood hazards.

Climate-Resilient Infrastructure

To withstand the effects of climate change, urban infrastructure must be designed with resilience in mind. Recommendations include:

Green Infrastructure and Permeable Surfaces:

Promote sustainable urban development that incorporates green infrastructure, such as permeable surfaces, retention ponds, and rainwater harvesting systems, to manage stormwater and reduce surface runoff.

Flood Prevention and Preparedness:

Implement comprehensive flood risk management strategies, including retention and detention of stormwater, to prevent and reduce the impact of flood events. Develop physical flood defences, such as levees, and prepare flood-prone communities with early warning systems and robust disaster response plans.

Settlement Recognition and Upgradation:

- Recognize informal settlements as integral to the urban fabric and prioritize their development.
- Gradually provide basic services and amenities to improve living conditions and resilience.
- Invest in durable infrastructure projects, such as underground drainage systems, for high-risk settlements.

4.2 WAY FORWARD

Flood Risk Management and Governance

Comprehensive Flood Risk Management Strategy:

Bengaluru must adopt a holistic approach to flood management, addressing it not only as a technical challenge but as a societal issue requiring transformation in governance, land use, and infrastructure planning. A shift towards flood risk governance, particularly for informal settlements, will ensure resilience and reduce the long-term impacts of floods.

Capacity Building and Training:

Capacity building is essential for enhancing resilience in flood-prone areas. Hasiru Dala has implemented a flood training program for residents in vulnerable communities, tailored to the needs of both migrant and local populations. This program equips residents with practical strategies to mitigate risks prior to catastrophic flooding. Local governments must also support such initiatives by providing resources to assist flood-prone settlements, enabling them to better manage and mitigate risks. Partnerships with NGOs and academic institutions can offer data-driven recommendations to inform effective policy implementation, creating a stronger foundation for long-term flood management strategies.

Inclusive Policy Development:

Policies should emphasize inclusive urban planning, ensuring informal settlements are integrated into city-wide flood management strategies. Addressing the inequities faced by these communities is essential to ensure a fair distribution of resources and attention. Anti-encroachment drives, often carried out under the guise of flood protection, threaten these vulnerable populations and must balance environmental management with their rights.

Documentation and Knowledge Sharing:

Effective flood management requires robust documentation and the sharing of knowledge. Key actions include:
- Studying and replicating successful flood management practices from states like Odisha and Assam.
- Leveraging local and traditional knowledge to inform policies and practices.
- Creating centralized databases that document flood risks, community assets, and intervention outcomes to support evidence-based decision-making.

Strengthening Disaster Preparedness and Recovery

Develop Community-Specific Plans:

Each community faces unique challenges based on its geography, infrastructure, and socio-economic conditions. Disaster management plans must be tailored to these specific needs, integrating local knowledge with technical expertise. Insights from Hasiru Dala's training sessions demonstrate that context-specific interventions are crucial for effective preparedness and resilience.

Build Emergency Response Infrastructure:

Investing in robust emergency response infrastructure is critical. Hasiru Mane has initiated the construction of temporary relief shelters in flood-prone communities, including two permanent and ten makeshift units. These shelters serve as emergency relief measures during disasters and as community centers in non-disaster times. To address prolonged inundation scenarios, four rainwater harvesting recharge pits have been constructed across three vulnerable communities to improve water management and reduce future flooding risks.
Additional investments should focus on:
- Building accessible flood shelters with necessary provisions.
- Developing clear access routes for emergency evacuations.
- Implementing effective early warning systems to alert communities of impending floods.

Comprehensive Risk Management:

Upgrading drainage systems, reviving traditional water channels, and developing flood-resistant housing solutions for vulnerable communities are essential steps forward. Integrating informal settlements into flood management strategies, ensuring timely and transparent compensation mechanisms for flood victims, and strengthening coordination among NGOs, government bodies, and community organizations will create a more inclusive and effective framework.

Community Engagement:

Community engagement remains at the heart of successful flood management. Empowering communities with early warning systems, emergency kits, and participatory planning processes enhances preparedness and resilience. Leveraging local knowledge ensures interventions are context-specific and practical.

Data Collection for Flood Analysis

To better understand and address flooding challenges, data collection must focus on key areas:

1. Monitoring decadal changes in flood patterns to track shifts over time.
2. Assessing impact trends, particularly the rise in flood levels and the expansion of affected areas.
3. Conducting damage and loss assessments to quantify economic and social impacts.
4. Documenting response mechanisms to capture insights into actions taken by communities and governments.

Chapter 5:
Annexure
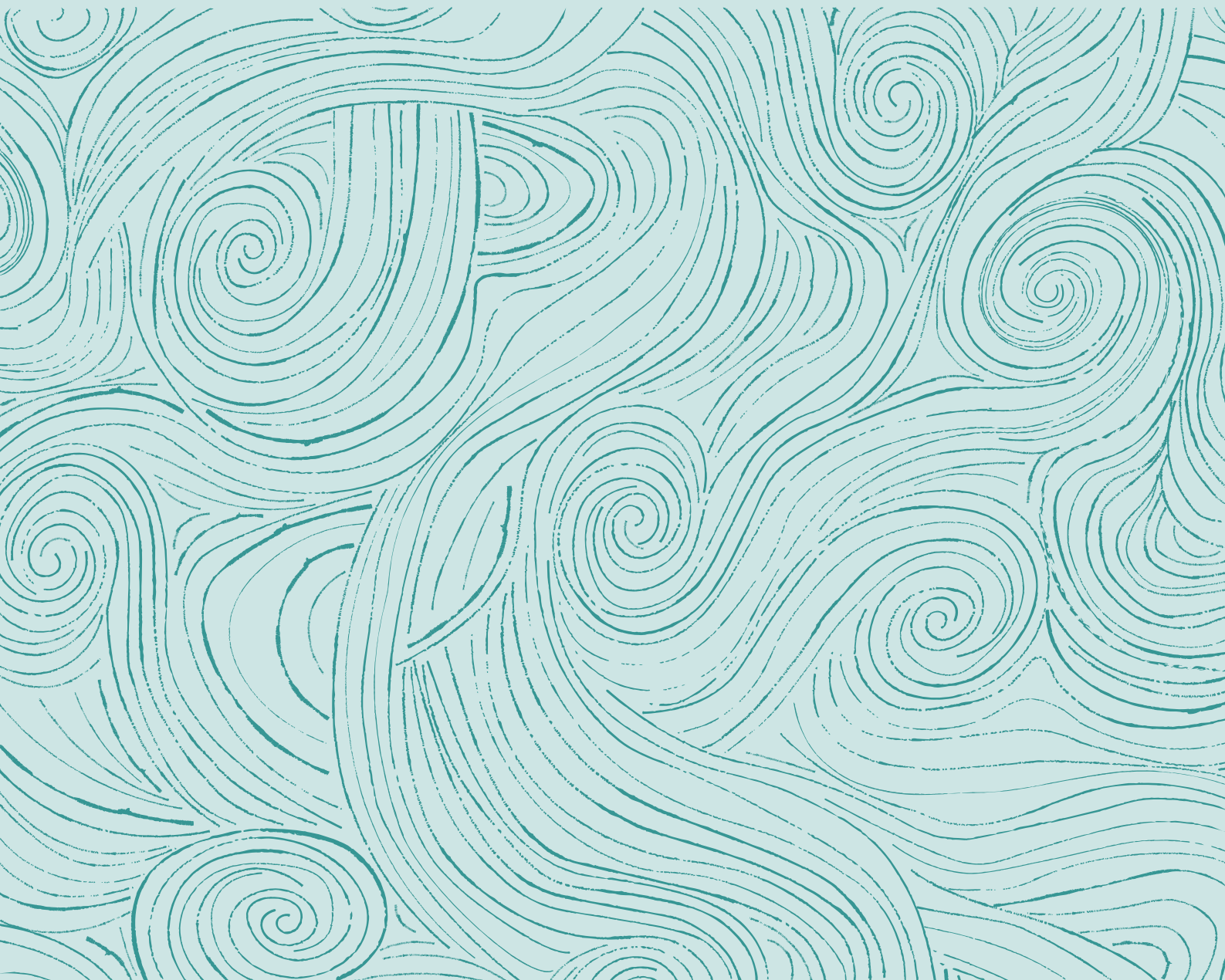
5.1 FACT SHEET

VINAYAKA NAGAR

Site Condition

- The community resides on utmost flat land and slopes towards one end of the settlement were it is connected to the drain.
- There is a nearby lake present in the vicinity, although does not affect the flooding situation in the settlement.

Flooding condition

Before floods	During floods	Post floods
- Excavating trench for water to drain towards the main drain channel. - Filling up the slope of the settlement.	Overflowing and clogged drainage. Water Inundation for about 2 weeks - 1 month	Reconstructing roof and collapsed walls. Drying the household items and cleaning the house

Socio-demographic data

15 families

Migrated from Bagepalli

Waste picking, hair picking and selling of broomsticks

Kannada, Tamil and Telugu

Kuccha houses

Rajakaluve beside the community.
KR puram lake - 100m

Illegal connection

Water tankers

No planned drainage;

heavy rainfall : 2022

During monsoon, clogged drainage and slope of the settlement

Fills upto foot

Vulnerability Index

SIDDHARTHA COLONY

Site Condition

- The site were the community resides is a chunk of land occupied in between the industrial region.
- The site is surrounded by factories and a open drain at the other end, while a small school is attached at the rear end of the settlement.

Flooding condition

Before floods	During floods	Post floods
Creating bunds in front of the house.	Overflowing and clogged drainage from the open drain Water Inundation within 10mins of continuous rainfall	Cleaning the houss with water filled Cleaning the drains.

Socio-demographic data

- 100 families
- Migrated from Yadgiri
- Men: Construction workers
  Women: Waste pickers
- Kannada, Telugu, Tamil and Hindi
- Semi pucca houses
- Main drain channel right beside the community
- No Electricity
- Public water tap
- No planned drainage;
- heavy rainfall : 2019 - 2022 ; 700 mm
- During monsoon, clogged drainage
- Fills upto minimum 2'
  Fills upto maximum 6'

Vulnerability Index

THYAMAGONDLU

Site Condition

- The community resides on utmost flat land and slopes towards one end of the settlement were it is connected to the drain.
- There is a nearby lake present in the vicinity, although does not affect the flooding situation in the settlement.

Flooding condition

Before floods	During floods	Post floods
Excavating trench for water to drain towards the main drain channel.	Overflowing and clogged drainage. Water Inundation for about 2-3 hours.	Reconstructing roof and collapsed walls. Cleaning the drains.

Socio-demographic data

23 families

Migrated from North Karnataka

Men: Labourers
Women: Waste pickers

Kannada, Tamil and Telugu

Semi pucca houses

Thippesettihalli - 200m

No Electricity

Public water tap

No planned drainage; sloped at 1m

heavy rainfall : 2019 ; 897mm

During monsoon, clogged drainage

Fills upto foot

Vulnerability Index

K A D A B U G E R E

Site Condition

- The site were the community is located towards the highway.
- The site is surrounded by empty plot on one side and petty shops on the other side, while front lays the Magadi Main road and rear end is towards residential buildings.

Flooding condition

Before floods	During floods	Post floods
- Excavating trench for water to drain towards the main drain channel. - Building bunds arounf the house with mud.	Overflowing and clogged drainage. Water Inundation for about 2 - 3 hours.	Reconstructing roof and collapsed walls. Drying the household items and cleaning the house

Socio-demographic data

27 families

Migrated from Davangere and Hassan and parts of Andhra pradesh

Waste picking

Kannada, Telugu and Tamil

Kuccha houses

-

No electricity connection 3 house powered with solar

Public water tank

No planned drainage;

heavy rainfall : 2018 737 mm

During heavy rainfall, clogged drainge

Fills upto foot

Vulnerability Index

NELAMANGALA

Site Condition

- The community resides on utmost flat land and is situated right outside the landfill.
- The land slopes from the landfill to the end of the highway. The community is in between and is comparatively not much affected by flood.

Flooding condition

Before floods	During floods	Post floods
- Excavating trench for water to drain towards the main drain channel.	Overflowing water through the slope and heavy winds lifting up the roofs.	Repairing the tarpaulin sheets and setting the roofs.

Socio-demographic data

- 9 families
- Migrated from shimoga and shira
- Waste picking and farm labourers
- Kannada, Telugu and Tamil
- Kuccha houses
- No electricity connection
- Using the Borewell inside landfill
- No planned drainage;
- heavy rainfall : 2018 653mm
- During monsoon, heavy winds
- Fills upto foot

Vulnerability Index

KONAPPANA AGRAHARA

Site Condition

- The site is accessed through a cemented road with plantation around.
- The water from the settlement drains to nearby waterbody just few steps within the settlement (10m).

Flooding condition

Before floods	During floods	Post floods
	Overflowing and clogged drainage.	Clearign the inundated water from the houses.
	Water Inundation for about 2-3 days.	

Socio-demographic data

- 18 families
- Migrated from Andhra pradesh
- Hair picking
- Kannada, Tamil and Telugu
- Kuccha houses
- Drain at the rearend of the community (10m)
- Illegal connection
- Public water tap
- No planned drainage;
- heavy rainfall : 2018 750mm
- Overflowing drain nearby during monsoon
- -

Vulnerability Index

SHIRKE

Site Condition

- The site is located on a corner plot having roads on all 3 sides and houses at one side.
- The settlement is at a lower level than the road but has a newly constructed drain along the road.
- The water from the settlement drains to nearby Rajakaluve at about

Socio-demographic data

8 families

Migrated from Tumkur - Turuvekere, Bellurur- cross, Tiptur - Kodihalli

Hair picking

Kannada, Telugu and Marathi

Kuccha houses

Storm water drains on all corners

No Electricity

nearby construction sites and houses.

No planned drainage; Open defecation

heavy rainfall : 2018; 750 mm

During monsoon, waterlogged marshy sands in their settlement

Flooding condition

Before floods	During floods	Post floods
Construction of a mud-wall barrier at the periphery of the settlement.	Overflowing and clogged drainage from the open drain Settlement stays inundated from the effect for 30 minutes.	Cleaning the houses with water filled

Vulnerability Index

HAKKI PIKKI COLONY

Site Condition

- The site were the community is located interiors of the village.
- The site is accessed through a cemented road with plantation around.
- The water from the settlement drains to nearby waterbody just few steps within the settlement (10m).

Flooding condition

Before floods	During floods	Post floods
No preparation strategy	Overflowing ponds nearby the shelter. Water Inundation for few hours	Reconstructing roof and collapsed walls. Cleaning the drains.

Socio-demographic data

35 families

Migrated from Kengeri Uppanagar, Davangere, Chelekere

Hair picking

Kannada, Tamil and Telugu

Kuccha houses

-

No Electricity

Public water tap

No planned drainage;

heavy rainfall : 2018

During monsoon, overflowing water-body and high winds

Fills upto foot

Vulnerability Index

MUNEKOLALU

Site Condition

- The site is on Munnekolalu Road and accessible by private vehicles.
- A water drain is about 300m away, connecting to Varthur Lake at 700m; the settlement is sloped from all ends.
- Roads to households flood, halting movement around the community.

Flooding condition

Before floods	During floods	Post floods
Excavating trench for water to drain towards the main drain channel.	Overflowing and clogged drainage. Water Inundation for weeks upto 1 month.	Drainign the water from the community through motors. Rebuild the structure

Socio-demographic data

800 families

Migrated from West bengal, Bihar, Nepal, Assam

Men: Waste picking & Sorting
Women: Sorting , Housekeeping

Assamese, Bengali and Hindi

Kuccha houses

Varthur lake - 700m

Metered per settlement

Borewell

No planned drainage; sloped at 1m

heavy rainfall : 2019 ; 897mm

During monsoon, clogged drainage

Fills upto waist height

Vulnerability Index

C H I R A N J E E V I   L A Y O U T

Socio-demographic data

- xx families
- Migrated from Delhi and other parts of North-East India
- Waste picking
- Hindi and Bengali
- Kuccha houses
- Storm water drain (rajakaluve) beside; Hebbal lake - 300m
- Metered connection by the Land owner; only for 2 hours
- Private water tankers
- No planned drainage;
- heavy rainfall : 2005 1625.63 mm
- During heavy rainfall, clogged drainge
- Fills upto knee

Site Condition

- The site were the community is located towards the highway.
- The site is surrounded by empty plot on one side and petty shops on the other side, while front lays the Magadi Main road and rear end is towards residential buildings.

Flooding condition

Before floods	During floods	Post floods
-Excavating trench for water to drain towards the main drain channel. -Building bunds around the house with mud.	Overflowing and clogged drainage. Water Inundation for about 2 - 3 hours.	Reconstructing roof and collapsed walls. Drying the house-hold items and cleaning the house

Vulnerability Index

BELEGERE

Site Condition

- The site is located at Belegere near BWSSB treatment plant.
- The Artery of the main drain channel runs in the community.

Flooding condition

Before floods	During floods	Post floods
No prior preparation	Stacking up household materials at an elevated space.	Repairing and rebuilding the entire shelter

Socio-demographic data

900 families

Migrated from West-Bengal

Waste picking, House-keeping, Cooking and Delivery partners

Hindi and Bengali

Kuccha houses

Between two drian channel - Varthur and Bellandur lake

Limited metered connection

External water tankers

No planned drainage; Temporary toilets

heavy rainfall : 2018 653mm

During heavy rains, overflow from nearby drains and blockages in the drainage system

Fills upto foot

Vulnerability Index

HULIMANGALA

Site Condition

- The site is accessed through a cemented road with plantation around.
- The water from the settlement drains to nearby waterbody just few steps within the settlement (10m).

Community

Flooding condition

Before floods	During floods	Post floods
	Overflowing and clogged drainage. Water Inundation for about 2-3 days.	Clearign the inundated water from the houses.

Socio-demographic data

- 18 families
- Migrated from Andhra pradesh
- Hair picking
- Kannada, Tamil and Telugu
- Kuccha houses
- Drain at the rearend of the community (10m)
- Illegal connection
- Public water tap
- No planned drainage;
- heavy rainfall : 2018 750mm
- Overflowing drain nearby during monsoon
- -

Vulnerability Index

VISHWA PRIYA LAYOUT

Site Condition

- The community is spread out within the residential layout.

Flooding condition

Before floods	During floods	Post floods
- Constructing bunds in front of houses to prevent water entry. - Clearing waste and creating drainage channels for water flow.	- Overflowing and clogged drainage from the open drain. - Settlement stays inundated from the effect for 1 day.	- Clearing the inundated area.

Socio-demographic data

- 20 families
- Migrated from West-bengal and Uttarpradesh
- Waste sorting
- Hindi and Bengali
- Kuccha houses
- approx. 250m to Chikka Begur Lake
- Limited Metered connection
- External water tanker
- Temporary toilets near Rajakaluve
- Heavy rainfall : 2022
- During heavy rains, overflow from nearby drains and blockages in the drainage system
- Fills upto knee

Vulnerability Index

K O P P A   R O A D

Site Condition

- The site is accessible by private vehicles and is next to NICE Road.
- A water body is 250 meters away.
- The settlement slopes from NICE Road and the access road.

Community

Flooding condition

Before floods	During floods	Post floods
Gather all the collected waste and store it in a safe location.	- Clear drain channels, dig trenches, and ease run-off flow.	Clearing the inundated water from the houses.
Place all items in higher storage.	- Water inundation lasts 8-9 days.	Drying the collected waste

Socio-demographic data

	7 families
	Migrated from Assam
	Waste picking
	Assamese, Bengali and Hindi
	Kuccha houses
	Doddkamanahalli Lake
	1 Metered connection
	Metered pays monthly to Thekedar
	No planned drainage;
	-
	Heavy monsoon rains, improper drainage.
	Fills upto foot

Vulnerability Index

BETTADASAPURA

Socio-demographic data

 60 families

 Migrated from West-bengal and Uttarpradesh

 Waste picking and sorting

 Bengali, Hindi and partly Kannada

 Kuccha houses

 Vittasandra lake at 500m

 No Electricity connection

 External water source

 No planned drainage;

 heavy rainfall : 2020 1608mm

 Water flowing from elvated road to the settlement

 -

Site Condition

- The settlement is located on the main road connecting hulimangala main road.
- Vittasandra lake is within 500m from the community.
- The community is sloped from the main road to the settlement.

Flooding condition

Before floods	During floods	Post floods
Dig trenches to link the settlement with Vittasandra Lake for better drainage. The community sells waste materials before the rains.	The community stacks household items on elevated surfaces within the shelter.	Clearing the inundated water from the houses.

Vulnerability Index

KODTHI

Site Condition

- The site is accessed through a cemented road with plantation around.
- The water from the settlement drains to nearby waterbody just few steps within the settlement (10m).

Flooding condition

Before floods	During floods	Post floods
	Overflowing and clogged drainage. Water Inundation for about 2-3 days.	Clearign the inundated water from the houses.

Socio-demographic data

- 200 families
- Migrated from Andhra pradesh
- Hair picking
- Kannada, Tamil and Telugu
- Kuccha houses
- Drain at the rearend of the community (10m)
- Illegal connection
- Public water tap
- No planned drainage;
- heavy rainfall : 2018 750mm
- Overflowing drain nearby during monsoon
- -

Vulnerability Index

R A Y A S A N D R A

Socio-demographic data

 5 families

 Migrated from Assam, Delhi and Kolakta

 Waste picking

 Assamese, Hindi and Bengali

 Kuccha houses

 -

 Metered connection

 Water tanker & Water dispenser

 No planned drainage

 heavy rainfall : 2018

 During monsoon, overflowing water-body and high winds

 Fills upto foot

Site Condition

- The site is located is accessed from Kadubeesanahalli road through a private vehicle.

The settlement resides on private land, for which the residents pay rent to the landowner. Both their workplaces and homes are located in the same vicinity.

Flooding condition

Before floods	During floods	Post floods
No preparation strategy	Improper drainge inundates the community. Water Inundation for few hours	Reconstructing roof and collapsed walls. Clearing the workplace

Vulnerability Index

SHAKTHIMAN GODOWN

Socio-demographic data

 6 families

 Migrated from Delhi

 Waste picking

 Hindi and Bengali

 Kuccha houses

 -

 Illegal connection

 Public water tap

 Drain at the rearend of the community

 heavy rainfall : 2018 750mm

 Overflowing drain nearby during monsoon

 -

Site Condition

- The site is accessed through a cemented road with plantation around.
- The water from the settlement drains to nearby waterbody just few steps within the settlement (10m).

Flooding condition

Before floods	During floods	Post floods
	Overflowing and clogged drainage. Water Inundation for about 2-3 days.	Clearign the inundated water from the houses.

Vulnerability Index

VEERANANNAPALYA

Socio-demographic data

 15 families

 Migrated from West Bengal and Uttarpradesh

 Waste picking

 Bengali and Hindi

 Kuccha houses

 Nagavara lake

 Metered connection

 Water tanker

 No planned drainage;

 heavy rainfall : 2018 800mm

 Heavy monsoon rain and improper drainage

 -

Site Condition

- The site is accessed by bus or any private vehicle.
- The settlement is very close to the National Highway 44.
- The land is sloped towards the road.

Flooding condition

Before floods	During floods	Post floods
Gather all the collected waste and store it in a safe location. Place all items in higher storage.	Overflowing and clogged drainage. Water Inundation for about 2-3 days.	Clearing the inundated water from the houses. Drying the collected waste

Vulnerability Index

5.2 TRAINING MODULES

To go through our training modules, scan the QR code below

5.3 COMMUNITY INTERVENTIONS   *(CASE STUDY)*

Makeshift Shelter

Introduction

Hasiru Dala's mission to support vulnerable communities in informal settlements extends to developing sustainable and resilient makeshift shelters. By integrating community insights, the initiative addresses critical needs for flood and wind-resistant shelters while ensuring affordability and practicality. Emphasizing the use of sustainable, context-sensitive materials, Hasiru Dala explores innovative solutions like modular shelters and durable alternatives to tarpaulin. These designs prioritize sturdiness, safety, and comfort, reducing long-term maintenance costs for the community.

Proposed shelter Design

for temporary shelters, integrating the modular frame structures with robust roofing and walling materials.

To enhance durability and climate resilience, the Multi Layeres Plastic recycled boards with Slotted angles as materials have been utilised for the structure.

Other makeshift housing options, such as tent-like structures, have been explored to ensure quick adaptability during disasters.

Siddhartha Colony   *(CASE STUDY)*

Siddhartha Colony, located in Peenya, is home to approximately 100 families residing in semi-pucca houses. The male population primarily works in factories, godowns, or as construction workers, while women engage in waste picking and sorting at nearby centers. The community occupies a parcel of land situated within an industrial region and has been established as a notified slum for 20 to 30 years.

The community lacks electricity supply and relies on two public water taps located at either end of its boundary for water access. Additionally, a drainage system connects the community to a lake approximately 330 meters away. Each household typically consists of at least five individuals, including an average of one senior member. The population is predominantly Kannada-speaking, with migrants from Yadgiri, Karnataka, and a smaller representation of Telugu, Hindi, and Tamil speakers.

Regarding housing construction, initial dwellings were built by the government, but subsequent rebuilding after flood damage has involved sourcing materials from construction waste dumped nearby. Approximately 10 to 15 men are employed in the construction sector, with one individual working as a mason.

Currently, the construction of a shelter for the children's anganwadi has reached the roofing stage, utilizing 40% ordinary construction materials and 60% multi-layer plastic (MLP) sheets, supported by high-quality MS angles.

In Siddhartha Colony, the flood relief shelter will primarily serve as a refuge for elders, pregnant women, and children during flood events. During regular days, the facility will function as an Anganwadi for the community.

During the visit to Siddhartha Colony, attention was also directed towards the construction of an Anganwadi due to the long-standing issue of its absence in the community. The Hasiru Dala team met with Dasarahalli Constituency MLA, to request space for this purpose. After submitting a formal request letter, MLA granted permission for the space allocation.

The construction includes a masonry wall built up to 4 feet above the plinth, with slotted angles erected on top.

Kodthi

There are 300 migrant families who have been residing in Kodathi for the past nine years. The population is dynamic, with some families relocating back to their native places or moving to other areas. Many residents are engaged in waste picking and sorting, sometimes using tricycles, for their livelihoods.

The demographic composition of the region includes individuals from West Bengal, Delhi, and Assam. Many females are engaged in housekeeping, while a smaller group participates in waste sorting. Males predominantly engage in waste collection using tricycles.

Housing consists mainly of temporary shelters known as "blue tents," constructed with wooden poles and metal sheets in some areas, while tarpaulin sheets are used in others. The primary languages spoken are Bengali and Hindi, with limited proficiency in Hindi among the population.

Flooding in the area is primarily caused by heavy rainfall during the monsoon season

In Kodthi, 600 families reside in the settlement and experience severe flooding during heavy monsoon rains due to an inadequate drainage system, causing water to stagnate for up to 10-15 days. As part of our pilot project and through community engagement, a relief shelter was constructed in the settlement to provide refuge during disasters. This project aims to offer a relief shelter for the community during disasters and a community shelter on regular days. The flood relief shelter will primarily serve as a safe haven for elders, pregnant women, and children during flood events.

Collaborations

Consultations held with the community, in partnership with the Hasiru Dala team, have resulted in the installation of two makeshift shelter units, constructed by Hasiru Mane and Pop-Up Housing Solutions.

Conclusion

The makeshift shelter initiative will show a proactive way to reduce the effects of urban flooding in informal settlements. By integrating community insights, sustainable materials, and functional designs tailored to the site context, this pilot project will create a basis for effective and scalable disaster response solutions. Ongoing teamwork with stakeholders and flexibility to local needs will be essential for the success of this project as it expands.

Recharge pit

Introduction

Urban flooding is a recurring issue in Bengaluru, particularly affecting vulnerable communities specifically in settlements where the community is not native the settlement land. These communities reside in informal areas and often lack proper drainage systems, leaving them inundated during heavy rains.

The **recharge pit** project aimed to **address flooding** while improving **surface runoff management** and **groundwater recharge** in **two selected communities:** Munnekolalu and Belagere.

The project was facilitated for construction by Ramakrishna from the well diggers community in Bengaluru.

Purpose

The project was initiated to explore sustainable flood mitigation strategies and enhance water management in areas prone to flooding. Recharge pits and open wells were identified as viable solutions to:
- Alleviate waterlogging during heavy rains.
- Improve groundwater recharge.

Site Selection and Assessments

Two communities, Munnekolalu and Belagere, were selected for the pilot project.

- **Munnekolalu:** High silt content in the soil made it unsuitable for recharge well construction. However, as an alternative solution, one recharge pit at the appropriate location was selected for installation.
- **Belagere:** A suitable site near Varthur Main Road was selected, and recharge pits and an open well were proposed.

Munnekolalu (CASE STUDY)

Munnekolalu is home to approximately 2,000 families, many of whom rely on waste picking, housekeeping, and similar activities for their livelihoods. The residents have migrated from various regions, including Delhi, West Bengal, and Kolkata.

In the community, residents face significant challenges due to a lack of basic facilities, including access to drinking water, sanitary lines, and washrooms. During heavy rainfall, many huts become inundated, and the roads are often flooded due to stagnant water. This situation has led to an increase in mosquitoes and various health issues, including skin problems.

To address these challenges, Hasiru Dala organized an awareness program in the community to educate residents about the benefits of recharge pits, using visual aids to illustrate the concept. With the landowner's permission, we initiated the construction of a recharge pit, which has now been successfully completed. The community has expressed their satisfaction with this development, viewing it as a source of inspiration. Additionally, neighboring godowns have shown interest in establishing open wells and recharge pits as well. The residents are grateful to Hasiru Dala for facilitating this initiative.

Belagere community

Brief of the community

The Belagere community consists of around 1,000 families who depend on waste picking and housekeeping for their livelihoods, having migrated from Delhi, West Bengal, and Kolkata. They face significant challenges due to a lack of basic facilities, such as drinking water and sanitation. Heavy rainfall often floods their huts and roads, leading to health issues from stagnant water and mosquitoes. To address these problems, Hasiru Dala organized an awareness program on recharge pits, and with the landowner's permission, we successfully constructed one. The community is grateful to Hasiru Dala for this initiative, which has inspired further improvements.

After consulting with Takedhars and community members, the installation of 2 recharge pits and 1 open well was agreed upon. Safety features, such as locking safety grills, were added to the open well to ensure the community's safety, especially for children.

Conclusion

This pilot recharge pit project demonstrates the importance of community engagement and sustainable solutions to address urban flooding. By combining traditional well-digging practices with modern safety measures, this initiative offers a replicable model for other vulnerable areas in Bengaluru.

5.4 QUESTIONNAIRE AND FOCUS GROUP DISCUSSION

Follow the link to access our questionnaire, and focus group discussion insights

For FGD

For Questionnaires