

## NOTES



# City Resilience Strategy Saharsa city



# FOREWORD

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**Citation**

GEAG, 2016. City Resilience Strategy- Saharsa, published by GEAG, Gorakhpur (U.P.) India

**Layout & design**

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The publication is made possible by the support of The Rockefeller Foundation under the ACCCRN initiative.

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First Edition  
January, 2017

Printed at :  
Kasturi Offset Systems  
Gorakhpur

Published by :  
**Gorakhpur Environmental Action Group**  
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# ABBREVIATIONS

ACCCRN	Asian Cities Climate Change Resilience Network
BPL	Below Poverty Level
BSAPCC	Bihar State Action Plan on Climate Change
BSDMA	Bihar State Disaster Management Authority
CBO	Community Based Organization
CCA	Climate Change Adaptation
CMIP	Coupled Model Inter Comparison Project
DDMA	District Disaster Management Authority
DHO	District Health Office
DM	District Magistrate
DRR	Disaster Risk Reduction
DUDA	District Urban Development Authority
GEAG	Gorakhpur Environmental Action Group
HH	Household
HIG	High income group
IMD	Indian Meteorological Department
IWP	India Water Portal
LIG	Lower Income Group
MIG	Middle Income Group
MLA	Member of Legislative Assembly
MP	Member of Parliament
MSW	Municipal Solid Waste
NDMA	National Disaster Management Authority
NGO	Non-Government Organization
NRLM	National Rural Livelihood Mission
PHED	Public Health Engineering Department
PPP	Private Public Partnership
RCM	Regional Circulation Model
RCP	Resilient Cities Programme
RVS	Rapid Visual Screening
SoP	Standard Operating Procedure
UCCR	Urban Climate Change Resilience
UNDP	United Nation Development Programme
WHO	World Health Organization

# ACKNOWLEDGEMENTS

The development of the city resilience strategy of Saharsa as a result of the support provided by the Rockefeller Foundation to scale-up the Urban Climate Change Resilience process of Asian Cities Climate Change Resilience Network (ACCCRN). In our effort we have tried to ensure that the city resilience strategy is relevant, practical and locally applicable. We have engaged the city stakeholders directly into the process to make it more contextualize. We would like to thank all those who participated in focus groups discussions, workshops and interviews, and our local partner Nav Jagriti as well as the member of municipality and local government. Finally, our thanks go to the citizen of the Saharsa city, who provided valuable inputs on the various issues of the city. It has truly been a team effort.



## EXECUTIVE SUMMARY

In the current phase of urbanization, climate induced risks are indeed serious concerns for the policy makers and implementers to promote urban development and maintaining the governance accordingly. In terms of capacity, emerging cities of developing countries like India are more likely to be affected because of poor coping and mitigation measures. The initiative of Asian Cities Climate Change Resilience Network (ACCCRN) process clearly manifested that more people are flocking into the urban centers, which is directly or indirectly increasing the probability of high losses due to disasters in Asian cities. The vulnerability assessment of most of the secondary cities during the ACCCRN process has recognized the need of hard and soft changes in the resilience building process. Though mitigation measures are also necessary to reduce the rate and magnitude of climate change, resilience building or adaptation is equally essential to reduce the damages from climate change impacts. On the other hand, integrating climate change adaptation and disaster risk reduction at the grass root level provides an opportunity to coordinate decision-making and planning efforts in order to reduce vulnerabilities and build resilience in all departments, thereby minimizing the severity of the resulting impacts and taking advantage of the opportunities.

The Saharsa city, a small emerging city of Bihar, lies in the Kosi basin is experiencing tremendous population pressure from its surrounding rural areas. During last six

decades the population growth of the city has increased by 15 times since 1951 while the infrastructure development was not at par to the population growth.

Consequently, the city's situation has deteriorated the quality of life of people. Here, it is important to highlight that Saharsa is not only the single case, there are hundreds of such cities in India facing the same situation due to unceasing population growth compounded with the impacts of climate change. Through the current study, efforts have been made to showcase the climate induced challenges of emerging cities and the urgency for adopting adaptation and resilience building measures to build the resilience of the city.

The development of the city resilience strategy is based on several workshops and other activities that engaged various stakeholders to leverage their expertise and local knowledge on vulnerability issues. Approximately more than 1000 people have been engaged in the development of the city resilience strategy to ensure that it aligns with existing organizational priorities and can be integrated within departmental functions.

The goal of the city resilience strategy is to build the city resilience within the ambit of Nagar Parishad (Municipal Council) to reduce the risks of climate change and enhance capacity to prepare for, respond to, and recover from the potential impacts of climate change with an emphasis on social, infrastructural and the natural environment resilience measures.

On the basis of vulnerability and capacity assessment of community, municipality and other parastatal department of Saharsa city, following are the six strategic directions and sector specific actions identified:

- Assess potential threats to understand the risks of climate change impacts
- Integrate climate component into city strategic planning, projects, annual departmental plan and investment decisions;
- Increase the resilience of man-made and natural infrastructure of the city
- Provide information, tools, and training the city officials on climate resilience to facilitate and accelerate action;
- Financing for short, medium and long term implementation of adaptive actions; and
- Develop response and recovery plan to bounce back effectively from extreme events

To attain the above, the strategic directions and sector specific actions have been analyzed to identify resources required to move forward towards planning and implementation. Time line of actions i.e. short-term, (those requiring less than two years to get implemented) medium term (within 2-5 years) and long term actions (more than 5 years), were identified to build a sense of success and momentum.

The city resilience strategy also seeks serious commitment of the Saharsa Municipality integrating climate change component. It is a long-term initiative requiring participation and engagement across all city departments as well as collaboration with community stakeholders in order to successfully achieve the city resilience vision.

The successful implementation of the strategy will require multi-year commitment of funds during different phases of implementation. Apart from this, smart collaboration amongst departments, the need of trained and qualified staffs and good governance is also essential to translate this strategic guideline into practice.

The city resilience strategy of Saharsa is intended to be a living document and will continue to be revised. As this document is first of its kind for Saharsa, many of the proposed actions are focused on increasing understanding of identified challenges, identifying potential gaps, and integrating climate component into current processes to develop resiliency into existing periodic operations and long-term planning. The actions proposed herein are intended to be mainstreamed into regular municipal functions in a way that integrates climate change adaptation as a core function within the municipality



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# 1

SECTION

## BACKGROUND



Indian cities especially the secondary cities are more pronounced with inadequate infrastructure development, poor management and governance with ageing and poor quality of critical basic services.

Climate change is expected to increase the incidence of extreme events, by altering average climatic conditions and inducing greater climate variability. Hence, increasing extreme weather events like heavy erratic rainfall, hiking heat index over 40 degrees, frequent wind storms and droughts. Most of the Indian cities especially the secondary cities are more pronounced with inadequate infrastructure development, poor management and governance with ageing and poor quality of critical basic services. Hence, they are more vulnerable to climate change impacts.

In addition to this situation, the rapid influx of rural population in urban centers and dynamic shift of urban area, coupled with the economic growth of cities, have added a variety of challenges. Increasing land prices and limited access to employment opportunities for unskilled labourers is contributing to urban poverty, leading to the growth of slums and informal settlements located in highly hazard-prone areas within a city.

Bihar is a developing state and here wide gap in rural and urban economy exists. The impacts of

climate change, both direct and indirect, have further exacerbated resource conflicts and induced the pace of rural-urban migration over the last few decades. Consequently, the issues such as water scarcity, flooding, water logging, waterborne diseases and epidemics in urban areas have become more acute and severe. This increases the stress on infrastructure services and on the resources of the cities.

Thus, it has become important for the emerging secondary cities to be able to undertake a rapid assessment of their vulnerability, in order to understand their capacity building requirements to plan for adaptation and infrastructural interventions less susceptible to cascading failures of other elements or related systems and key service deliveries.

### Why develop a city resilience strategy?

The impacts of climate change have been recognized as an important issue in Bihar and Saharsa city is no exception. The city has faced urban flooding acutely in 2016 when the whole city



“During the vulnerability assessment in 2014 it was found that 70% of citizens felt they had already experienced the impacts of climate change in Saharsa.”

was collapsed during the monsoon season due to heavy rainfall and inundation for more than three months. Considering the last flooding event, the district and city administration has now become sensitive towards taking measures to mitigate such impacts. Apart from this, at the state level Disaster Management Department of Bihar has released a Disaster Risk Reduction (DRR) Action Plan in 2016 to address disasters and climate change impacts in rural and urban areas of the state. On the other hand, the Bihar State Action Plan on Climate Change (BSAPCC) and Bihar DRR roadmap both acknowledged that adapting to climate change goes beyond the mandate of any one ministry and recognized the need for adaption with changing nature of disasters and climatic variabilities.

The DRR roadmap also states that it is important for all the stakeholders to work together to adopt and implement DRR strategies based on current local knowledge and to gather scientific information to inform future climate change adaptation actions. Being an emerging city but confronting with poor infrastructure, services and infrastructure of Saharsa is quite susceptible to the impacts of climate change that will impose additional pressure on local government to take proper measures.

The focus of developing this city resilience strategy is to (1) identify the potential impacts related to climate in Saharsa and the risk on various services and to the community and 2) propose possible actions to reduce risk and vulnerability associated with climate change impacts through adaptive measures.

The strategy will complement existing municipal and state processes as well as ongoing climate adaptation initiatives of state and will serve as a resource for other municipalities in Bihar. Having a city resilience strategy will also place the city in a strong position to access potential source of funding as the state government has planned to

implement Resilient City Programme (RCP) and resilience building components in basic infrastructure and asset planning decisions.

### Urban Climate Change Resilience (UCCR) initiative under Asian Cities Climate Change Resilience Network (ACCCRN)

The Asian Cities Climate Change Resilience Network (ACCCRN) initiative, pioneered by the Rockefeller Foundation, USA in 2008, worked at the intersection of climate change, urban systems and vulnerability to consider both direct and indirect impacts of climate change in urban areas. ACCCRN worked in 10 cities in 4 Asian countries (India, Indonesia, Thailand and Vietnam) to develop and demonstrate effective processes and practices for addressing urban climate vulnerabilities using multi-stakeholder planning as well as implementing targeted intervention projects. Gorakhpur Environmental Action Group (GEAG) was assigned to lead the research agency with credible local level organization in the state and city. GEAG started the intervention from Gorakhpur and scaled-up in three cities Jorhat (Assam), Saharsa (Bihar) and Basirhat (West Bengal). In Saharsa, the intervention was implemented in collaboration with Nav Jagriti and Saharsa Nagar Parishad (Municipal Council) supported by the Rockefeller Foundation to enhance the adaptive capacity of the city residents and making city's infrastructure and systems resilient towards climate change impacts.

“Supported by the Rockefeller Foundation and led by Mercy Corps, Asian Cities Climate Change Resilience Network (ACCCRN) is a network of practitioners and institutions engaged in building urban climate resilience through knowledge creation, accessing resources and influencing policies. ACCCRN is currently engaged in six countries including India.”



Photo 1 :  
Shared learning  
dialogue with community,  
Saharsa

In this perspective, the present endeavor to develop a “city resilience strategy of the Saharsa city is a pioneering attempt in Bihar to assess urban vulnerability to environmental degradation and climatic change and to formulate a concrete strategy for reducing concerned risks. The development of this city resilience strategy is based on various interactive workshops and planning activities that leveraged expertise, local knowledge of government officials, city managers and key community stakeholders.

### Goal and objectives

The overarching goal of the city resilience strategy is the foundation around which the objectives and resilient directions are identified. These are developed based on the stakeholder's engagement and vulnerability analysis. They provide the framework to move forward in achieving the climate adaptation vision.

The objective of the city resilience strategy is to build on the city's existing strengths and align current resources to increase the resilience of the Municipality from strategic perspective to respond and recover from the impacts of climate change.

The sub-objectives of the study are as follows:

- To examine the nature of climate variability and climate change based on available information in Saharsa and its neighborhood
- To study the impacts of weather and climatic anomalies on the physical and cultural landscape of the city
- To identify vulnerable areas and sectors within the city.
- To prepare strategic directions for the city with focus on strengthening UCCR.

This strategy report presents the resilience direction to the Saharsa city based on the current climatic trends, future shocks and development scenario as well as present vulnerability at ward level.



This document may help municipality and urban planners to set their priority areas of developmental work and the direction of vulnerability reduction activities. This document clearly reflects the vulnerability of Saharsa city in view of climate change and the possible actions to reduce the vulnerability and building community resilience.

### Collaborative Approach and Methodology

The city resilience strategy of Saharsa was developed through bottom up approach. Several community and departmental consultations were done to comprehend the vulnerabilities and gaps in the existing systems. The whole information of the

city presented in the strategy is collected from research work of over two and half years. The intention of this strategy is to develop a living document and which will continue to be revised and updated over the time.

This is a pioneering attempt to understand the current vulnerabilities, identify gaps and impact of climate change into current planning, design and emergency management practices to build the current strengths and incorporate resiliency into operation as well as infrastructure investments. The strategic direction and sub-directions proposed herein are intended to be mainstreamed and integrated into regular municipal functions. The following four milestone framework has provided a structured approach to design the strategy:

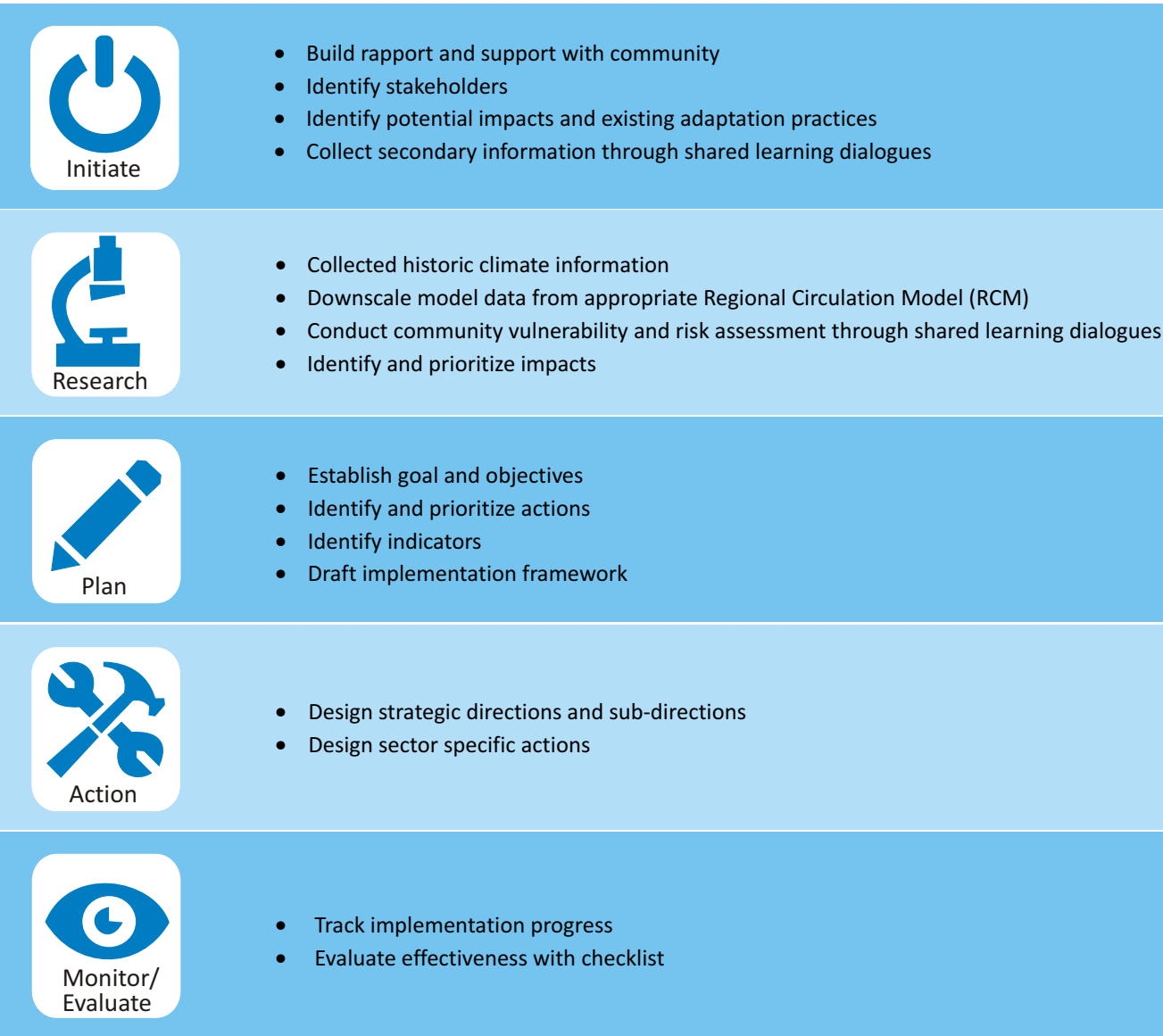
The above mentioned points have been the bases to the city resilience strategy, bringing together key community stakeholders, municipal decision-makers, and key parastatal departments to shape the city's resilience strategy. The climate change impacts, goal, objectives and actions presented in this strategy have been centered on shared learning dialogues and engagement activities that leveraged existing capacity and local knowledge of key community stakeholders, city managers and staff, service sector professionals, to ensure that the overall strategy aligns with existing organizational priorities and can be integrated within departmental functions.

These collaborative efforts have been instrumental to strengthen existing collaboration, to draw on

community expertise, and to identify where additional engagement may be required to implement the adaptation actions identified. Thus, in total, more than 1000 people have been engaged in shared learning dialogues from the entire city in the development of the City's resilience strategy. A strong collaborative approach was followed to ensure:

- Local knowledge integration;
- Involvement of decision-makers and city staff, and stakeholder engagement throughout the process;
- Reflection of practical needs and fiscal realities of the city; and,
- Integration of actions into existing plans and policies.

Photo 2 :  
Saharsa and its people





## CITY PROFILE



The rapid influx of population from nearby rural areas has exerted tremendous pressure on the city's infra-structural capacity. This has led to the development of numerous slums, with deteriorating living conditions within the Saharsa city.

Located at the eastern bank of Kosi river, Saharsa is a city with its municipality in Saharsa district in the Indian state of Bihar. It is the administrative headquarter of the Saharsa District, and the pat of Kosi Division. As per historic records, no authentic information is available as to the origin of the name of Saharsa but there was a village at a distance of about one and half miles from the Saharsa railway station which is known as 'Saharsa' (District Gazetteer, 1965).

Currently, the city (fig-1) spreads over an area of 21.13 sq. km. and has a population of 1, 55,175 (Census of India, 2011). Over the last six decades, city's population has increased by 15 times (fig 2). A cursory look at the population figures of Saharsa city since 1951 reveals that immediately after formation of the district in 1954, there was a rise of 43.73 per cent in its population in 1961. The reason behind such growth was the establishment of government offices and movement of officers/ workers into Saharsa. Since 1961 population has increased by seven folds.

The population is spread unevenly in the city. Saharsa is considered the largest commercial center of the Kosi region. The average density is 7344 person/sq. km with a lower population density in the newer wards. The rapid influx of population from nearby rural areas has exerted tremendous pressure on the city's infrastructural capacity. This has led to the development of numerous slums, with deteriorating living conditions within the city. Currently, slum areas of the city are accommodating around 40 % of the population in which 31 % people are living below the poverty line (Census of India, 2011).

Saharsa at a glance	
Total Area	21.13 sq.km.
Population	1,55,175 persons (Lit. rate 77.66%)
Male	82,589 (Lit. Rate 84.11%)
Female	72,586 (Lit Rate 70.27%)
Sex Ratio	879 female per 1000 male
Child Sex Ratio (0-6 years)	916 girls per 1000 boys

Map 1 :  
Saharsa at a glance

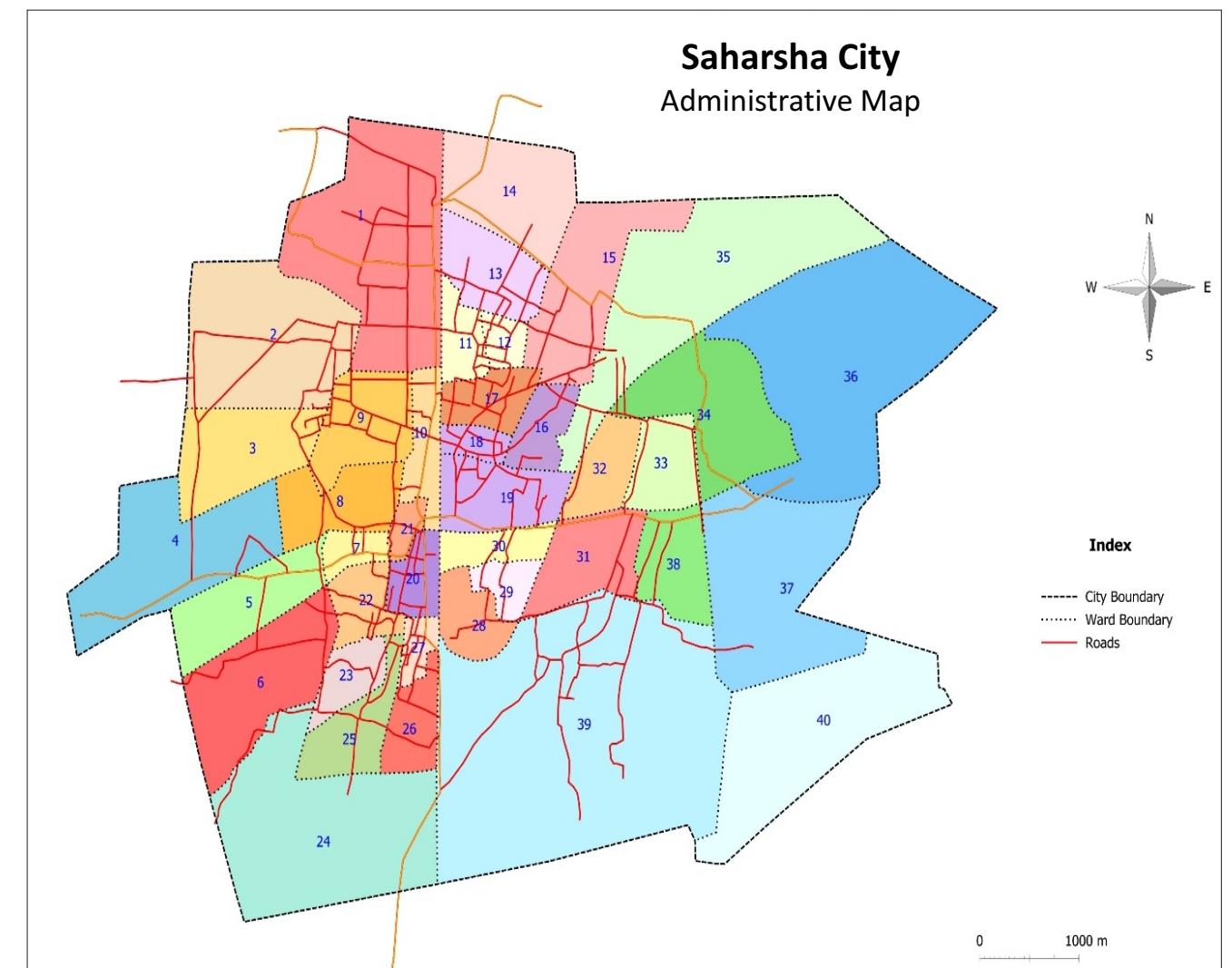


Fig 1 :  
Trends of population growth

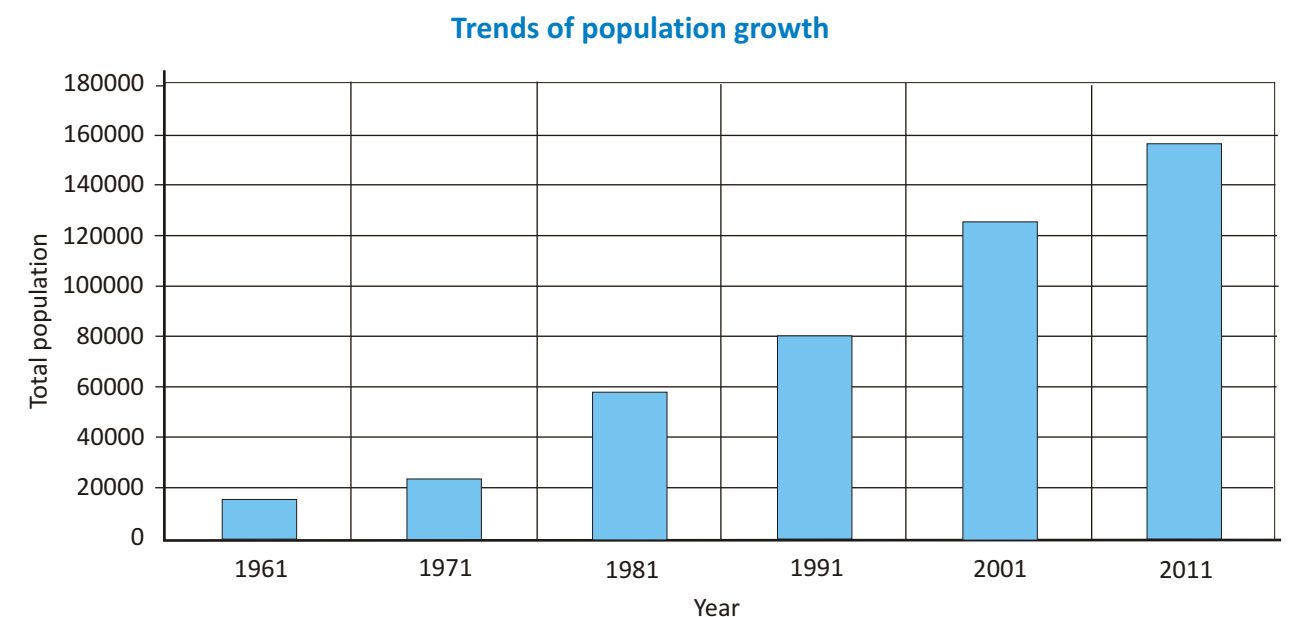




Photo : 3  
Permanent water logged  
area in ward no. 21



Historically, Saharsa is prone to hydro-meteorological risks and experienced severe water-logging every year during the summer monsoon. In recent past, the depth and duration of water-logging in certain wards of the city has been increasing, as the city has expanded. The reasons which exacerbate flooding and water-logging in the city are the loss of water bodies and permeable areas that once absorbed monsoon rains, inability of the city to provide services that reduce flooding/ water-logging, such as solid waste management and wastewater/storm water networks, and unplanned infrastructure development that trap storm water for 23 months, causing water-logging.

### 3 SECTION

## CLIMATE CHANGE IN CONTEXT



City's maximum and minimum temperatures, and rainfall pattern over the last century has changed. However, the changes are not equal for all the months and season spatially and temporally.

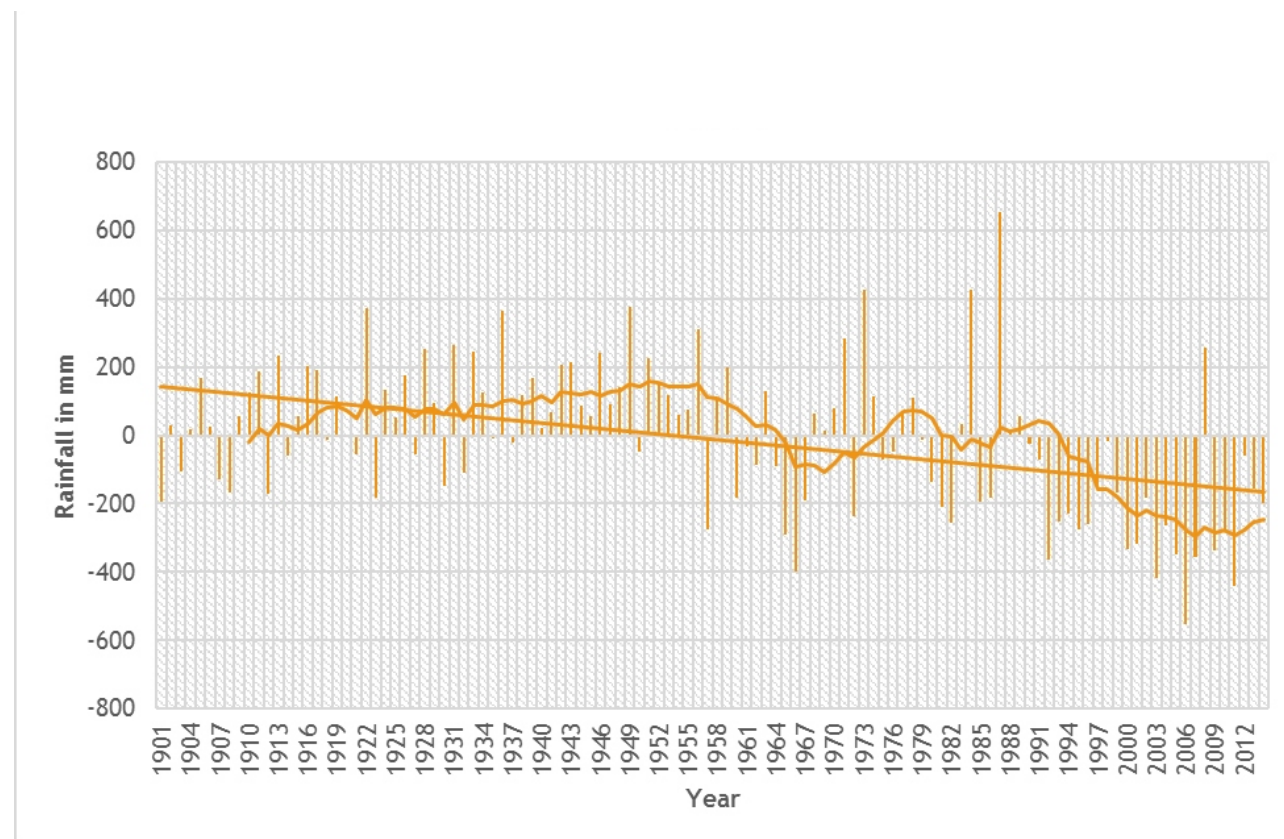
The impact of climate change is quite explicit at local level. Saharsa is no exception. It has been impacted severely in recent years, including the heavy rains of 2016, drought of 2013, 2010 and 2009, and severe storms in 2015. In general, climate of the Saharsa is characterized by tropical monsoon climate with three distinct seasons, i.e. cool day winter, hot day summer and warm wet rainy season. Cool day season extends from October to February with fairly low temperature varying between 5 °C and 16 °C, with very little rain, clear sky and relatively low humidity. Hot dry season spreads over March to Mid-June with temperatures rising up to 42 °C with low humidity. Warm wet season is the period of monsoon from mid-June to September. During these period temperatures range from 24 °C to 35 °C with cloudy sky and high humidity. The average annual rainfall of Saharsa is 1154 mm with 57 normal rainy days, and annual average maximum and minimum temperature are 31.10 °C and 19.4 °C respectively. The main rainy season contributes about 74-78 % of annual Rainfall. Rainfall during monsoon season varies from the lowest of 392 mm to the highest of 1783 mm during last century. In the present study, to assess the climatic variabilities, long-term

observational records (1901-2014) of rainfall data have been obtained from different sources like India Water Portal (IWP), Indian Meteorological Department (IMD), district's NIC and statistical department.

Climatologically, trend analysis for a 115 years' period is of sufficient duration to reflect natural climatic variability on a multi-decadal timescale, which is important in considering long-term impacts of climate change. Apart this, CMIP5 model data has been used for projecting future climate scenario of Saharsa. The analysis of historic observation data revealed significant wide warming in both maximum and minimum temperatures over the last century. However, the changes are not equal for all the months and season spatially and temporally. Trend in temperatures showed a much higher degree of spatial coherence and statistically significant warming, reflecting increases in both maximum and minimum temperatures. The rainfall trends are not significant in all the seasons, where as there is spatially coherent decrease in annual rainfall, particularly in monsoon and winter season is a cause of worry. Details of periodic trends during one decade are summarized as under:



**Fig 2 :**  
Deviation from Normal  
Rainfall, Saharsa  
1901-2014



### Annual trend in temperature and rainfall

- Significant increasing trend were found in the mean maximum temperature over the Saharsa ( $.004^{\circ}\text{C}/\text{year}$ )
- The maximum increase in annual mean maximum temperature was observed after 1960.
- Annual mean minimum temperature has significantly increased in last century over the Saharsa ( $.005^{\circ}\text{C}/\text{year}$ )
- Spatially coherent decreasing trend in annual rainfall are found over the Saharsa ( $1.6\text{ mm}/\text{decade}$ ) during one decade.

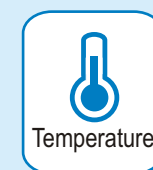
### Seasonal trend in temperature and rainfall

- No Significant trend has been noticed in mean maximum temperature both spatially and temporally in summer and monsoon season.
- The highest increase in seasonal mean maximum temperature has occurred in post monsoon season ( $+0.0120\text{ C}/\text{year}$ )

- While significant spatially coherent increasing trend in mean minimum temperature during winter and post monsoon seasons.
- The highest increase in mean minimum temperature in post monsoon season is observed ( $0.011^{\circ}\text{C}/\text{year}$ ).
- The increase in post monsoon and summer rainfall is non-significant over Saharsa during (1901-2002) i.e.  $8.0$  and  $5.0\text{ mm}$  respectively.
- Even though decrease in monsoon rainfall is spatially coherent but significant ( $4.5\text{ mm}/\text{decade}$ ). It is still a concern for the rain-fed agriculture and water resources of the area.

### Future climate change projections for Saharsa

The BSAPCC indicates that potential climate change will impact the cities of North Bihar. It will affect all city administration departments and service delivery. The CMIP5 downscaled data for Saharsa indicates the following projected changes in climate in coming three decades:



- ♦ Increase in the frequency and magnitude of warm days (heat index above  $48^{\circ}\text{C}$ ) and warm nights (heat index above  $32^{\circ}\text{C}$ )
- ♦ Increase in mean annual temperature of about  $0.75^{\circ}\text{C}$  to  $2.1^{\circ}\text{C}$  by the year 2040
- ♦ Mean maximum and minimum temperature is likely to increase by  $0.40^{\circ}\text{C}$  to  $0.80^{\circ}\text{C}$  and  $0.30^{\circ}\text{C}$  to  $1.2^{\circ}\text{C}$  by the end of fourth decade of this century



- ♦ By the end of 2040s, there are no clear trends in rainfall of monsoon season. Variability appears to be increasing, Annual rainfall projected to be changed to  $+69\text{ mm}$ . During post monsoon and winter, rainfall is projected to be  $-.94$  to  $+3.2\text{ mm}$  and both heavy rainfall and droughts events might increase



- ♦ Extreme rainfall events may likely to be increased by  $10-20\%$

**Photo : 4**  
Water logging in City





## Why the climate change matters?

### Impacts on the city's environment

As the city lies on the bed of river Kosi so has several water bodies, which play an important role of buffer zone during flood and extreme rainfall events. These natural resources provide adaptive services by absorbing excessive water of river Kosi and heavy rainfall and contribute to storm water management thereby lowering flood risk. In addition to this, increasing average temperatures and erratic pattern of rainfall, climate change is predicted to exacerbate pests attack, and increase pollutant. High wind storm events also have the potential to significantly damage/destroy of private and public infrastructure.

### Impacts on the city economy

Saharsa city is the commercial hub of Kosi basin and provides economic services to the surrounding areas. Climate change can be thought of as a cause of pervasive economic shock that will potentially affect all sectors of the economy. The impacts of extreme weather events (such as water-logging) on roads and other infrastructure could disrupt the distribution and communication networks, local businesses that depend on these networks, and have the potential to impact city's economy. Disruptions to essential service suppliers, such as grocery and medicine, would also impact the health and safety of residents.

### Impacts on Lifestyle

Human health concerns and quality of life are extremely important aspects of resilient planning. The city is already vulnerable in conditions of health care facilities and hence climate change poses significant risks to human health and well-being, particularly to those who are living in slum conditions with limited incomes. The impacts from extreme weather events, water-, food-, vector-borne diseases all have the potential to affect the lifestyle of Saharsa's residents. Increasing warm days and nights spells expected in the region will likely lead to an increase in related health problems especially for vulnerable people. Apart from this, during summer, the impacts of climate change are expected to affect the Labour group whose livelihood is dependent on outdoor activities.

### Impacts on Basic Services

Erratic and intense weather conditions will affect municipal functions. Erratic rainfall will challenge water holding capacity of open drains and other storm water control systems. Roads may be impassable due to high water-logging and may degrade or damage due to intense storm events. In general, this will bring new challenges and liabilities to maintain infrastructure. Many aspects of energy supply, transmission, and demand will also be impacted by various dimensions of climate change, including higher temperatures, changing frequency and intensity of extreme events, and changes in water availability.

## 4 SECTION

# CURRENT STATUS AND CHALLENGES



City's current vulnerabilities are directly attributed to poor planning and upkeep of infrastructure, lack of investment in basic services and poor enforcement of regulations and norms.

Saharsa city is devoid of infrastructural facilities. The current actions, existing plans, policies and procedures are not at par to tackle the impacts of climate change. The climate change impacts have the potential to affect all city departments and service delivery. This is why it is imperative to the city governance to take unique interest in planning to adapt to climate change.

Understanding the impacts and local vulnerability to climate change will determine how to address projected changes and reduce the risks they pose to the city's basic services, environment, lifestyle, economy, governance, and overall quality of life.

The focus of the city resilience strategy is to align current resources to increase the resilience of the Nagar Parishad from a strategic perspective. The directions presented in this strategy will provide directions for the city to strengthen policies, develop new programs or practices where gaps exist, work collaboratively with key departments and other levels of governments, and undertake the steps necessary to integrate climate adaptation as a core function within the Nagar Parishad. There

is a significant overlap between the actions mentioned in the city resilience strategy and the existing priorities. For example, include storm water management, solid waste management and official planning, in general. The integration of the climate sensitive city resilience strategy with existing Programme (Resilient City Programme) will serve to pull everything together, bridge cross-departmental gaps, and increase the city's resilience to climate change impacts while building on existing strengths.

The vulnerability assessment report of Saharsa clearly manifested that the city's current vulnerabilities are directly attributed to poor planning and upkeep of infrastructure, lack of investment in basic services and problems emanating from poor planning and lack of enforcement of regulations and norms. These in turn have a close bearing on the scale at which a climate related event will hit a city or the impact in absolute measures. The city of Saharsa grapples with acute infrastructure deficit and hence facing following challenges:

**Drainage :** As per the census records, 52 percent area of the city is devoid of drainage system. The improper drainage situation, waste disposal sites, and increasing urban settlements play vital role in aggravating the problem of water logging day by day. Water logging causes prolonged inundation of houses, deterioration in the quality of stored food grains and other household goods. During rainy season, the streets convert into filthy cesspool, which provides conducive environment for breeding mosquitoes and other water borne vectors. **Water logging duration and depth varies in different locations from 7-30 days to 2-3 feet respectively.** There are no changes reported in the nature of water logging in last 10 years in entire town and the problem is aggravating year after year due to lack of appropriate town management policies and practices.

**Solid waste management**

Lack of solid waste management and poor waste disposal and collection practices lead to advent of diseases, dirty sites and water logging or prolonged periods sometimes ranging from 3-4 months. The sewerage system, sanitation and solid waste management are very poor and Saharsa emerges as one of the poorer cities on these services. Lack of staff, lack of adequate O& M budget, and similar other institutional problems undermine the proper development of this critical sector.

**Sanitation**

About 30-40 % households are still defecating in open. All the faecal materials from toilets are disposed off through soak pits. Those resorting to open air defecation leave the disposal to nature. Cleaning of drains and garbage collection is scarce and is carried out once a month, at best, or during the festivals or once in six months. Household wastewater is disposed off directly in open spaces/fields and redundant/defunct drains. There is no functional community toilet reported in any locality of Saharsa town. The practice of open defecation and improper sanitation services has made the whole city prone to water and vector borne diseases.

**Water quality**

About 83% households of the city is dependent on the hand pumps for drinking water, the rest being served by the packed water containers. The quality of water though is a concern due to bad sanitation practices and non-existent faecal management system at place. The Soak pit led faecal management leads to infiltration and contamination of ground water. The Bihar State Action Plan for Climate Change also highlights the poor state of basic services in the urban areas of the state. Saharsa has been mentioned as one of those cities that fare badly on all three water related national as well as state level standards ( 2015, BSAPCC ).

Photo : 5  
Open hole often cause waterlogging on the street of colonies



**Migration and poverty**

The migration level to the city is very high; particularly from adjoining rural areas in search of livelihood and also students because of large number of coaching institutes coming up in the town. Saharsa is the hub for entire Kosi basin. It is the only city which is connected with railway from other parts of the country and huge number of poor population migrate to Gujarat, Punjab and other states in search of livelihood. About 41% of the population lives in slums and 32 % of the

population is living below poverty line. These are the worst affected in the advent of a disaster or extreme climate event like heavy rainfall and floods.

All the above mentioned factors are responsible for acute water-logging in the entire city. During summer monsoon, all the wards get affected. The vulnerability assessment report through community consultations in different parts of the city reveals that following points of the city are severely affected by the water-logging.

Table 1 :  
Acute water-logging points in city, depth and duration

Actute water-logging points in city, depth and duration  
(Based on field observation, 2016)

Water logging points	Depth in feet	Days
On Sah Tola Road	1 Feet	One week
Animal Husbandry Colony	1 Feet	One week
Along the road of Dr. Gopal Saran Singh Clinic	1 Feet	15 days
Bengaha Tola	1 Feet	One week
Naya Bazar to Sarahi Road	2 Feet	15 days
Refuzi Colony Chowk	1 Feet	One week
South street from Refuzi Colony Road	1 Feet	One week
East Road from Dr. Manoj Jha Clinic	1 Feet	15 days
Dr. Manoj Jha Mohalla	1 Feet	15 days
Western side of Gandhi Path Road	1 -2 Feet	One week
New Colony Road	1 Feet	3 days
Street linked with DB Road	1 Feet	3-4 days
South of Maha Dalit Tola	1 Feet	One month
Near of Railway line	1 Feet	15 days
Low lying area of Ekpada Mohalla	1 Feet	One week
Rahman Chawk to Meera Talkies Road	2-3 Feet	One month
Gayatri Mandir Road	2-3 Feet	One month
Panchwati Chowk to Nagar Palika Chowk	2-3 Feet	One month
In Gautam Nagar- Near Income Tax Office	2 Feet	One month
In Gautam Nagar- Koshi Chowk	2 Feet	One month
In Gautam Nagar- dozens of houses near railway line	2-3 Feet	15 days
Azad chowk to clinic of Dr. P.K. Malik	1-2 Feet	One month
Middle of Batraha Mohalla to Mahavir chowk	1 Feet	One week
Dahlan Chowk to Gandhi Path Road	1 Feet	One week

Source : Field visit and community consultation in the city



Table 2 :  
Ward-wise status of infrastructural  
facilities and level of development  
in Saharsa city

Ward-wise status of infrastructural facilities and level of development in Saharsa City

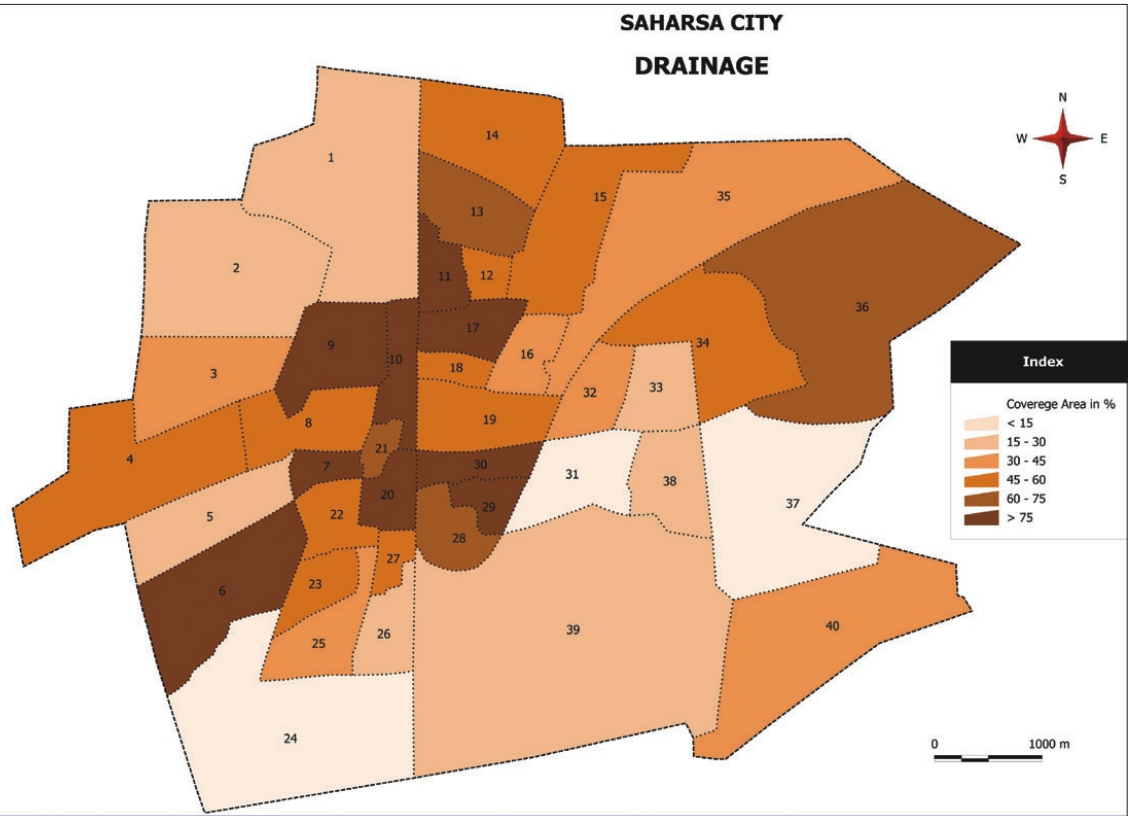
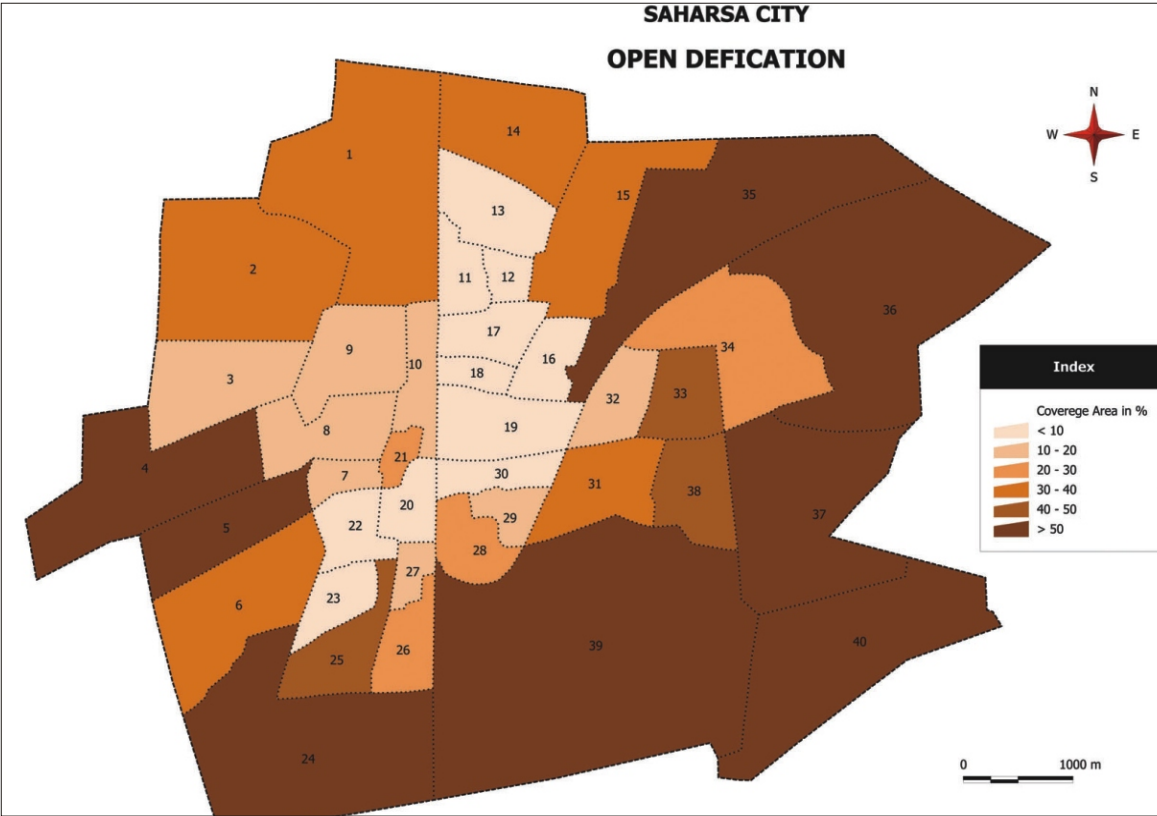
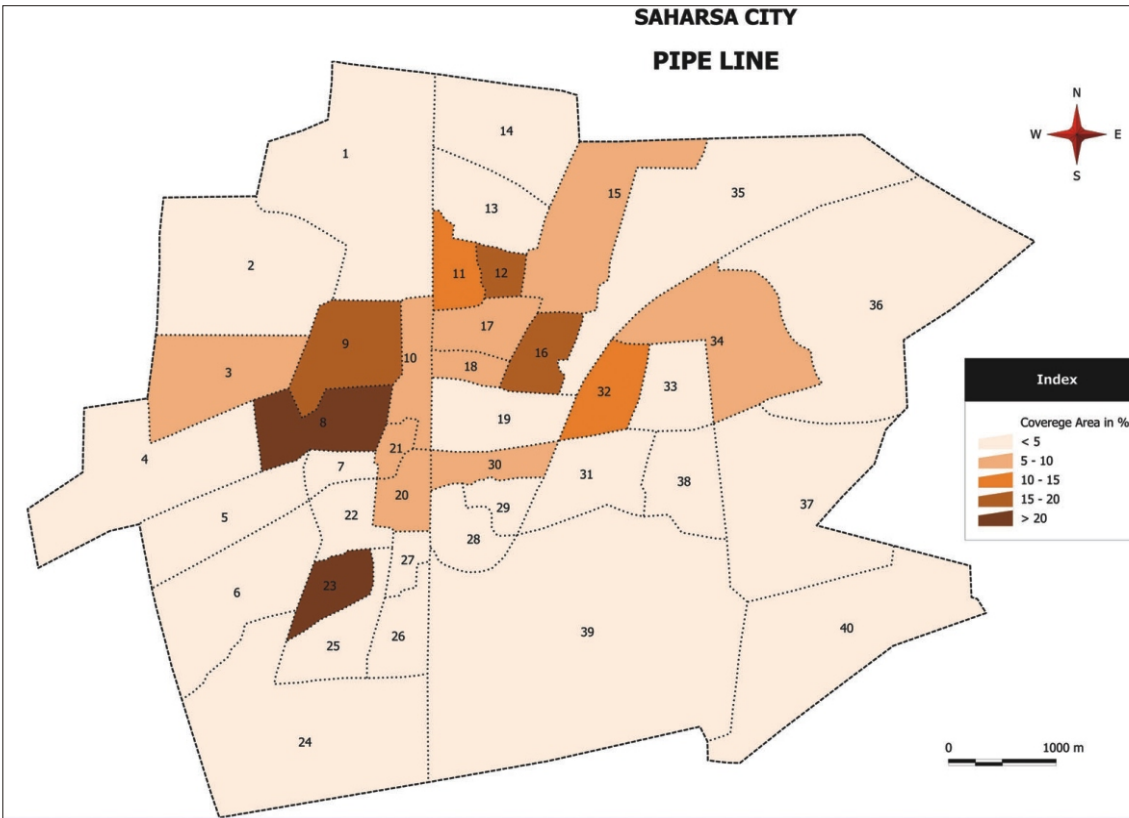
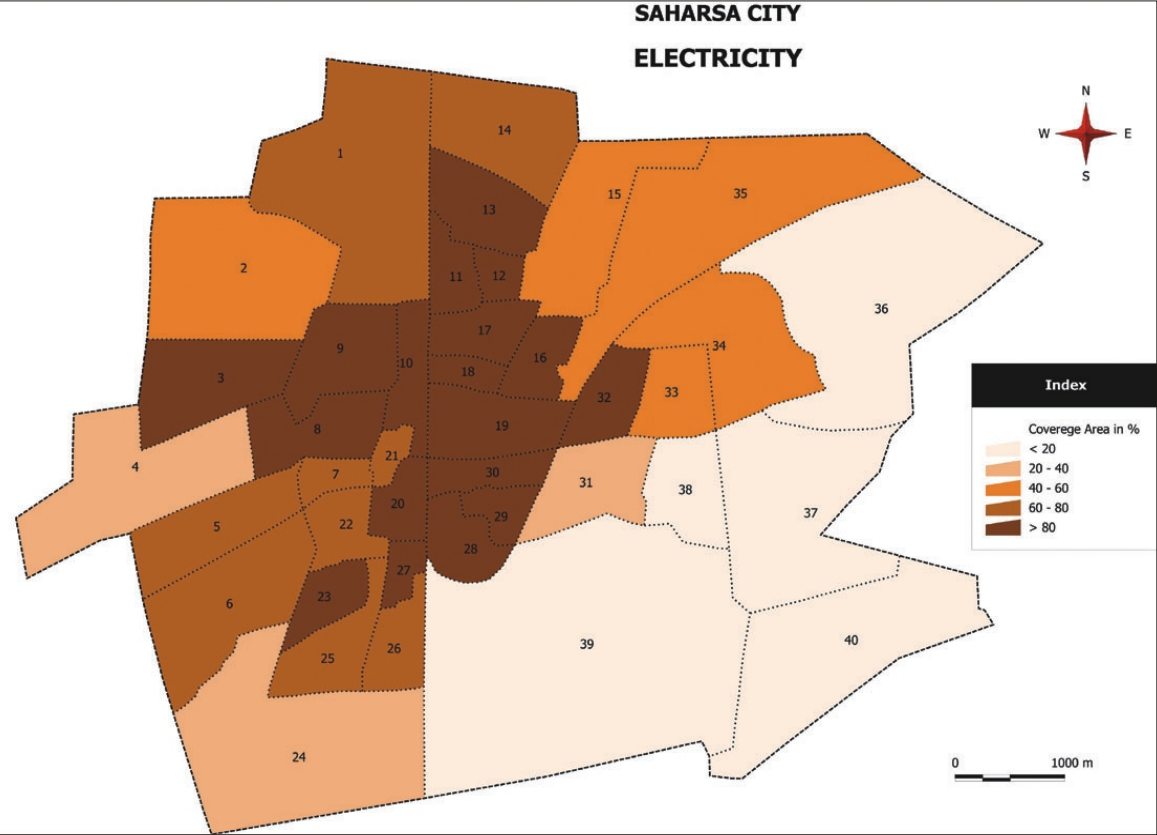
Ward No.	Livable House	Pipeline	Hand Pump	Electricity	Having Toilet	Piped Sewer system	Septic tank	Open Defecation	Closed drainage	Open drainage	No drainage	Level of development
Nagar Parishad	92.5	5.7	83.8	64.1	67.6	4.8	47.3	30.4	20.7	27.4	51.9	45.11
1	78.7	3.5	93	70.8	67.3	0.6	51.8	32.7	11.4	7.6	81	45.31
2	90.9	2.2	84.6	46.1	62.5	1.2	25.2	37.2	6.4	9.8	83.8	40.90
3	94.1	7.3	90.2	88.8	81.2	1.3	54.9	18.8	18.6	22.7	58.7	48.47
4	94.6	0.9	94.3	23.9	13.8	0.6	8.5	83.6	1.7	45.4	52.9	38.20
5	85.2	1.6	95	68.8	49.1	4.7	29	50.9	6.1	21.5	72.3	44.02
6	97.8	0.1	95.1	79.3	68.6	2.9	59.8	31.2	14.2	64.7	21	48.61
7	94.5	1.2	95.1	68.1	77.6	9.6	54.1	17.6	52.3	29.5	18.1	47.06
8	93.5	20.6	71.4	83.5	82.4	12.5	60.8	12.9	34.7	21.1	44.2	48.87
9	89.8	17.5	58.9	86.5	81.3	3.1	63.7	18.6	33.5	56.6	9.9	47.22
10	92.5	7.1	88.4	82.8	77.3	6.4	63.5	20	63.1	20.8	16.1	48.91
11	95	14.4	76.3	87.1	93.5	12	67.5	5.7	42.3	34.6	23.1	50.14
12	93	18.1	78.1	82.6	93.3	1.1	70.8	5.4	26.3	30.6	43.1	49.31
13	95.2	4.2	93.7	86.5	88.9	4	73.8	9.9	20	47.4	32.6	50.56
14	98.1	3.9	86.9	65	63.3	2.2	52	36.4	10	39.4	50.6	46.16
15	92.9	5.2	89.5	58	64.5	4.7	42.3	34	22	30.6	47.3	44.64
16	96.8	17.9	76.5	88.6	92.9	1.4	84.5	6.6	20.9	11.7	67.4	51.38
17	97.4	7.1	91.6	87.9	99.2	2.5	74.9	0.6	50.5	37.7	11.8	51.02
18	97.1	7.4	84.8	84.5	91.7	11.2	75.3	8.3	28.9	29.6	41.5	50.94
19	90.6	3.3	70.6	89.3	91.7	5.8	74.7	5.9	21.2	33.1	45.7	48.35
20	94.5	8.3	73.9	86.7	91.9	4.2	82	3.9	69.5	13.5	17	49.58
21	86.2	5.3	70.1	76.9	72.9	11.4	51.5	23.8	53	9.7	37.3	45.28
22	98.6	2.6	83	76.7	96.3	13.2	57.7	3.2	40.9	12.4	46.7	48.30

Ward No.	Livable House	Pipeline	Hand Pump	Electricity	Having Toilet	Piped Sewer system	Septic tank	Open Defecation	Closed drainage	Open drainage	No drainage	Level of development
23	99.4	21.2	77.3	94.5	93.1	15	69.9	2.5	32.2	25	42.9	52.08
24	78.1	0.5	92.5	29.7	19	2.5	8.1	81	2.2	9.5	88.4	37.41
25	91.8	1.7	96	60.8	56.2	1.7	46.2	43.8	14.8	29.7	55.5	45.29
26	81.7	2.5	92.9	65.9	69.7	6.5	29.6	29.8	6.3	23.7	70	43.51
27	87.7	2.6	96.4	83.3	86.3	0	49.8	11.5	5.6	41.5	52.8	47.05
28	99.3	0.4	96.9	84.5	72.9	1.4	60	25.3	8.3	53.6	38.1	49.15
29	93	2.9	80	83.4	88.1	6.3	78.5	10.4	49.1	29.2	21.7	49.33
30	99.2	5.7	88.3	93.1	93.6	31	61.1	6.4	73.3	20.4	6.3	52.58
31	97.9	1.6	97.9	28.2	67.3	3.6	26.8	32.6	2.9	8.6	88.4	41.44
32	90.4	12.5	82.8	83	85.8	6	62.4	13	11.8	29.9	58.4	48.73
33	81.3	3.9	95.7	41.3	47.1	0.8	32.4	48.8	27	19.6	77.8	41.04
34	98	7.6	90.5	50.9	52.1	3.5	34.2	27.6	10.5	37.1	52.4	42.23
35	95.5	1.2	81.7	47.9	37.9	1.9	33.6	62.1	3.6	33.2	63.2	41.98
36	80.9	0.4	98.8	5.2	12.7	3.2	3.2	55	1.6	66.5	31.9	32.67
37	90.5	0.8	90.6	17.4	10.5	1.3	7.3	88.2	0.6	12.6	86.7	36.95
38	91.5	0.8	64	15.3	49.6	0.6	19.7	44	1.5	22.8	75.7	35.05
39	94.9	2.7	46.8	18.6	8.6	0.1	4.7	91.4	0.1	20.2	79.7	33.68
40	80.4	0.3	54.2	5.9	2.7	0.2	2.4	97.3	0	37	63	31.22

Source : Data on infrastructure were taken from Census of India, 2011 and grading were done with community consultation in Saharsa city



Fig 3 :  
Spatial Pattern of  
Basic facilities

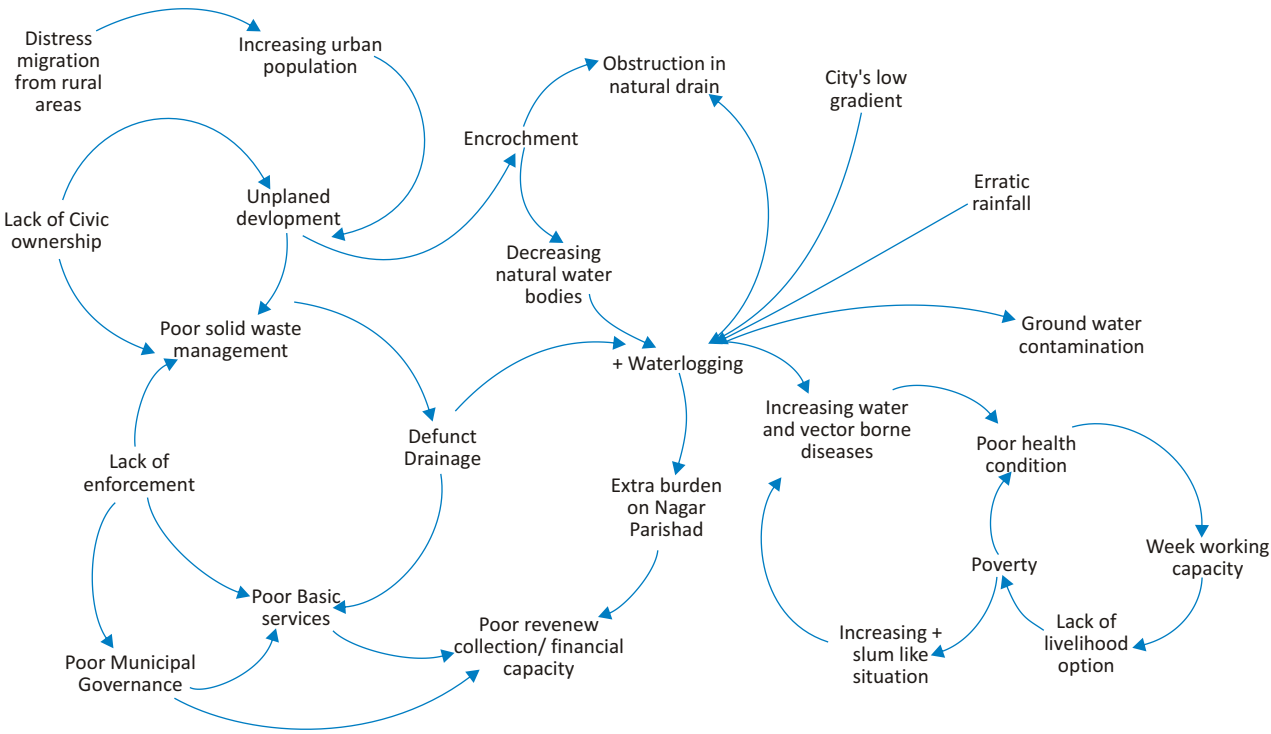


Current vulnerabilities

Saharsa city is emerging with limited infrastructure and resources. As per the Census of India Data 2011, about 41 % of total population of Saharsa city is living in the slums spread over 12,614 households. Socio economic census data, 2011 indicates that 32 % of the total population of Saharsa city is bound to live Below Poverty Line (BPL). These large proportions of population are more vulnerable in terms of inappropriate infrastructure and poor services like roads,

housing, drinking water, waste management and health etc. The open defecation, reckless discharge of waste and increasing incidence of water logging coupled with erratic rainfall and high humidity have been exacerbated and impacting the children, old age and poor people. The interaction with community and key stakeholders revealed the causes /sub-causes and the impacts of water logging in different sectors of the city ( Fig 6). These causes/sub-causes and impacts have been depicted through the following causal loop diagram:

Fig 4 : Causes of Waterlogging and its impacts



During the vulnerability assessment, several community and departmental consultations were done to assess the current vulnerabilities and

challenges posed by climate change. The table below depicts the vulnerable sectors, challenges and their current vulnerabilities to climate change.

Table 3 : Sectors and current vulnerabilities

Sector	Current Vulnerabilities
Housing	<ul style="list-style-type: none"><li>Houses are not constructed as per building by- laws</li><li>Frequent exposure to water logging</li><li>Poor access to basic services</li></ul>
Drinking Water	<ul style="list-style-type: none"><li>Poor quality of drinking water</li><li>Contaminated ground water (higher concentration of iron content as per the WHO and Indian Standards)</li><li>Lack of safe water supply (pipeline water supply)</li><li>Very high tendency of deep private boring for safe drinking water</li><li>Higher dependency on shallow hand pumps and private borings</li></ul>
Health	<ul style="list-style-type: none"><li>Insufficient health centers</li><li>Incidence of water and vector borne diseases increased</li><li>Proportion of doctor and patient deteriorating</li><li>Skin disease pronounced due to prolonged water logging in slums areas</li><li>Diarrhea and Malaria cases increased</li></ul>
Transportation	<ul style="list-style-type: none"><li>No traffic rules prevailed, heterogeneous traffic system</li><li>Narrow road sizes</li><li>Poor condition of roads</li><li>Encroachment along the roads</li><li>Frequent Traffic jams during peak hours</li></ul>
Solid Waste Management	<ul style="list-style-type: none"><li>Amount of solid waste increasing day by day</li><li>Lack of landfill sites</li><li>Plastic and solid waste are disposed on road or on open ground/ areas</li><li>Waste collection from streets are not frequent</li><li>Poor coordination among Nagar Parishad and other parastatal departments</li><li>Poor solid waste management induced breeding ground for mosquitoes and flies</li><li>Lack of sanitary workers</li></ul>
Drainage System	<ul style="list-style-type: none"><li>Inadequate drainage system</li><li>Most of the existing drains are clogged due to heavy silt in drains</li><li>Poor connectivity of household's wastewater with drains</li><li>Effluent from septic tanks are directly discharged into storm water drains</li><li>Conflict between railway and municipality</li><li>Prolonged water logging causing contamination of drinking water</li></ul>
Sanitation	<ul style="list-style-type: none"><li>No community toilets</li><li>No toilets facilities in slum areas</li><li>Prevalence of water and vector borne diseases</li><li>Unhygienic living conditions</li><li>High percentage of soak pit toilet among MIG and HIG population</li><li>Mass open defecation practice is prevalent</li></ul>
Slums population	<ul style="list-style-type: none"><li>Increasing slum habitations</li><li>Poor access to basic services</li><li>Unhygienic living conditions</li><li>Temporary shelters along the roads</li><li>Increasing trend of Diarrhea and malaria cases among children</li></ul>
Ecosystem within city and its periphery	<ul style="list-style-type: none"><li>Apathy among the community and administration towards the conservation of natural resources like water bodies, open spaces, etc</li><li>Prolonged water logging in the periphery of the city</li><li>Degradation of natural water bodies, and paleo channels of river Kosi and its tributaries</li><li>Construction in agriculture and open areas</li><li>Extensive soil mining for brick kiln</li><li>Fertile top soils are used for building construction</li><li>Migration from rural to urban areas is increasing pressure on existing infrastructure</li></ul>
Electricity	<ul style="list-style-type: none"><li>Demand-supply gap increased</li><li>Frequent power cuts</li><li>Illegal connection increased</li></ul>



# STRATEGIES AND DIRECTIONS



There is a need for integration of climate change adaptation (CCA) and disaster risk reduction (DRR) to build long term resilience, reduce risks to achieve the goals of Resilient Cities Programme.

As it is mentioned above that the vision of the CRS is to build resilience of the Nagar Parishad to reduce the risks of climate change. While designing the strategic directions and action points for the resilience building of Saharsa, the city resilience strategy recognizes the need of integration of climate change adaptation (CCA) and disaster risk reduction (DRR) to build long term resilience, reduce risks to achieve the goals of Resilient Cities Programme being implemented by the government of Bihar.

Since the city is trying to accommodate the unceasing pressure of urbanization with its limited infrastructure, the impact of climate change, undoubtedly, will add new dimensions of risks and challenges to the city people and administration. In this context, it seems to be pertinent to look at and address the current problems of the city and pursue future climate proofing of the city in terms of planning and infrastructure design and provision as next steps. The city resilience strategy outlines the following strategic directions and action points for addressing resilience of the Saharsa city:

## Strategic Direction 1

### Integrate climate resilience component into development plans, land-use, financial and strategic planning

Policy and regulatory choices can be powerful enablers of adaptation to help implement technical, behavioral, and financial measures at an optimal scale. Integrating concepts of climate resilience into the city's existing processes allow for adaptation to be implemented at the municipal

“

The city resilience strategy recognizes the need for integration of climate change adaptation (CCA) and Disaster Risk Reduction (DRR) to build long-term resilience, reduce risks to achieve the goal of Resilient Cities Programme.”

scale through planning, design, and the allocation of human, capital, and material resources. Climate resilience should be considered within every department of the city to make Saharsa resilient to the impacts of climate change.

## Sub-directions

- Evaluate existing programmes that are prone to get affected by climate change impacts.
- Develop climate sensitive City Master plan for next 20 years based on the current land-use pattern and future development directions.
- Create and implement hazard specific Standard Operating Procedures (SoPs) developed by the Government of Bihar and develop a process to review the policies, plans, and projects in order to integrate climate change adaptation component.
- Develop a “Resilient City Checklist” to guide efforts of all stakeholders towards resilient city.
- Assessment of city on the basis of Resilient City Checklist to create a baseline status for the Resilient Cities Programme.
- Review current SoPs, policies, plans, and strategies for alignment with adaptation and update where necessary with the goal of strengthening using an adaptation lens.
- Identify and integrate extreme weather events and impacts into emergency response.
- Review land-use planning and policies from a climate change adaptation lens to ensure that the impacts of extreme weather events are addressed.
- Develop storm water management plan using a climate change lens on an annual basis.

## Strategic Direction 2

### Assess potential city specific threats and understand the risks specific to climate change impacts

The potential risks of climate change impacts must be understood in order to make concrete decisions to increase the resilience. Having a better understanding of the potential threats of climate change impacts will allow the city governance system to target adaptation actions where these are most necessary and can make better use of resources. In some cases, specialized information

and technical support will be needed to make informed decisions and develop appropriate adaptation policies.

## Sub-directions

- Conduct a 'risk/hazard mapping' exercise to identify critical areas that would be impacted by extreme weather events and pose risks to infrastructure and populations.
- Undertake comprehensive analysis of flooding and water logging risks, land-use patterns and existing water and drainage management systems as well as the natural drainage patterns in the city and their impacts on urban flooding and water logging.
- Based on the flooding and water logging risk analysis, assess the need of water pumps and pumping stations and installation/ deployment of the same at vulnerable and strategic locations.
- Identify and/ or construct safe spaces/ flood shelters at appropriate places in the city.
- Conduct Rapid Visual Survey (RVS) and Safety Audit of old/ existing public and community buildings from multi-hazard perspective in the city in partnerships with builders' associations, hotel owners associations, citizen councils, residents' welfare associations and housing cooperative societies.
- Conduct a detailed evaluation of potential impacts of extreme weather events on municipal infrastructure.
- Identify non-municipal infrastructure/facilities that provide critical support to city and determine their vulnerability to extreme weather events.
- Identify ecosystems services of city and its periphery areas that are at a greater risk and design actions to conserve and reclaim them.

## Strategic Direction 3

### Increase resilience of infrastructure

Protecting infrastructure systems is essential to achieve the adaptation vision. The actions presented here aim to increase the resilience of municipal infrastructure and ecosystems to maintain and enhance the services they provide.

Urban infrastructure will play a significant role in the resilience of the city in the future since infrastructure renewal, upgrades, and new



development are all key actions for the city to adapt to climate change impacts. The effectiveness, life-span, and long-term financial implications of municipal infrastructure must be evaluated through a climate resiliency lens to prevent damage and improve the resilience of the City. Protecting and restoring peri-urban is also a crucial aspect of climate change adaptation. The city's peri-urban landscapes not only provide resiliency services but also mitigate the impacts of climate change and increase sustainability. Healthy ecosystems of peri-urban areas retain soil (prevent erosion), clean the air, work as a buffer against floods, absorb moisture, create shade for cooling, provide a source of local food and improve the quality of life.

### Sub-directions

- Identify best suitable management practices for designing, construction, and maintenance that can be adopted in projects and implemented as per standards.
- Set up waste water and sewage treatment plants and/or recycling plants at appropriate places within the city and connect with natural drainage systems.
- Identify new and existing best management practices for green infrastructure, land-use planning, and design which address climate change impacts to the community, with a provision of annual review.
- Set up a vigilance cell for strict monitoring and prevention of any construction of flood-protection walls.
- Identify the types of ecosystems within the city and its periphery.
- Identify incentive programs that could be adopted to support the conservation of peri-urban ecosystem.
- Develop policies and by-laws to protect existing peri-urban areas.
- Provide support to non-municipal Infrastructure/facilities to increase resiliency and recovery.
- Identify and provide incentives to promote the adoption of green infrastructure on private, commercial, and institutional properties.

## Strategic Direction 4

### Provide information, tools and training on climate adaptation to facilitate and accelerate action

Resilience building process should occur across the whole community including at the governmental, institutional, commercial, and household levels. It is important that understanding climate information is a crucial step in designing adaptation framework. These actions aim to develop knowledge and tools to empower city staff and community members. Providing tools and trainings to city staff will play an important role in the successful implementation of adaptation actions across all departments and divisions. With improved information and tools, city staff will be better positioned to identify, prioritize, and implement climate resilience actions. Educating residents and engaging community stakeholders will also be a crucial step in increasing the city's resilience. Since resilience is not just a function of government alone. Everyone must be aware of the potential risks associated with climate change and extreme weather in order to build resilience within the community.

### Sub-directions

- Undertake comprehensive capacity enhancement of city staff / officials on risk analysis, risk informed planning and implementing initiatives based on the resilient checklist.
- Train staff of various departments to establish cross-departmental adaptation specialists.
- Investigate and collate various organizations' educational materials into a central resource database/portal to be shared amongst community organizations.
- Develop a basket of communication and education tools and materials using different electronic and social media like smartphone, TV, Radio, Newspapers, street plays to support citizens' response and recovery from extreme weather events and to increase resiliency.
- Improve current efforts to communicate the city's emergency response plans to the public and raise awareness.
- Develop education and communication materials with the support of district administration to promote the use and benefits of green infrastructure.

## Strategic Direction 5

### Plan for the financing and long-term implementation of adaptive actions

Climate change presents real financial risks. Allocating resources to achieve climate resiliency will be necessary to successfully implement this strategy and benefit from the long-term cost savings associated with proactive resilience measures. However, uncertainty regarding the availability of funds on time, as in most of the cases in secondary cities, can be a barrier to financing climate adaptation.

Though the city has plan/policies and instruments to increase investment in city's resilience but the current municipal resources are not sufficient to fund the implementation of all actions identified in the resilience strategy. So, additional funds will be required from sources of government (district, state and national) and the private sector to support the city's efforts.

### Sub-directions

- Identify financial implications and incorporate climate adaptation priorities into existing short- and long-term financial projections of the city's plan.
- Work with district and state government to get financial support for disaster recovery.
- Work with district, state and national governments to get funding to improve infrastructural resiliency

## Strategic Direction 5

### Respond and recover effectively from extreme events

Minimizing damage to homes, livelihoods, and people is an important function of resilience just as the need for rapid rebound when extreme events cannot be avoided. Continued operation and delivery of critical infrastructure and services, even when an event exceeds the normal coping capacity of organizations and governments, is important for the resilience of the community as a whole. The city lacks in infrastructure which can be strengthened through a climate adaptation lens.

### Sub-directions

- Evaluate city's emergency response plans and look for opportunities to integrate plans or areas where plans can mutually support each other.
- Identify the services, organizations and private sector services that are available to support recovery from an extreme weather event.
- Improve internal communication strategy and identify human resources to support citizens during an extreme weather event in recovery.
- Evaluate the feasibility for the development of a neighborhood-level (ward committee) response program.
- Evaluate community preparedness for response to extreme weather events and promote the importance of emergency response plans for community organizations.
- Update and formalize first response communications plan/strategy to ensure it responds to the needs of the city and clarifies the roles of external agencies in communicating to the public.

## SECTOR SPECIFIC ACTION POINTS AND ACCOUNTABILITY



The sector specific actions for resilience building has been designed with reference to the recommendations of Bihar DRR road map and Bihar Action Plan on Climate Change to avoid confusion among the departments.

In continuation of above mentioned directions, this section is focused on sector/ department specific action points of resilient building process. While designing the sector specific actions, recommendations of Bihar DRR road map and

Bihar Action Plan on Climate Change and City development plan of Saharsa developed by UNDP have also been taken into account to avoid confusion and overshooting of tasks. The identified actions are as follows in table 4.

**Table 4 :**  
Sector specific actions and Stakeholders

**Sector specific actions and Stakeholders**

Sector	Action Points	Time Line	Stakeholder
Housing	Housing situation analysis and risk analysis of housing system survey	Short Term	Saharsa Municipality, building construction department, Builder association. CSOs and CBOs and district disaster management authority.
	Awareness generation of low cost resilience housing system	Short Term and ongoing	District disaster Management Authority, Building construction department, Nagar Parishad, CSOs and CBOs
	Mason training for low cost/disaster resilient housing	Short Term	District Urban Development and Labour dept. DDMA, and Nagar Parishad

Sector	Action Points	Time Line	Stakeholder
Housing	Strict provision for map approval and construction monitoring	Short Term and ongoing	Nagar Parishad/ Revenue department
	Provisioning of proper basic services like water connection, sanitation, solid waste management	Short Term	Nagar Parishad and concerned parastatal departments
	Design a resilience housing indicators / measures for Saharsa city and implemented	Short Term	DUDA/ Nagar Parishad's engineering Department, Building construction department
	Design and implementation of slum improvement programmes	Short and Medium Term	District administration, Nagar Parishad (Engineering), DUDA and SUDA
	Assessment of infrastructure needs in slums	Short and Medium Term	Nagar Parishad, DUDA and SUDA
	Encourage community participation in slum development	Short and Medium Term	CSOs and CBOs
Solid Waste Management	Follow MSW Handling Rules 2000	Short Term	Nagar Parishad and District Administration
	Preparation of a comprehensive plan for solid waste management	Short Term	Nagar Parishad and District Administration
	Identify solid waste land fill site/ disposal place and management	Short Term	Nagar Parishad and District Administration
	Formation of ward level self-managing institution for door to door segregation of solid waste collection	Short Term	CBOs/ Ward member, Nagar Parishad
	Community monitored ownership solid waste collection and disposal system	Mid Term	CBOs/ Ward member, Nagar Parishad
	Development of Awareness generation of sustainable packing material to avoid the use of polythene in commercial institution/ shop and community	Short and Mid Term	CBOs/ NGOs/ CRPs/ Ward member, and educational institutes
	Development of recycling plan of solid waste	Mid Term	Scientific support from university/ NGOs and / District Health office
	Installation of collection point at road side, offices and commercial institutions and proper disposal system/ pickup system developed	Short Term	Nagar Parishad Corporate sector, Funding agency, NGOs
	Sewage treatment plant establishment/ Installation	Mid Term	Saharsa Municipality
	Formation of monitoring cell	Short and Mid Term	CBOs and NGOs ward members
	Development of drainage plan		DUDA/ Drainage Dept/ Engineering department of Saharsa Municipality
	Channelized the existing drainage system of city		DUDA/ Drainage Dept/ Engineering department of Saharsa Municipality

Sector	Action Points	Time Line	Stakeholder
Solid Waste Management	Regular cleaning system, monitoring system developed		Saharsa Municipality
	Assessment of need for community toilets, especially in poor communities		PHED, Nagar Parishad
	Involve private sector in construction and maintenance of community toilets		Nagar Parishad and PHED
Solid Waste Management	Development of water supply system plan	Short Term	PHED
	Assessment of existing pumps and their covering capacity	Short Term	Engineering department, PHED Revenue and CBOs
	Formation of safe drinking water management Institution/ water management communities	Short Term	PHED, Ward members/ CSOs/ CBOs
	Maintenance /Reinstallation of Pump/ Bore-well for safe drinking water supply	Mid Term	PHED, Ward members/ CSOs/CBOs
	Awareness generation on sanitation/open defecation and their impact.	Short and Mid Term	CBOs/NGOs, Education department through children, Health department
	Standard/monitored institutional community toilet construct/developed nearby public places, slum areas and LIG population	Short Term	PHED, Revenue, Nagar Parishad
	Explore options for PPP in implementation		Nagar Parishad
Drainage system	Extension of coverage of drainage in new colonies and uncovered areas	Short and Medium Term	Town planning department, PHED, Nagar Parishad, Ward Parishad, MLA/ MP, DUDA, CBOs and citizens
	Preparation of an inventory of water logging prone areas	Short Term	Nagar Parishad, Ward Parishad, CBOs, NGOs
	Linkage of HHs drain to Sub and Main drainage	Short and Medium Term	Nagar Parishad, PHED
	Insuring the household wastewater pipeline to sub and main drain for fluent discharge.	Short and Medium Term	DM, Executive of Nagar Parishad, CBOs, CRPs and ward members and citizens
	Establishment/strengthen of ward committees for proper maintenance	Short Term	CSOs and CBOs
	Formation and strengthen of City level enforcement cell for regular/proper monitoring of drainage system and its management	Short and Medium Term	CSOs, CBOs and Citizens
	Establishment and liasioning with Railway and state/city/ panchayat department for channelized the drainage system	Medium Term	Elected person, city manager, ward committee, engineering, and district administration
	Restrict wastewater disposal directly into water bodies	Medium Term	Nagar Parishad, District Administration
	De-silting of nallahs and roadside open drains	Long Term	Nagar Parishad, District Administration

Sector	Action Points	Time Line	Stakeholder
Basic Amenities	Preparedness plan for ensuring to providing all basic amenities to all citizens.	Short and Medium Term	Nagar Parishad, planner and related department, district administration, Health, PHED, DUDA, Education, DDMA, CBOs
	Coordinated budget planning with departments and citizens		
	Season to season, door to door vaccination.		
	Planning of system of access of basic amenities of pre and post monsoon	Long Term	Nagar Parishad, Jal Parishad, Supply department, DDMA Planning department, finance department, CBOs
	Inter-departmental regular short term meet to mitigate the problems raised during monsoon and disasters	Ongoing	
	Ensure potable water availability in stress condition	Short and Medium Term	Nagar Parishad, PHED
	Develop diversified/ redundant/Resilient water supply system.	Long Term	District administration, Nagar Parishad, DUDA, and DDMA,
	Ensuring PDS and Mid- day meal during stress conditions	Medium Term	Food Supply and Education department
	Formation of SHGs in slum areas and linkage with NRLM	Short Term	District Administration, CBOs NRLM
Health	Develop community level preparedness plan to control of transmitted disease	Short Term	Health department, CBOs, ward committee, BSDMA, Veterinary department, Nagar Parishad, National Health & Hygiene programme
	Awareness generation on health and hygiene practices	Ongoing	Health department, CSOs/CBOs, Ward members
	Formation and strengthening of ward level health committee	Short Term	CSOs/ CBOs, Nagar Parishad
	Pre monsoon vaccinations of human and livestock	Ongoing	Health department, Veterinary department
	Developed the enforcement cell of city level for betterment of health services and prevention measures	Short and Medium Term	CSOs/ CBOs, Citizens, Ward Parishad
	Ensuring pre and during monsoon fogging with community ownership	Ongoing	CSOs/ CBOs, Citizens, Health department
Transport system	Preparation of an integrated transport plan	Short and Medium Term	Saharsa Nagar Parishad with the financial support of state and national government
	Widening and strengthening of all main roads	Short and Medium Term	Nagar Parishad and RCD
	Provision of foot paths and street lights along main roads	Short and Medium Term	Nagar Parishad and RCD, ward members
	Improvement of junctions and provision of signals and signage	Medium Term	Nagar Parishad and Traffic Police
	Construction of ROBs at major crossings	Medium Term	Nagar Parishad and RCD



# MONITORING AND EVALUATION CHECKLIST AND FUTURE UPDATES



Monitoring and evaluation is imperative to guide future activities and pave direction for the updating of the resilience strategy.

The process of monitoring & evaluation informs an ongoing cycle of learning that provides insight into the nature of city resilience strategy. Based on previous experiences and responses observed from the city, corrections can be integrated into future city's resilience strategies. A five-year monitoring & evaluation cycle is required to guide future monitoring and evaluation activities as well as regularly updating the city resilience strategy formulation progress.

A checklist of resilience building at city level is being recommended as measures of the success of the city resilience strategy and to track how the Nagar Parishad and the community are achieving the city resilience strategy's vision and goals. The current vulnerability of the city is so pronounced that there is hardly any benchmarking available to base climate proofing measure at this stage. In the resilience strategy all these indicators are designed based on the services that the city is being rendering to its citizen and also mentioned in the guideline of service level benchmarking which is mandatory to follow to city level authority to perform and receive fund from the national and

state government. With the help of these indicators, Nagar Parishad can track their performance and progress over time against the baseline. Municipality must do following processes to monitor & evaluate their achievement and failures and design their future actions:

## Develop annual report, work plan review and prioritization

Each year the Nagar Parishad will report progress to Municipal Council and the community through its annual report. The focus of the annual report will be based on the trends observed amongst the identified indicators and reflections on the factors which influence the trends. The city will also review work-to-date and prioritize actions on a yearly basis. Prioritization of actions is expected to change from year to year based on the city's existing decision making processes, evaluation, annual review, budget, and external factors.

## Risk and Vulnerability survey

It is recommended that every two years, risk and vulnerability survey should be done to gauge

preparedness and awareness of climate change adaptation both within the city and the community.

## Review of Goals, Objectives and Actions

It is recommended that every five years, the city resilience strategy itself should be reviewed. This five-year review would be an explicit opportunity to consider appropriateness of the goal, objectives, actions and strategic directions.

## Staffing and Resources

Given the wide ranging list of actions and cross departmental responsibilities, along with the ever changing information and science associated with climate change, the city resilience strategy will need to be administered and managed on a long term basis to ensure its success.

A strategy of this scale and scope will require dedicated individuals who will be able to act as lead administrators, providing the necessary resources, support, and expertise to assist city departments in implementing their actions. Collating and reporting on performance indicators, preparing reports, communicating to municipal council and the community, assisting with annual prioritization of actions, and continuing to build stakeholder involvement are some of the administrative tasks that are likely to be associated with this strategy in implementation.

To this effect, financial resources will be required for ongoing implementation and management. Allocating both human and financial resources to the city resilience strategy will be essential in achieving the city's adaptation vision.

The list below illustrates different checklists for this purpose to collect information for assessment and evaluation for further updates of the strategy.

## Checklists : Understanding disaster and climate induced risks

- ☐ No. of risks that the city confront
- ☐ No. of water logging points
- ☐ % of area inundated due to the urban flooding/water logging
- ☐ % of population (ward wise ) get affected by urban flooding / water logging
- ☐ % of public buildings having resilient design to earthquake, flood (plinth above HFL) and fire

## Understanding the level of basic services as per Service Level Benchmarking norms

### Checklist

#### Water Supply

- ☐ % area under the pipe line water supply connection
- ☐ Per capita supply of water
- ☐ Continuity of water supply
- ☐ Quality of water supply
- ☐ % of HHs having more than one sources of safe drinking water
- ☐ % of HHs having raised hand pump
- ☐
- ☐

#### Wastewater management (Sewerage and Sanitation)

- ☐ Coverage of toilets
- ☐ Coverage of waste water network services
- ☐ % of drains choked in the ward
- ☐ Frequency of drain cleaning

#### Solid waste management

- ☐ Household level coverage of Solid Waste Management services
- ☐ Efficiency of collection of municipal solid waste

#### Storm water drainage

- ☐ Coverage of Storm water drainage network
- ☐ No. of Water logging / flooding points
- ☐ Duration of water-logging at different points

## Capacity to respond and recover effectively from extreme events

### Checklist

- ☐ % of annual expenditures that are directly attributed to adaptation
- ☐ % of municipal plan that include climate component in their development plans
- ☐ Growth of annual revenue from different sources
- ☐ % of BPL population
- ☐ Competency level of existing staff for implementing proposed projects
- ☐ No. of wards have constituted ward level committees



## CONCLUSIONS

Climate change is an unpredictable phenomenon with implications that cross political and physical boundaries and traditional disciplines. The city resilience strategy of Saharsa will be a live model of resilience building for other cities in Bihar. But its success lies in wise implementation through collaborative approach and learning. The city Saharsa has shown leadership in recognizing the impacts of climate change and making a commitment to continue to adapt to them. By planning to reduce vulnerabilities, increase resilience, build on existing strengths, and minimize the severity of the emerging impacts of climate change on the municipality, Saharsa can become lighthouse for other small cities.

At the current size and scale of the city, it has an advantage to establish community coherence effectively and it is easier to gather citizen participation, interest and involvement in the affairs of the city. The relationship between city and community is easier to develop and regular communication can be maintained. With this, the city resilience strategy gives utmost importance to community involvement in implementation of the strategy by 2030. Community participation and voice in the planning mechanisms will also make sure that laws and mandates are developed and implemented.

## REFERENCES

The following is a list of plans and reports that complement the city resilience strategy of Saharsa city

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