

ACCCRN : CLIMATE CHANGE & URBAN RESILIENCE

VULNERABILITY ANALYSIS

GORAKHPUR CITY

December, 2009



Conducted by :

- Gorakhpur Municipal Corporation
- Gorakhpur Environmental Action Group

Supported by :

- The Rockefeller Foundation
- Institute for Social and Environmental Transition (ISET)

Table of Contents

- Introduction**
 - Project perspective
 - Objectives
 - Process and Methodology
- Part 1. General Urban characteristics**
 - Physical Profile**
 - Location
 - Topography
 - Rainfall
 - Temperature
 - Cultural Profile**
 - Population growth and composition
 - Age structure
 - Literacy
 - Occupation
 - Socio economic status
 - Housing condition
 - Ownership of Houses
 - Population projection
 - Key issues
- Part 2. Risk vis a-vis with urban infrastructure**
 - Water supply
 - Present scenario
 - Future demand
 - Sewerage and sanitation
 - Present scenario
 - Solid waste management
 - Present scenario
 - Future status
 - Water logging
 - Risk frame: Its causes
 - Natural
 - Behavioral
 - Policy
 - Key issues
- Part 3. Impact of risk and vulnerability**
 - Education
 - Drinking water quality
 - Health
 - Losses
 - Livelihood
 - Employment
- Part 4. Institutional framework and Major Challenges**
 - Institution for urban governance and service delivery
 - Institutional role and responsibility
 - System discrepancies
 - Key issues
- Part 5. Adaptive Measures**

Introduction

Rapidly expanding urban settlements in the developing world are and will continue to face severe climatic risks in light of climate change. Urban populations will increasingly be forced to cope with increased incidents of flooding, air and water pollution, heat stress and vector-borne diseases (IPCC, 2001; IPCC, 2007). Cities in developing countries are at particular risk due to their high density populations, a lack of adequate drainage channels, a concentration of solid and liquid waste, expansive informal settlements and urban expansion onto risky sites. Increased climate hazards coupled with rapid urbanisation are likely to put increased strain on the capacity of local governments as they attempt to respond to the vulnerabilities of the urban population, particularly the urban poor.

Despite these challenges present climate change adaptation-related projects largely ignore urban areas in favor of rural livelihood-focused activities. Rural livelihoods tend to be more dependent on climate sensitive natural resource-based livelihoods, and rural areas tend to have less protective infrastructure for climate extremes. This has meant that poor urban populations have not commonly been considered as priorities in adaptation planning and interventions. This is despite the reality that they often do not benefit from these infrastructure investments or are made more vulnerable because of their dependence on faulty infrastructures, such as substandard housing. Recent research highlights an urgent need to improve our understanding and action on climate vulnerability and adaptation in urban areas as an urgent priority, particularly where poverty levels and population growth rates are highest.

Considering the above view, the Rockefeller foundation has taken climate change resilience initiative in developing countries to shape and substantiate strategy to help people regarding the adverse impact of climate change. It is now become a bare truth that climate change will hit poor and vulnerable people the hardest, because these population have the fewest resources to prepare and plan for the impact and the lowest capacity to respond. They are also often heavily reliant as climate for livelihood and in many cases survival and the most expose to climate change.

Objectives

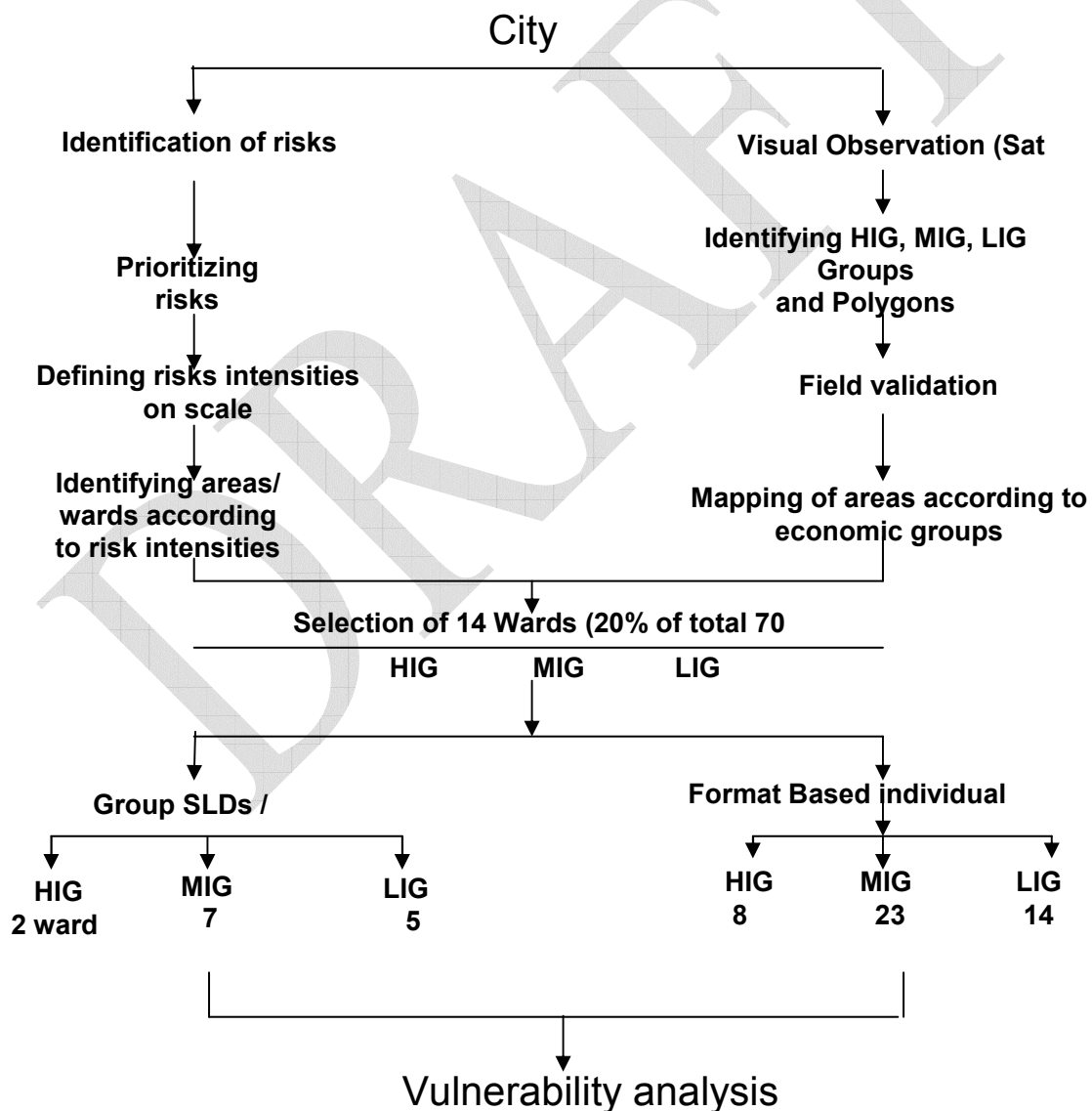
The **Asian Cities Climate Change Resilience Network** aims to catalyze attention and action on building climate change resilience for poor and vulnerable people by creating robust models and methodologies for assessing and addressing risk through active engagement and analysis of various cities. The sub objectives of the ACCCRN are as follow:

- To develop an improved understanding of the consequences of climate change for urban areas and how these, and the communities within them, can adapt to climate change.

- To explore policy options for urban planning in response to climate change, with emphasis on changes in urban form and urban governance.
- To improve the interaction between the scientific community (natural scientists), the urban planners and other relevant stakeholders.
- To initiate stakeholder involvement in order to develop adaptation strategies for urban environments

Procedure/Methodology

The present vulnerability study is primarily based on the analysis of primary data collected through community and Household questionnaire and Participatory Methodology tools and Shared Learning dialogues Secondary data had also been used occasionally for the purpose of the analysis. The procedure of the study has been presented in following diagram.



Due to limitation of small number of administered format based questionnaire, the main thrust was to rely on participatory appraisal tools and city level projections with the help of secondary data.

Criteria for selecting survey area

- The number of risks (and its intensity) affecting the area
- Coverage of various socio-economic groups
- The impact of risks on economic activities
- Diversity in area (Covering both old and new urban settlements)

In the first instance, during the above mentioned study, the 70 wards of Gorakhpur city were divided into 7 regions on the basis of boundaries of Police station areas :

1. Gorakhnath
2. Kotwali
3. Shahpur
4. Cantt
5. Rajghat
6. Chiluwataal
7. Khorabar

In these seven police station regions, 17 risks/problems were identified through community participatory dialogue (dated 2nd July 2009) and were rated /graded on the basis of intensity of risk/problems (on a scale of 1-5)

Standards for measurement

Various indicators were decided in order to determine the intensity of the risks on a scale of 1-5 points .These indicators are as follows:

Water logging/accumulation

- If water logging is more than 3 days
- If water enters in 25% of the houses
- If drains remain blocked.

Sewerage and Sanitation

- Lack of existence of underground sewer system
- Irregularity in cleanliness of sewerage

Solid Wastes Disposal

- No wastes disposal facility
- Wastes are frequently disposed of
- Wastes are disposed of every day

Drinking water

- In summer pumping stations do not function properly
- Filth/dirt from water taps along with the water
- Leakage in pipes
- Water not purified by municipal corporation
- No force pressure in water supplied by municipal corporation

On the basis of above mentioned standards the risks were given following marks and rating order in the city as a whole:

Problems	Marks obtained	Grade or Rating order
Water logging	16	1
Sewerage and sanitation	15	2
Drinking water	14	3
Disposal of solid wastes	12	4

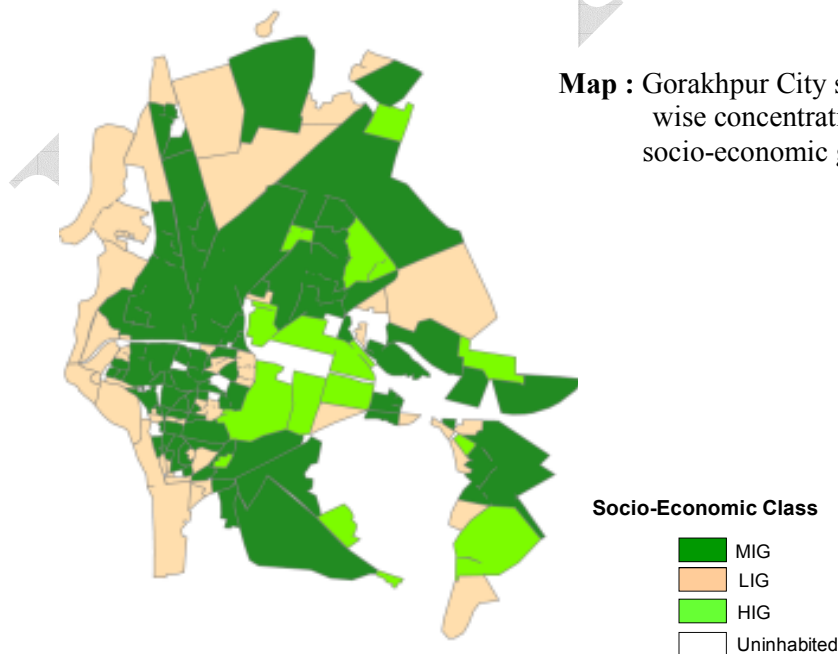
Source : Based on group- SLD

Through this procedure the following four major problems were identified which have the potential of enhancing the risk of city due to climate change impacts.

- Water logging
- Sewerage and sanitation
- Drinking water
- Disposal of solid wastes

It is extremely important to mention here that out of these four risks sewerage, solid wastes disposal, water logging influence the quality of drinking water and hence drinking water was taken as a cross-cutting risk. For assessing social - economic groups in Gorakhpur city, following procedure was adopted .

On the basis of visual observation of satellite Image of the nature of inhabitation, three (HIG,MIG,LIG) socio-economic groups were classified by means of polygon. These were physically and validated by field visits.



Source : Based on Google Satellite image and field verification

After identifying major risks and concentration of socio-economic groups, various wards were assessed according to influence of risks and the wards were selected for detailed survey so that :

- it matches with over all socio-economic inhabitation
- the selected wards have diversity of risk and risk combinations
- various geographical locations are covered.

Police Station	Wards	Major Risks				Major Social Economic Groups			Selected Wards for survey
		Water logging	Sewerage	Solid Wastes	Quality of Drinking water	L I G	M I G	H I G	
Gorakhnath									
	Rajendranagar		√			√	√		
	Lachhipur		√			√			
	Chaksa hussen	√	√	√	√		√	MIG	
	Lohia nagar						√		
	Jatepur north						√		
	Janki Bihar	√	√				√		
	Humaunpur	√	√				√		
	Purana Gkp	√	√		√		√	MIG	
	Andhiyaribag	√	√				√		
	Netaji s nagar			√		√	√		
	Surajkuund			√		√	√		
	Rasulpur	√	√	√	√	√	√	LIG	
	Dharmsal	√	√			√	√	MIG	
	Madhopur	√	√		√	√	√	LIG	
Rjaghat									
	Naushar		√		√	√	√		
	mahewa	√	√	√	√	√	√	LIG	
	Hansapur	√	√			√	√		
	Turkmanpur		√				√		
	Raiganj								
	Kazipur	√							
	Mirzapur	√	√			√	√		
	Basantpur					√	√		
	shekhpur								
Kotwali									
	Alinagar			√			√	√	
	Diwan bazaar			√	√		√		
	Ismailpur			√			√		
	Delizakpur			√			√		
	Purdilpur	√		√			√		
	Miyabazar		√	√	√	√	√		
	Mufftipur	√		√	√		√	MIG	
	Narsinghpur	√	√	√		√	√	MIG	

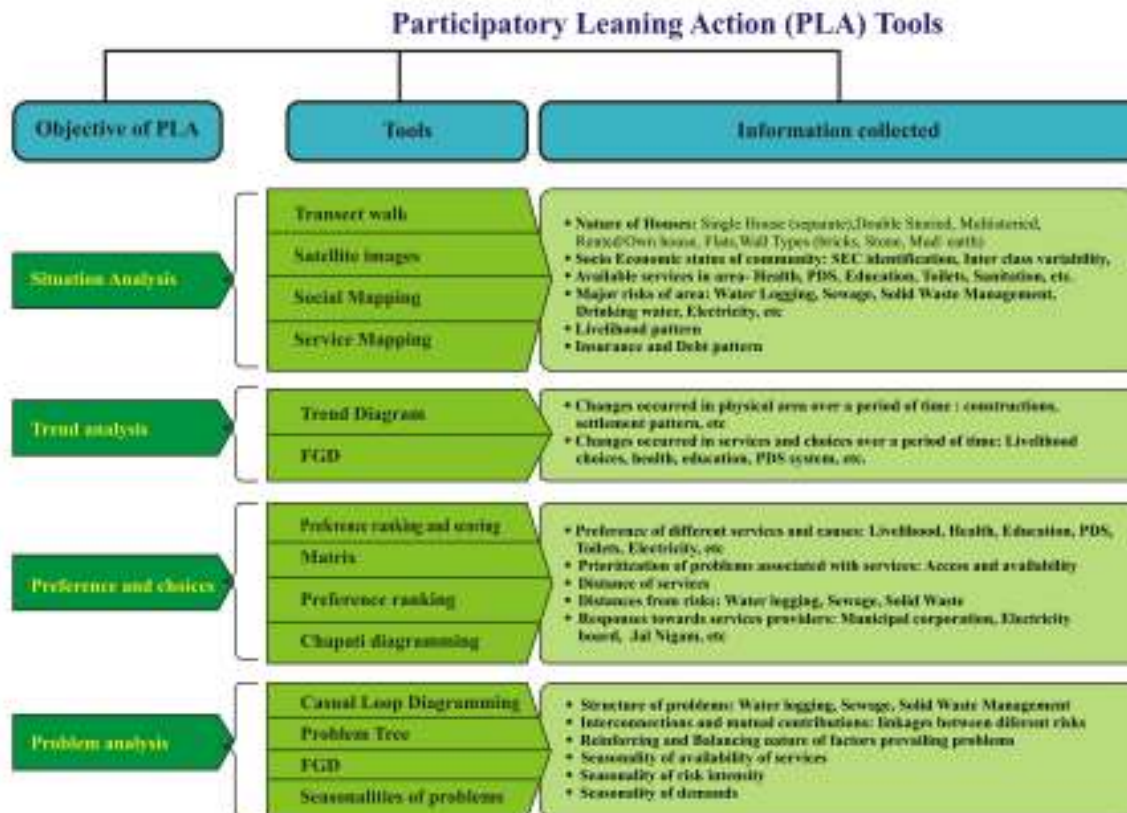
Police Station	Wards	Major Risks				Major Social Economic Groups			Selected Wards
		Water logging	Sewerage	Solid Waste	Quality of Drinking water	L I G	M I G	H I G	
Shahpur									
	Raptinagar	√				√	√		
	Jangal salik					√			
	Sheopur shabazgunj	√	√			√			
	Jangal tul W					√			
	Jangal tul E					√			
	Ghosipur					√			
	Bheriaghta					√			
	Jatepur rl			√		√			
	Jatepur north	√		√		√			MIG
	Krishnanagar	√				√	√		
	Basaratpur					√			
	Ram janki					√			
	Shahpur	√	√			√	√		HIG
	saktinagar	√	√			√			
Cantt									
	Civil line		√			√	√		
	Civilline		√			√	√		
	Betiahata					√	√		
	Daudpur	√	√	√	√	√	√		MIG
	Rustampur		√	√		√	√		
	Mohhadipur					√	√		
Khorabar									
	Gopla pur	√	√			√			LIG
	Mahuwisuharpur	√	√		√	√	√		LIG
	Jharna tota		√						
	Mahadeo jhar 1		√			√	√		
	Mahadeo Jhar 2	√	√			√	√		LIG
	Taramadal	√	√		√		√		HIG

Source : Based on Group SLD

In the entire city, on the basis of settlement of social economic groups (50%MIG, 30 %LIG and 20% HIG), 14 wards were selected for the purpose of survey. The ratio of socio-economic group was maintained as per the overall city's settlement.

Following methodologies were adopted in the survey :

- **Community Consultation and SLDs at various levels** : Various administrative departments, informed citizen, elective representatives of different wards and academic personnel were consulted besides the consultation with communities of various socio-economic groups.
- **Secondary data** were helpful in analyzing the results obtained from SLDs.
- **PRA/PLA Tools** : Various PRA/PLA tools were identified and used for SLDs and community consultations and a list of such tools are being provided in following table:



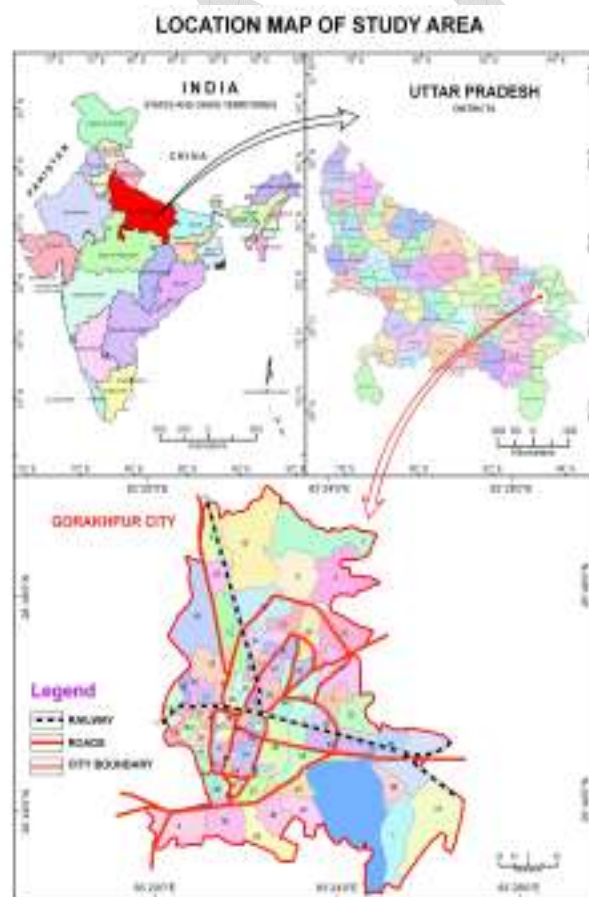
- **Sharing Platform** : Regular feed backs were obtained from the Steering Group (list being provided in the last) on the fundings of SLDs and analysis.
- Sectoral studies, pilot project and short studies/actions were also helpful in vulnerability assessment

■ GENERAL URBAN CHARACTERISTICS

Physical Profile

Location

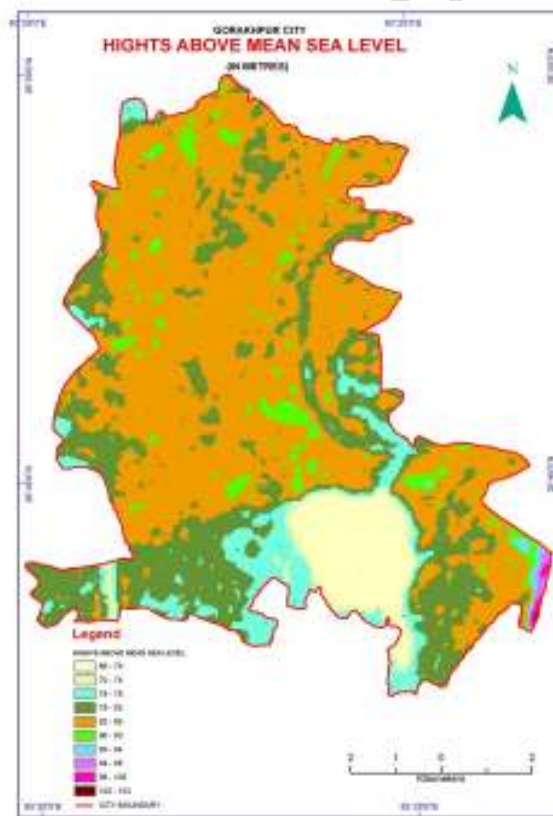
Geographically, the city of Gorakhpur is situated at the Latitude of 26° 46' N and Longitude 83° 22' E on the left bank of the river Rohin in confluence of rivers Rapti and Rohin at eastern part of Middle-Ganga plain. It is the second largest city of eastern Uttar Pradesh after Banaras in term of population growth. From the administrative point of view there is found an incorporation of rural and urban cultures in the city distributed in 70 wards. The city developed to a great extent after the year 1945 with the establishment of headquarters of north- eastern railways. The city itself is the head quarter of tehsil, district and mandal of its name. At present the Gorakhpur city is extended up to an area of 147 Sq .km while in year 1960 it had its extension of approx. 38.55 Sq .km and 136.55 Sq .km in the year 1982.



Source : Gorakhpur Municipal Cooperation

Topography

As Gorakhpur City is located in the plain area, hence the nature of the surface of the city is plain or smooth. It is evident from the contour and the flow of the rivers that normal slope of the city is from north to south. The slope is decreasing from the middle part of the city towards east and west sides. The average height of the city from mean sea level is between 75 meters to 85 meters. The western area is much higher than eastern area. The contour of 80 meters passes near Gorakhpur–Maharajganj road. It's proximate eastern part is lower in height than it. The Gorudhoia Nala/drain flowing through this region from north to south joins lake “Ramgarh Tal”.



Source : Prepared on the basis of SRTM Data

The contour of 80 meters passes across west of the city parallel to Rohin river. This river flowing in conformity with the slope from north to south meets with river Rapti in south west border of the city .The railway station is situated in the middle of the city at a height of 79 meters. Towards the southern part of it, the height of the surface diminishes lumpishly. The Ramgarh tal situated in south-east part of the city and the neighboring area of Ghantaghar near Basantpur situated in west of the city are approximately 75 meter high.

Climate

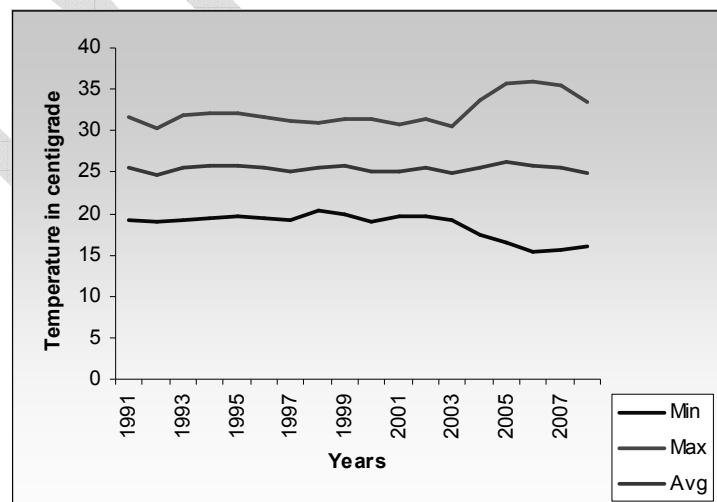
The climate of the city is moderate. Its average temperature is 25.68⁰c but average maximum temperature is 31.95⁰c where as average lowest temperature is above 19.57⁰ c and the city receive an annual rainfall above 119.2cm.

Gorakhpur city : Climatic Characteristics

Months	Relative Humidity	Maximum temperature	Minimum temperature	Average temperature	Rainfall
January	74.0	22.79	9.17	15.98	17.95
February	67.90	25.41	11.18	18.33	10.83
March	57.80	32.25	16.35	24.33	8.13
April	51.50	37.42	21.85	29.33	18.59
May	54.10	38.30	24.96	31.55	24.58
June	57.70	26.08	25.24	31.15	138.52
July	85.50	32.75	26.19	29.47	118.93
August	88.00	32.02	25.95	28.94	338.04
September	88.00	32.47	25.13	28.80	229.57
October	75.40	31.75	20.29	26.27	72.55
November	73.90	27.85	14.07	25.96	1.15
December	73.50	23.53	9.90	16.76	4.47
	70.35	31.05	19.03	25.57	1183.37

Sources: Department of meteorology, Govt. of India , Gorakhpur

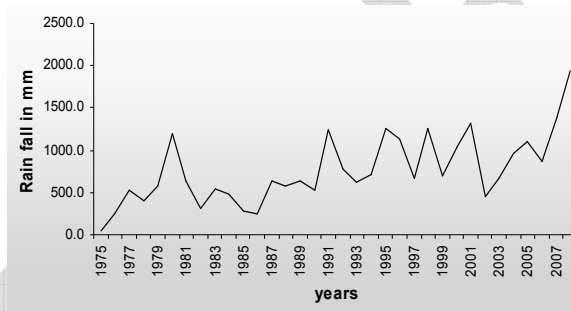
Since from last four decades, the city is experiencing increasing trend in temperature. It is obvious from the figure below that till 2003 the temperature (average annual, maximum and minimum) remained unchanged because there was no much change in the various components of climate.



But after 2003, though the annual average temperature is unchanged. But the annual maximum and minimum temperature have a pattern of continuous changing. There is about 9.51% growth in maximum temperature during 2003-2008, where as the annual minimum temperature recorded a decreasing trend. In 2002, it was 19.63^{0c} but now it is 15.98^{0c}. Thus there is 22.84% decrease in the minimum temperature during 2002 -2008. Hence, summer and winter both are becoming more severe than previous. Summer season is being hotter and winter comparably more cold.

As far as the rainfall is concern, the figure below shows that there is a marked variation in annual rainfall since 1975. It is continuously increasing except in 2002, 2003 and 2006. In 2001 the total rainfall was 132.4 cm. but in 2007 it was 137.6cm and in 2008 it was 194.1cm. Thus the heaviest annual rainfall was recoded in 2008 which was 62.83 per cent more than the normal. Thus, the analysis of the data of precipitation reveals that the amount of rainfall is continuously increasing

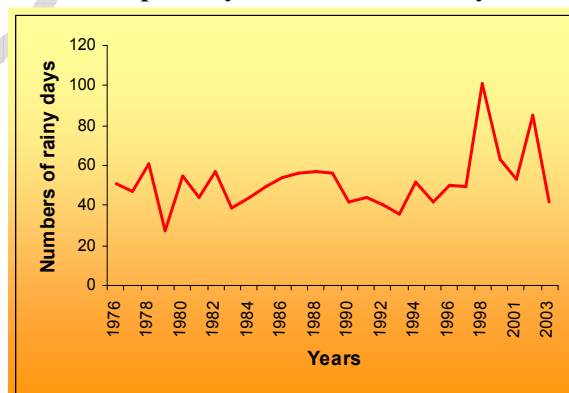
Gorakhpur City: Rainfall Amount



Source : Based on rainfall Data collected from Meteorology Department, Govt. of India, Gorakhpur

During the rainy season the amount of rainfall depend upon the number of rainy days too. The normal average annual number of rainy days (day with rain of 2.5 mm or more) is 54 days but it varies year to year. The occurrences of rainy days since 1975 are presented in the fig below :

Gorakhpur city: No of Rainfall Days



Source : Based on rainfall Data collected from Meteorology Department, Govt. of India, Gorakhpur

It is apparent from the above figure that the number of rainy days is not uniform during the period 1975-2008. In 1998 the number of rainy days was highest (100 days) but there was a short fall in the rainy days in 2001. Again it has increased in 2002 and reached as much as 92 days. The number of rainy days as obvious from the figure is quite undulating. After a decrease in year 2003-05 it has increased in 2008. Therefore, an abnormal growth in the number of rainy days has been experienced after 1998.

Cultural Profile

Demography

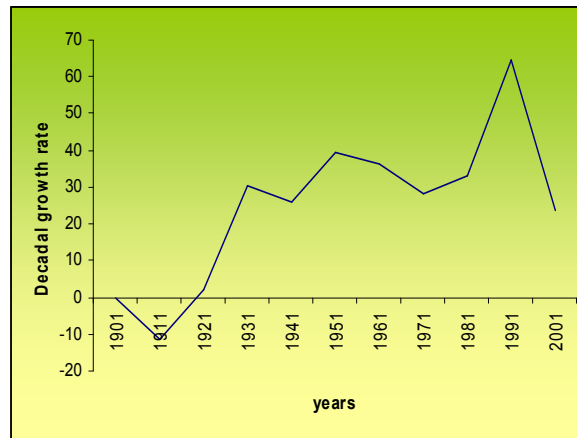
The city has a total population of 622701 (according to 2001 census) in an area of 136.85km², yielding an overall density of about 4559 person/km² which is quite high. In 1901 the population of the city was 64148 which reached to 57985 in 1921 recording a decrease of 9.6%. The population became 95127 in 1941 recording 64.05 percent growth during the period of 1921-41. The population has increased by 143 per cent during 1941-71. But even more faster during last three decades with a record growth during 1981-1991(66.7 percent) and a moderate growth during last decade, 1991-2001(23.16 per cent). The Figure and table below shows the growth of the population in the city during last 10 decades.

Gorakhpur City: Population Growth (1881-2001)

Years	Population	Absolute Growth	Decadal Percentage change
1881	50,908	-	-
1891	63620	12712	24.97
1901	64148	528	0.83
1911	56892	-7256	-11.31
1921	57985	1093	1.92
1931	75644	17659	30.45
1941	95127	19483	25.76
1951	1,32,436	37309	39.22
1961	1,80,255	47819	36.11
1971	2,30,911	50656	28.10
1981	3,07,501	76590	33.17
1991	5,05,566	198065	64.41
2001	6,22,701	117135	23.61
2011*	7,59,051		

Sources: Census handbook, Census of India 2001

Gorakhpur City: Population Growth



Source : Prepared on the basis of data of Census of India

It is obvious from the figure that after 1921, there was a sharp growth in the population of the city because some of the villages of the fringe were classified as urban and were included in the city boundary. During 1981-91 remarkable growth of population was recorded because 47 adjacent villages were incorporated within its boundary. Thus 64.1% of population growth was experienced.

Distribution of population

There is observed inequality in the density of the population in Gorakhpur city according to the census of 2001. There is high density of population in the old inhabited wards like old (Purana) Gorakhpur, Turkmanpur, Hansapur, Purdilpur etc whilst there is low density of population in the newly constructed wards inhabited in the north of the city like Samera, Fertilizer Nagar etc. (fig below) There is growth in the number of slum dwellings with the growth of the population in the city.

Due to rapid migration from rural to urban area, the living condition of urban area is deteriorating day by day. At present 110 slum dwellings have been developed. The total population of these slums dweller are 2,02,341 which is 33% of the total population of the city. The numbers of the slum dwellings has been increasing at a faster

POPULATION DISTRIBUTION (Based on 2001 Census)



one dot : 25 persons

rate. There were 52 slum dwellings in the year 1991 which has rose to 110 in the year 2001. This certainly point out that there is a regular increase in number of the migrants from rural areas to the city.

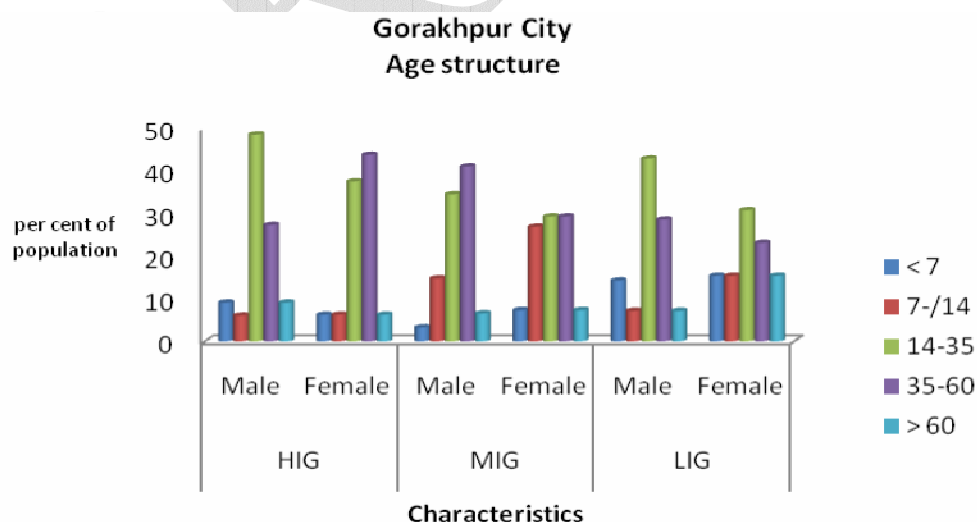
Age structure

Age structure depicts the general composition of population in different age group. It also depicts the resistive capacity of a society against the risks. The following table demonstrates the age composition of the population that has been generated through household data. From the table below it is clear that 70 percent of Households are in the age between 14 to 60 years which indicates that majority of people in Households are in young stage. In different socio economic classes disparities in composition has been noticed. In HIG group highest 48 per cent of male and 37.5 per cent female are in 14 to 35 age group while in MIG group highest percentage of population in households are between the age of 35 to 60 years.

Age- sex structure of Gorakhpur city

Age in years	HIG		MIG		LIG		Total	
	Male	Female	Male	Female	Male	Female	Male	female
< 7	9.09	6.25	3.27	7.31	14.28	15.38	6.48	8.57
7-14	6.06	6.25	14.75	26.86	7.16	15.38	11.11	20.00
14-35	48.48	37.5	34.45	29.26	42.85	30.77	39.81	31.43
35-60	27.28	43.75	40.98	29.26	28.57	23.09	35.46	31.43
> 60	9.09	6.25	6.55	7.31	7.14	15.38	7.41	8.57
	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00

Source : Based on Format based household survey, 2009



The percentage of population in the age below 7 in Low income group is quite substantial as compared to MIG and HIG.

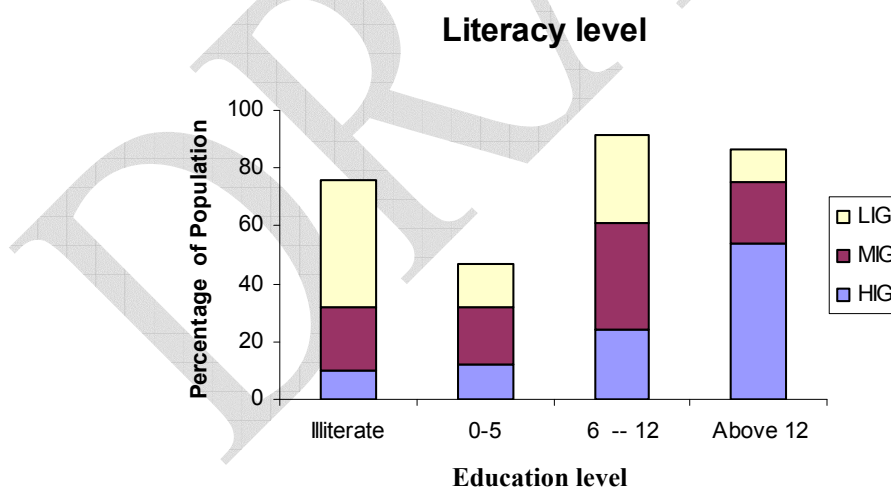
Literacy

During last 50 year the city has made remarkable progress in education field. Current total literacy rate within the Municipal Corporation Gorakhpur area is high (78 percent) as compared to state urban average of 56.3 percent and national urban average of 70.1. From the table below it is clear that as usual the literacy in HIG group is higher as compared with MIG and LIG. In HIG group 90.39 percent of people have been reported as literate while in MIG it is 78.26 and in LIG it is as low as 56.10 percent. In LIG group percentage of illiteracy is near about 44 where as in MIG and HIG it is 21.74 and 10.20 percent respectively.

Literacy level in different Socio Economic Group in Gorakhpur City

Literacy level	HIG	MIG	LIG
Illiterate	10.20	21.74	43.90
0-5	12.24	20.00	14.64
6-12	24.46	36.52	30.49
Above 12	53.69	21.74	10.97
Total	90.39	78.26	56.10

Sources: Computation Based on Community and Household Survey, 2009



From the survey it is clear that parents of low income group are not so keen to send their children into the school. Besides it has also deduced that in spite of enrolled into the school, the children of low income group do not go to the school due to engagement in livelihood activities and other family compulsions..

Economic base

The economy of the city is largely dependent on organized sectors based on retail and whole sale market. It is being considerably a large commercial centre of the Suryu par plain. So varieties of work are done in the city. Broadly, it can be categorized that tertiary and home based self employment are predominant sector in the city. From the field survey it is clear that higher income group Households have double income sources.

Gorakhpur City: Nature of Occupation

S. No.	Occupation	Percentage of total working population	
		HIG	MIG
1	Agriculture	12	6.66
2	Contractors	4	-
3	Service retired	8	3.33
4	Govt. and other services	44	23.33
5	Business	20	46.66
6	Private	12	3.33
7	Others	-	16.66

Source : Computation based on Community and Household Survey, 2009

Being surrounded with rural area, agriculture is also an important source of income. From the table below it is clear that 12 % of HIG Households have their income sources from agriculture while majority are engaged in Government and organized sector employment (44 percent). About 20 Percent Households in higher income are engaged in Business activity. In MIG group large proportion of working population i.e 46.66 per cent are associated with self-employed Business activities. Next to the business, 23.33 percent of middle income group Households are associated with govt. and other organized services. Besides these two major sections, 16.66 percent Households of middle income are engaged in other activities' such as LIC agent and share marketing etc.

Nature of Job in LIG Group

Occupation	% of Total Working Population
Chaukidar	7.40
Labour	14.81
Daily wates in shops	7.40
Private hardware	3.70
Milkman	3.70
Service	25.93
own Shop	14.81
Carpenter/mason etc.	7.40
Silai	3.70
Tuition	7.40
House Maids	3.70

Source : Computation based on Community and Household Survey, 2009

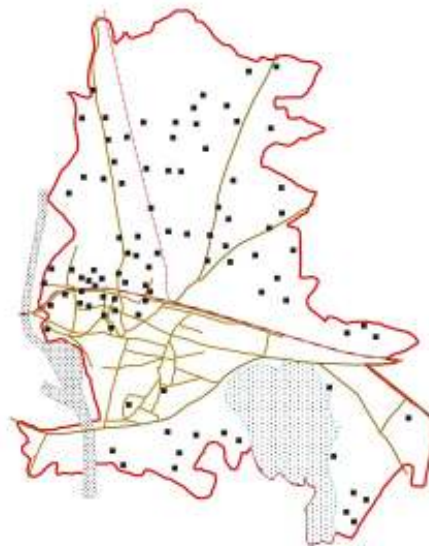
In LIG group varieties of work are being carried out for livelihood. In Low income group 32.92 percent of people have been noticed as active population. About 29 percent of lower income group household have responded that they have single active member in their house while 71.43 percent of household told that they have more than one person who are engaged in livelihood activities. As far as structure of occupation in LIG group is concern though majority of people are associated with lower level service class, which accounts 25.93 per cent active population while 14.81 percent people are engaged in different types of labour activities.

Housing condition

Housing is one of the basic services and most important part of planning for providing better quality of life to urban citizens. At present in Gorakhpur city, increasing level of urbanization has created the stress on housing front. Further, as there is lesser opportunities of investment and the rural background of the city so strong, people tend to invest in purchase the land and construction of house in the city. This had increased the land costs in the city. As per secondary information of population growth during last two decades, it has increased by 64 % during 1981-91 due to inclusion of 47 village into the municipal corporation boundary, while it came down to 23 % in next decade. But the increase in housing can not catch the pace of increasing population, hence, resulting in housing gap. Due to acute shortage of housing, Gorakhpur city faces the problem of over crowding, with average household population of 6.7. The overall condition of the Households especially in central and old part of the city is very bad and overcrowded.

In Gorakhpur city 90% houses are pucca, but when they are assessed on the ground of livable condition they are very much at par with slum condition. According to District Urban Development Agency (DUDA) information, 33 % population are living in slums condition developed in different parts of the city. The housing condition in low income group, which comprises 30% of the total population, is very bad and overcrowded. In low income group 35 % households are living in one or two room houses. Due to surrounding with rural and backward area, huge influx of floating population in the city is also inducing slums development in the city. The classified slum areas are evenly distributed in city and it is inferred that most of the low-income group inhabitations are having slum like conditions.

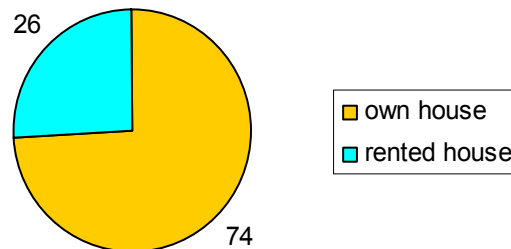
Slums in Gorakhpur



Ownership status of Houses

Ownership status is one of the major components as it helps to determine the housing demand of the city in future. From the survey it has been clear that 74 % of population reside in own houses and the remaining 26 % Households live in rented accommodation. Thus the housing demand in the city is increasing at higher pace but the supply is at very lower pace.

Ownership of Houses

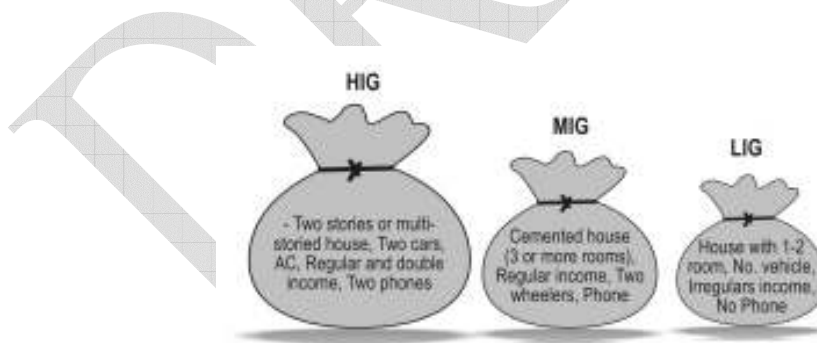


Social– Economic Status

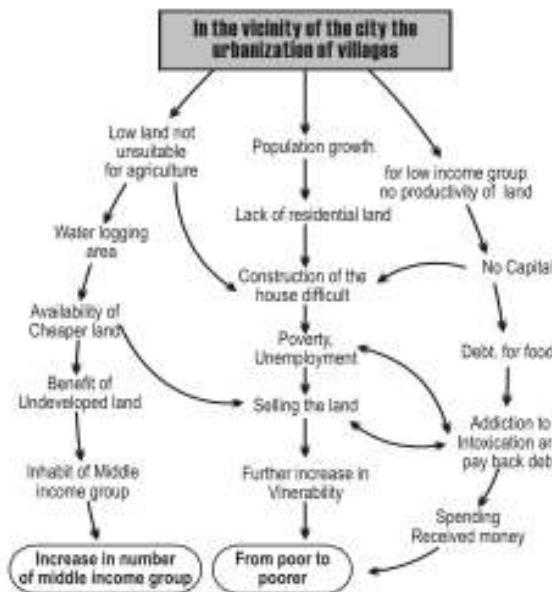
The social-economic situation in Gorakhpur city is multi-cultural. People of various categories, religions and castes live harmoniously in the city of Gorakhpur. During the study when attempt was made to analyze the situation from such perspective, sufficient variations were found. The following table indicate the anatomy of population in the city.

Category	Estimation through satellite photo	Physical Verification
High Income	10%	20%
Middle Income	70%	50%
Low Income	20%	30%

Source : Based on visual observation and field verification



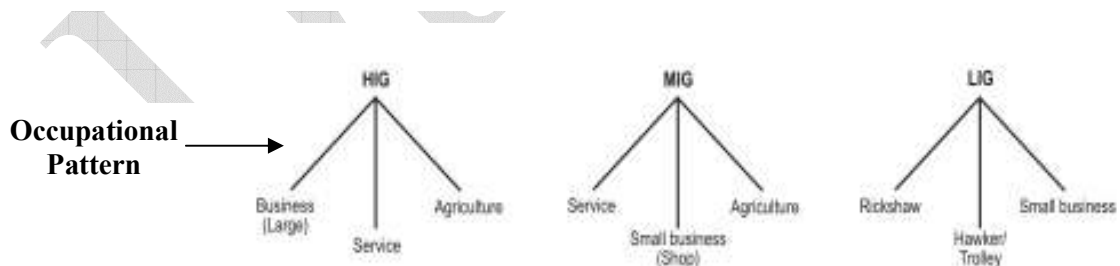
In the city of Gorakhpur all categories of people are living together in almost all the areas. In some areas there is abundance or prominence of any particular kind of category such as Betiahata Civilline, Bilandpur etc dominated by HIG. However, the percentage of such type of colonies is quite negligible.



It was also revealed that in the last 15-20 years, there is significant change in the situation of city so far as socio-economic groups are concerned. Due to urbanization of the neighborhood colonies and villages of the city, rich and powerful rural people have purchased unproductive land at cheaper rate and have started constructing houses in vicinity of the cities. In this way the strength of middle income group is increasing while because of poverty of the small labour-farmers they are selling their land and getting increasingly marginalized .

The easy money from the sale of land etc. is also increasing addiction of alcohol, gambling etc.

Muhaie Sudharpur ward is situated in north-east of Gorakhpur and is lying 2 km away from embankment. It is the ward of mixed population of both middle and low Income Groups. Low Income Group had sufficient lands not used due its unsuitability for agriculture. Being troubled by poverty and unemployment, 40% of the people have sold their lands to people of middle Income group living in vicinity of other blocks and after such land sale they started living on embankment in thatched hut or in house of one room . This way they are increasing their vulnerability by migrating and exhausting their resources and capital.



Normally in the city of Gorakhpur the percentage of the people having regular and fixed income is less while percentage of the people having irregular and daily wage earning is more. The prime reasons of these are lack of employment opportunities, shortage of industries and high population density.

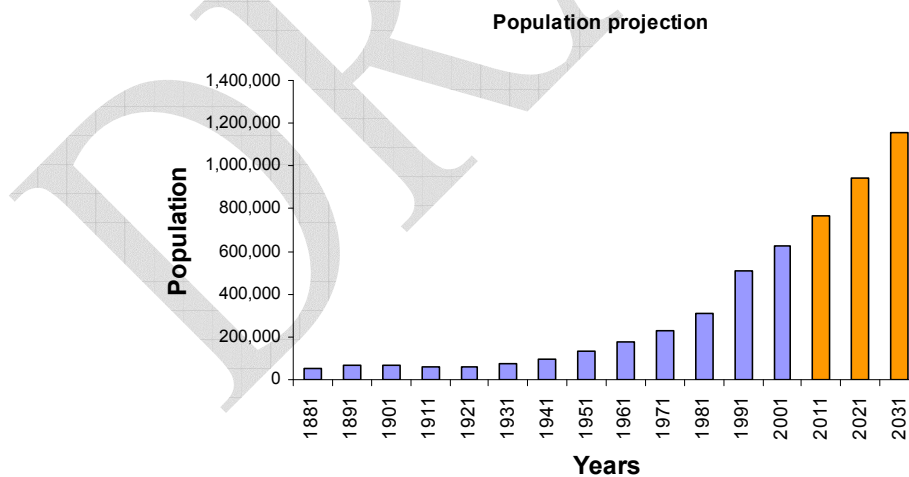
Population Projection

Population projection is important and basic requirement for the provision of basic services to the people. It is also required to plan for service provision and revenue realization from the users in a city, which is the direct function of the population and population growth. The city of Gorakhpur has a uniquely different growth character, complemented by the movement of people from surrounding areas for occupational reasons. The base data used for population projection is the data obtained from the Census of India, with detailed urban area population and municipal ward for 2001 and the 1991 census data summaries. This data provided the numeric basis for benchmarking the actual population and its decadal growth for the past decades. Different population projection methods like incremental increase, geometric methods and exponential method have been used to calculate future population. Different methods will have a different projections, average of all the shown are as under :

Gorakhpur City: Population Projection

Method	2011	2021	2031
Arithmetic	7,39836	856971	9,74106
Geometric	7,83222	985122	12,39069
Exponential	7,85299	990356	1248957
Total	2308357	2832449	3462132
Average	769452	944150	1154044

Source : Population projection computed on this basis of population growth rates during 1991-2001 census



Key Issues

Based on the above analysis following issues have emerged with regard to the demographic characteristic of the City.

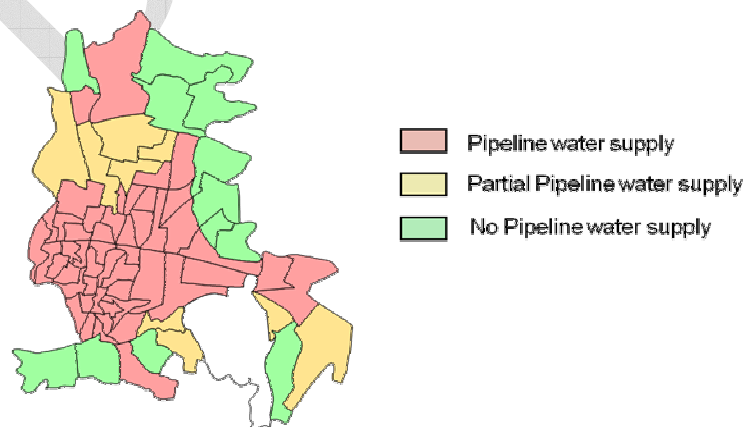
- *Although there is a sharp decline in percentage population growth compared to previous decades there is an absolute increase in population of Gorakhpur during the last decade. This is due to natural growth and migration of people from surrounding areas in search of job.*
- *The migrant population is likely to increase the demand for housing particularly LIG. If not planned for this section of population then slums or unplanned growth will be expected.*
- *The positive feature of Gorakhpur is that still a large parcel of vacant lands are available along outskirts of the city and current densities are low, except the core old city, hence there is no issue of land availability, but the affordability is area of concern.*
- *Intensive increase of middle Income group*
- *Percentage of slums population is increasing due to haphazard development*
- *The growth in population is also likely to stress already stressed public transport and will have impact on other services, hence planned efforts are required to direct the growth of the city in right direction.*

■ RISK VIS-A-VIS URBAN INFRASTRUCTURE

Urban communities are dependent upon the infrastructure that supplies them essential services such as drinking water, waste management, electricity, transportation and telecommunications. Basic services such as these are often the main assets of the urban poor, which assist them to pursue livelihoods and improve their quality of life. In city like Gorakhpur water logging is increasing every year damaging the infrastructure and affecting the society. As the climate change impact projections in the Rohin Basin (near Gorakhpur city) reveal that it is expected there will be more rain fall during monsoon months (*ref : From Risk to Resilience, Working paper 4, 2008*) the effect on the city will be in form of more water-logging and hence disruptions of infra-structural faculties. Deterioration of water quality services affect the health of the population and disrupt livelihoods and incomes. Thus, it is essential to protect critical infrastructure from failures in order to prevent families and communities from being trapped into further poverty. In this section basic infrastructure such as water supply and sewerage of Gorakhpur city has been assessed in the context of water logging risk.

Drinking water

The growth process and expansion of economic activities inevitably lead to increasing demands for water for diverse purposes of which drinking and domestic need attains paramount importance. But it is ironies that still after 6 decades of our independence the large section of people of Gorakhpur city have no access to safe drinking water. Water supply system of Gorakhpur city is 46 years old. There are two organizations responsible for water supply in town. Jal Nigam is responsible for planning and execution of water supply scheme and Jal Kal is responsible for operation and maintenance of the system. The main source of drinking water in the city are municipal pipelines, private tube wells and hand pumps.



Source : Gorakhpur Municipal Corporation, 2009

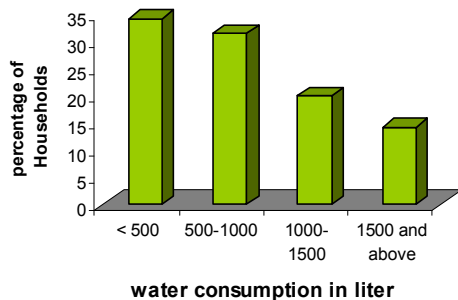
At present the distribution and supply of water is not sufficient to meet the present population demand. According to official record 65 % area of Gorakhpur city is under the pipe line water supply system while the remaining part is served by hand pumps. According to Jal kal department, daily 79 mld of water is being supplied to the Households through 64 tube well, 12 overhead tanks, but the total demand is 105 mld.. At present the length of distribution network is about 580 km. Thus, there is shortage of 26 mld of water per day in the city.



Utilization of water for domestic purposes

Use of Water in liter	Percentage of Household
< 500	34.28
500-1000	31.42
1000-1500	20.00
1500 and above	14.30

Source : Based on Group and individual SLDs



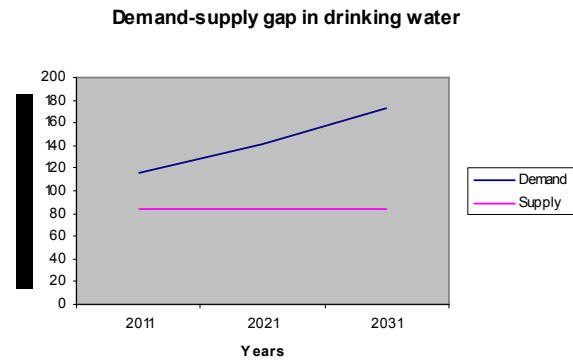
Consumption of Water

As far as seasonality status of water supply is concerned, 46 per cent of Households have responded that during summer season the amount of water supply reduces due to power cut and increased demand, while 42 percent have responded that along with reduction in water quantity, the quality of water also deteriorates during summer and rainy period.

From the above table it is clear that daily water demand varies in the city from 500 liter to more that 1500 liter per household. In Low income group 77 percent Households have water use less than 500 liter per day while in MIG and HIG group it is between 1000 to 2000 liter.

Future demand

It is important to calculate the future water demand, as it will form the basis for planning of facilities that will be required for proper delivery of water supply to the city. Projected population for the years 2011, 2021 and 2031 will be used to calculate the future water demand/requirement.



Projected Water Demand

Year	Population	Water requirement in mld	Water production capacity mld*	Deficit mld
2011	769452	115.41	84.00	31.41
2021	944150	141.62	84.00	57.62
2031	1154044	173.10	84.00	89.1

Source : Based on norms of Govt. of India and current production capacity

*** Presuming that present production capacity will continue**

This demand has been calculated on the basis of assumption that water supply for the future population will be at the rate of 150 lpcd for domestic use.

Sewerage and sanitation

Sewerage and sanitation are not only the basics necessity of life, they are also crucial for achieving the goal of “health for all”. Need less will be to mention, that sanitation has close and direct link with environment, water supply, health and hygiene.. Gorakhpur city is one of the most important emerging urban hub in eastern uttar Pradesh. The growing population pressure on present infrastructure has rendered several problems like slums generation; dilapidated humane condition etc. which has further deteriorated the sanitation condition of the city.

The situation and coverage of the sewerage network in Gorakhpur city is rather very poor. The existing city’s sewerage system was designed exclusively to carry domestic sewage only, but owing to the traditional pattern of open drains laid in the core city area; storm water also enters the trunk sewer directly or through manholes and branch sewers. This leads to tremendous pressure on the sewerage network, especially during monsoons.

The existing sewer lines in the city are more than 54 years old and are prone to chocking and leakages. Cleaning and maintenance of sewer lines is not done properly resulting in reduced section and less carrying capacity of the system. The clogging of these drains due to polythene and waste dumps lead to formation of stagnant pools of water leading to foul smell. The nallahs and rivers of the city are in a critical state due to the quantum of untreated sewage and waste entering the rivers on a daily basis.



Choked drain causing water logging

Presently only 22% of the total area is provided with underground sewer network with total length of about 55km and size of the sewer pipe is 300 mm to 150mm. The length and the size of the sewer pipe, both are quite meager in respect to fast pace of growing population and growth of use of water and generation of liquid waste. There are five sewer pumping stations at Nursinghpur which pump the sewage from the city to dispose of disposed off in the River Rapti, where as one pump located in Betia Hata near Reed's Sahib Dharmshala to pumps the sewage into Ramgarh Lake and in Rapti near Maheva. Thus, about 78 percent of the area of city is still unserved with sewerage system. There is no any sewer treatment plant in the city and raw sewers are disposed without any treatment in river Rapti, Ramgarh Lake and other fresh water streams.

Present Management Capacity

Jal kal and Jal nigam are both the regulatory and maintenance authority of sanitation system in Gorakhpur. The present sanitation system is 54 years old and now it needs rejuvenation. Though, the Nagar Nigam has developed a DPR on solid waste management and sanitation but it has yet to take an operational state. At present the Nagar Nigam has 1029 permanent and casual sanitary workers. According to norm of sanitation for Gorakhpur 28 Sanitary workers is needed for every 10000 people. Thus in this way 1744 sanitary workers is needed for the Gorakhpur city. But due to shortage of sanitary worker the pressure on sanitary workers is increasing day by day. At present the ratio between sanitary worker and people is 1: 605, which is quite high as per norm.



Source : Gorakhpur Municipal Corporation, 2009

Tools and equipments

Under the Municipal Act, road/street sweeping and drain cleaning are the obligatory responsibilities of the GMC and the solid waste generated in the town shall be collected and removed by the sanitary workers of the Public Health Division.

Tools	Numbers
JCB	2
R.C. Truck	3
Dumber placer	2
Loader	3
Tripper truck	6
Tractor trolley	15
Big Hand trolley	69
Small hand trolley	550
Drain crain	1
Dumber Bins	28
R.C. Bins	363

Source : Gorakhpur Municipal Corporation, 2009

Currently, the wastes are not treated in a systematic and scientific manner while disposing. As a result, the whole area in and around the disposal site is unhygienic and

poses serious threat to the environment and to public health. No treatment methods are adopted for disposing the waste. The wastes are just dumped without segregating biodegradable and non-biodegradable wastes

Future demand

As the city is growing very rapidly, the attention regarding proper sewerage and sanitation system would be the core issue in near future. As the central part of the city is already packed with dense population, the peripheral area of the city is also in being inhabited with new settlement. During 1991-2001 the growth rate of population of Gorakhpur city was 2.32 percent per annum. The following table shows the future estimated demand of water and sewerage load.

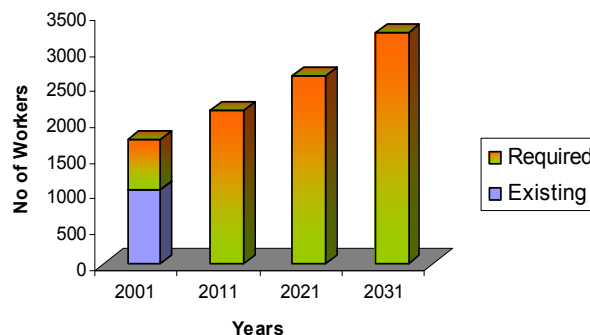
Future estimation of sewerage load

Years	Population	Domestic water demand @150 lpcd in MLD	Sewerage Load In MLD
2011	769452	115.41	92.32
2021	944150	141.62	113.3
2031	1154044	173.10	138.4

Source : Based on population projection and water demand

On the basis of this growth rate future population projection has been made for the year 2011, 2021 and 2031. Based on per capita domestic water demand of 150 lpcd, the net domestic water demand for the year 2011, 2021 and 2031 have been estimated. 80 % of the net water demand has been considered in the estimation of sewerage load

Future demand of Sanitary Workers



Future demand of sanitary workers

Years	Total population	Existing sanitary workers	Required sanitary workers as per norms
2001	622701	1029	1744
2011	769452		2155
2021	944150		2644
2031	1154044		3233

Source : Projection based current Norm of Municipal Corporation Gorakhpur

Solid waste

Solid waste is a material that no longer has any value to the person who is responsible for it. It is generated by domestic, commercial, industrial, health care activities and accumulates in street and public place. This is the second most important issue of the city as explained by citizens in various consultation. At present the Municipal Corporation Gorakhpur has no solid waste management system in place. The whole solid waste generated in the city is being disposed either along the roads or are being used as land filling material. The municipal solid waste mainly comprises of waste generated from household, markets, commercial establishment, hotel, hospitals and small scale industries in the town. During the survey it was deduced that that daily on an average per capita solid waste generation from the residential area of the city is about 0.270 kg. though the municipal standard(.375grams) is quite higher.

Gorakhpur is the prime whole sale and retail commercial centre for the surrounding rural areas. Therefore it receives significant floating population (4% of total population) who also contribute to waste generation in the town. The total quantity of solid waste generation in Gorakhpur is about 300 million tons per day out of which only 240 million tons per day is being addressed. This constitute to 80 % of the total waste. Household and commercial waster comprises the maximum percentage of solid waste generated.

Estimated Solid Waste Generation per day in City

Category	Generation amount (in tons)	Percentage
Residential	168.13	57.86
Construction and other	41.4	14.24
Commercial	40.0	13.76
Industrial	40.0	13.76
Hotel	0.53	0.18
Clinical Waste	0.50	0.17
Total	290.56	100

Source: Gorakhpur Municipal Corporation, 2009

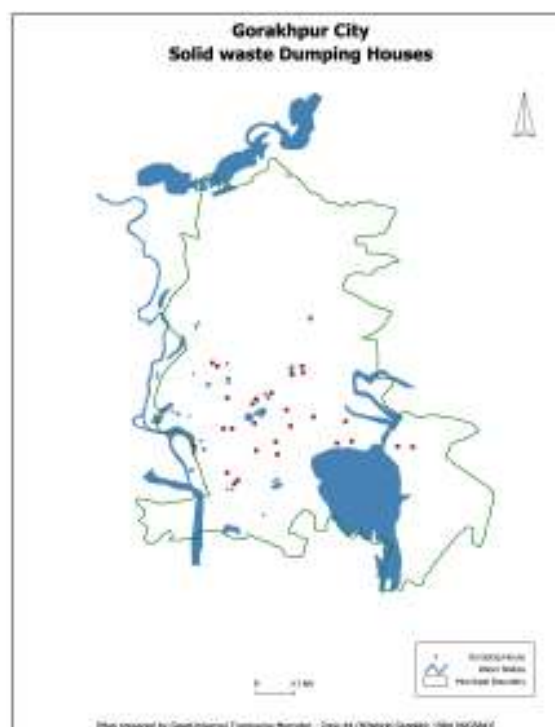
As far as the characteristic of municipal solid waste management of Gorakhpur city is concerned, it is deduced that 44.73 percent of total solid waste is of bio degradable nature. It is not segregated either at the primary collection points or at dumping sites. Most of the bio degradable wastes are found to grazed upon by cattle at temporary open dumps, resulting in waste being strewn here and there. Street sweeping materials are next major constituent of the non bio degradable waste. These wastes are disposed off at the dumping sites along with other wastes without any prior processing. The recyclable waste (polythene, plastic, paper carton) which account 13.97 per cent of total waste are often segregated manually by rag pickers. The rag pickers in turn sell the same to scrap dealers. However rag pickers do not collect and dispose all the recyclable plastics and other wastes of city and large portions are left on dumping sites, road sides, drains etc.

Quantity and characterization of solid waste

Waste characteristic	Percentage of total waste
Recyclable (paper rubber synthetic glass and metal)	13.97
Bio degradable	44.73
Construction waste	13.8
Street sweeping	22.49
Drain silt	5
Total	100

Source : Gorakhpur Municipal Corporation, 2009

In residential solid waste generation, the middle income group is at the top. This group is contributing almost 47.76% of solid waste generated from residential areas. As Gorakhpur is middle income group dominant city and 50 % of inhabitants belong to Middle Income Group this group contributes maximum solid waste in the city. However, the lower income group generates more per capita waste in comparison to the middle and higher income group. This is because they have no proper source of income and depends on daily shopping and bring cheaper and poor quality commodities which generate more solid waste.



Average Waste generation in different socio economic group

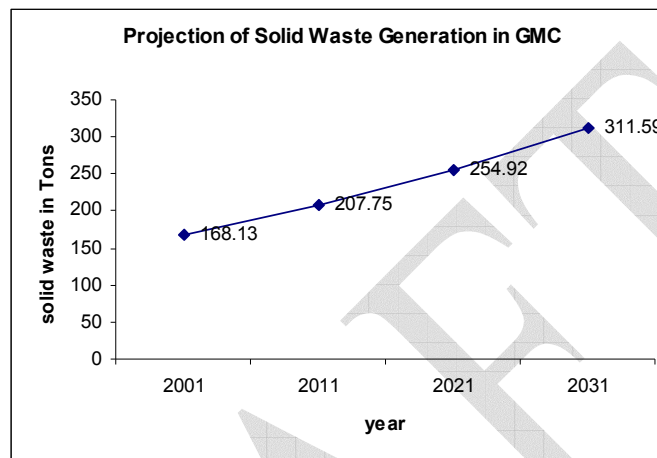
Group	Composition of Socio Economic Class in City Gorakhpur in percentage	Average daily waste generation in kg/ day/capita	Total generation of waste in ton/ day	Percentage Solid Waste Generation from Different Socio Economic Class
HIG	20%	0.250	31.618	18.80%
MIG	50%	0.260	80.30	47.47%
LIG	30%	0.300	56.21	33.43%
Total Avg.		0.270	168.13	

Source : SLDs in different income group settlements

Future solid waste generation from Residential area

Years	Population	Waste generation in tons
2001	622701	168.13
2011	769452	207.75
2021	944150	254.92
2031	1154044	311.59

Source : Based on current solid waste Generation by Households and projected population



Water logging

The intervening impact of poor sewerage and solid waste management is water logging in the city. During last few decades the problem is becoming more chronic and horrible. During the survey and shared learning dialogue with different communities it was found that 31 wards of the city are facing water logging problem of various magnitude. The municipal corporation Gorakhpur has identified 59 water logged point in the city. Besides poor sanitation and solid waste management, the problem of water logging in the city is also aggravated by its natural causes. The water logging is increasing both in newly developed areas as well as old areas.

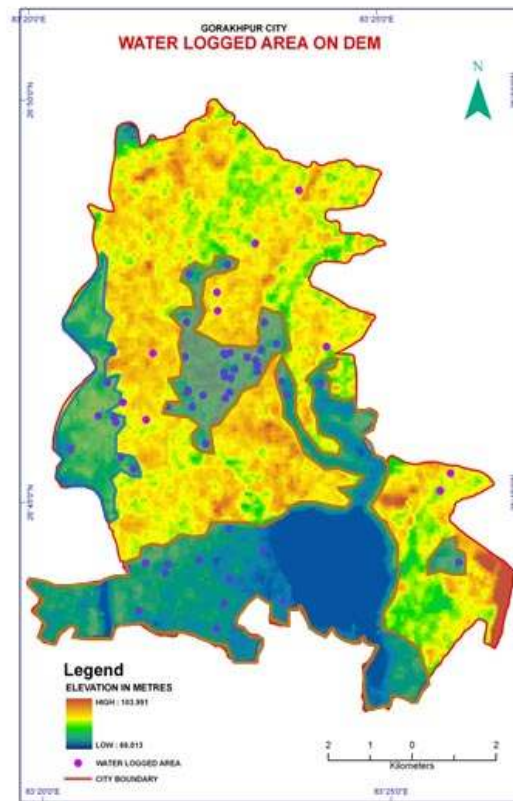


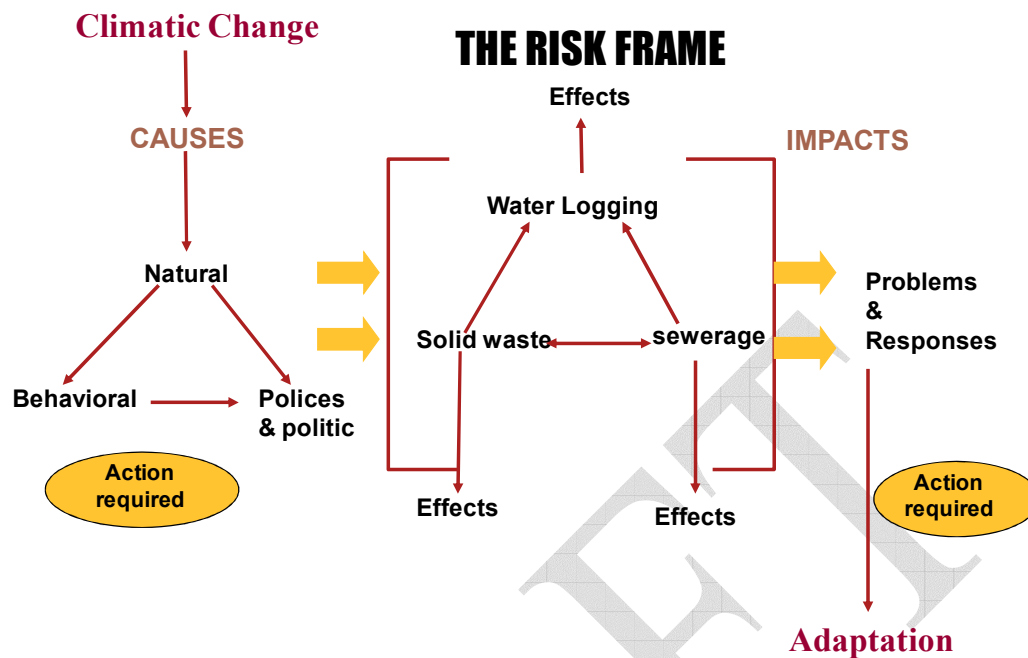
Informal dwelling surrounded by rain water

The problem of water logging is not new to the residents of Gorakhpur city. But in the last 15-16 years this problem has taken up a horrible condition and has become a subject of deep concern among residents. The southern part of the city due to lower elevation caused by repetitive erosion by river Rapti faces acute water logging problem. In the city there are many such localities which suffer from water logging for up to 9 months in a year such as Daudpur, Rustampur, Goplapur, and areas near Engineering College.

The Risk Frame

As per initial observations and discussions in the city level steering group, it was identified that Water logging, Solid Waster Management and Sewerage disposal are the three main risks which are enhancing the vulnerability of city in the context of changing climate patter. It was revalidated in the larger citizen's forum organized on 2nd July 2009 when the representatives coming from different sectors (business, service, professional, elected representatives, academics etc.) tried to identify the risk intensity and link various risks with the specific wards of the city. It was revealed that Drinking Water is also an important aspect enhancing the vulnerabilities of people. Drinking water has been a historical concern for the area, mainly due to its easy availability- high ground water level and hence possibilities of contamination. However, with the changing geo-climatic patterns and increasing water logging, the contamination of ground water is on an increasing trend ultimately affecting the health and livelihoods of the people. Therefore, Drinking Water was identified as one of the over-arching concerns and its deteriorating quality was recognized as one of the impact of three identified risk factors (WL,SWM, Sewerage).





Looking at the three identified risk and discussing ground realities with the citizens of Gorakhpur city, it was revealed that problems of solid waste and sewerage have, on one hand, its own effect in form of diseases and health risks, both these factors also contribute the situation of water logging in a city which already is prone to water logging due to the natural topography of the city.

The above risk frame explains the inter-connectedness of three major identified risks and water logging being the main risk tends to enhance due to the contribution of solid waste and sewerage.

On the basis of survey conducted in the entire city, the causes of the above mentioned problems have been analyzed in the following three contexts-

1. Physical and Natural reasons
2. Man made and behavioral reasons
3. Policy reasons

Physical reasons

The location of the Gorakhpur city, its nature of the surface, the nature of change of climate has enhanced the problem of water stagnancy, water evacuation etc. This physical reason can be viewed under following points:

● **Geographical delimitation**

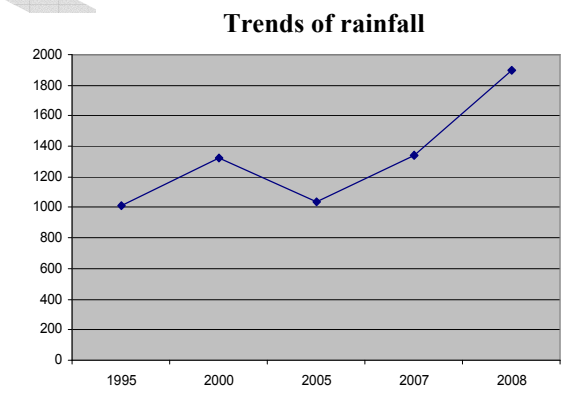
Gorakhpur is surrounded by natural boundaries from north and west. In the West Rivers Rapti and Rohin are flowing while north boundary is limited by Chillua Tal. The river Rapti is regarded as sorrow of Gorakhpur due sometimes to inundation/flood, change of drainage area every year. Due to construction of embankment in the west bank ,though, the city is relieved of the fear of flood but the houses in the wards lying in west border of the city like Narsingpur, Jafra bazaar locality of Madhopur remain water logged for many days.

● **Nature of surface**

The nature of the surface of Gorakhpur city is responsible for enhancing the problem of water stagnancy to a very great extent. The average height of city from the mean sea level lies in between 75 to 85 meters. Normal slope of the city is from North to South. The height reduces in diminishing order slowly from mid part of city to North and South. The western part is higher in comparison to eastern part .The water level of Rapti river lying in the west is higher than the average height (70-75 meters) of wards specifically Nausarh and Madhopur lying in the west of the city. Thus in rainy season when water level of the river reaches more than 75 meters, then the doors of the regulators implanted in these areas are shut down and water of the drains passing through these regions can not flow normally into the river and cause water logging situation in these areas.

● **Change of Climate**

The change in climate conditions is considered responsible for enhancing the problem of water logging in the city of Gorakhpur. In the past few years, in characteristics of the seasons like temperature and rainfall, there have been observed abnormal changes. The following graph shows the trends of the nature of rainfall in the past few years:

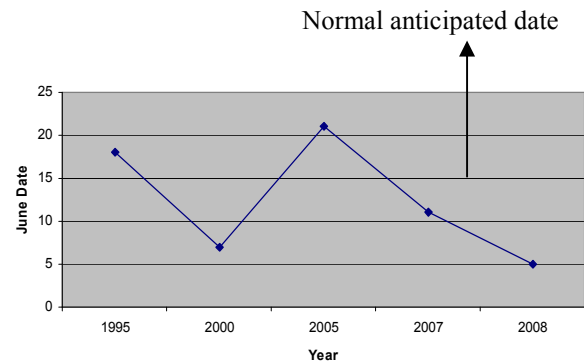


Year	Quantity of precipitation	Date of arrival of Monsoon
1995	1012.3	18-6-95
2000	1329.1	7-6-00
2005	1034.3	21-6-05
2007	1340.5	11-6-07
2008	1896.3	05-06-08

Source : Department of Meteorology, Gorakhpur, Govt. of India

Arrival of Monsoon in Gorakhpur

It has been evident from the above table and figures that although there is observed irregularities in the quantity of precipitation in between the years 1995-2008 but there is fast increase in its volume. The quantity of the rainfall has gone up by 32.41% in between the years 1995 – 2007 whilst in the years 2007-2008 its quantity reached up to 41.49%.



It can be inferred from the studies conducted in the past on the basin of Rohin that in forthcoming 50 years, the precipitation is likely to be increased in its model form to 1000-1500 mm in the basin of the river and its adjacent areas (*From Risk to Resilience : Working paper- 4, October, 2008*).

In addition to it, the days of the precipitation have been decreased in the past years but quantity of precipitation increased which is becoming the main cause of water logging in the city of Gorakhpur.

Behavioral factors/ Man Made factors

The man made factors are playing a significant role in enhancing the problem of water stagnancy in the city of Gorakhpur. The man made factors include population growth at fast rate, rural influx and fast extension of residential areas, illiteracy, irresponsible behaviour, lack of ownership and level of awareness etc. Policies blind for sustainable and long term development of the city and the political indifference again due to less awareness and actual public participation in governance help in enhancing the risks for the city.

In the past few decades after Independence, the population of the city has increased 370.19%, in which migration has played a significant role. The fast speed of population has put tremendous pressure on residential areas of the city and encouraged unplanned development. Although there is tremendous increase in number of houses but in its comparison, there is higher increase in number of families, which can be seen in following table:

Year	Total families	Total housing units	Shortage of houses
1981	46,366	46,571	2,795
1991	80,023	75,200	4,823
2001	1,10,000	99,785	10,205

Source : Gorakhpur Master Plan, 2021 published by town and country planning Dept, Uttar Pradesh and Gorakhpur Development Authorities, Gorakhpur

Under in pressures, such the low land areas of Gorakhpur city like Daudpur, Mahewa, Rasoolpur, Madhopur, Ilahibag etc. there has been unplanned development of residential areas. There areas being low lying, effect of water logging is gaining seriousness day by day in these areas.

It is vivid from the above mentioned table that in order to resolve the residential problem, the land allotted in outlay of master plan prepared for planned development, has been used for residential development in restricted areas. Thus due to non compliance of the master plan, the city is developing in an unplanned way which has increased the gravity of the problems of water logging and solid waste.

People's Participation

The public participation in governance of resources and development of city is largely limited to Municipal Elections through which corporators are elected. However, actual involvement of informed citizens in planning and governance of city is far from realization. The lack of ownership and indifferent behaviour of communities are the results of such missing priorities. The people of the Gorakhpur city show indifferent attitude towards the problems like water stagnancy, water evacuation, electricity and drinking water. This lack of ownership of common man came up repeatedly during the study. In the city of Gorakhpur in the areas where there is abundance of middle income groups, their indifferent attitude is instrumental in further enhancing the seriousness of the problems.

Castes/communal harmonization

The lack of Castes harmonization poses problems in equal distribution of benefits. There is found inter- mixture of various castes in the city of Gorakhpur. The voting in electing representatives is largely on caste lines and people give priority in electing a representative of their own caste. In return, the elected representative make all efforts to distribute the benefits of the schemes to the people of his/her caste. During the study such kinds of examples were found in various wards. Just opposite to this, in few other places, the advantages of resolving the problems are attained due to communal harmony and intimacy.

Policy factors

The appropriate policy formulation and proper enforcement is a major issue causing the problems in the city and hence a holistic long term development. Following instances and examples explains this problem:

Unplanned land utilization

In the past 5 decades there is significant change in the utilization of land in the city. Between the years 1971 and 2000 the residential area occupy maximum percentage of land which is continuously increasing. In the last two decades there has been an excessive

pressure on residential areas. In the city there were 46,571 residential units in the year 1981 which increased to 75,200 in the year 1991 and 99,785 in the year 2001.

Land utilization	Area (in hact.)	% of total developed area	Area (in hact)	% of total developed area
Residential	1031.00	63.72	4103	72.10
Commercial	35.21	2.18	173.20	3.05
Industrial	56.05	3.46	445.00	7.82
Governmental	90.34	6.08	161.00	2.83
Public and Semi public	350.01	21.3	398.32	7.01
Parks and open areas	47.35	2.3	291.20	5.01
Transport	No	No	117.10	2.07
Total			5689.12	100.00

Source : Gorakhpur Master Plan, 2021, published by Town and Country Planning Dept, Uttar Pradesh and Gorakhpur Development Authorities, Gorakhpur

Various unauthorized colonies have been developed in the city due to this pressure. The following table is shows a list of unauthorized colonies in the city

Colonies	The proposed area in the city plan	Area (in hectare)
Eastenpur colony	Agriculture	2.02
Arya Nagar	Reserved for PAC	0.08
Vivekanandpuri	Reserved for PAC	0.60
Shri Ramnagar colony	Reserved for PAC	0.60
Gayatri Nagar Lal ganj	Agriculture	40.48
Jharna tola	Agriculture	6.07
Mourya Tola	Agriculture	1.20
Nandanagar Dargahiya	Agriculture	4.05
Sainik Kunj	Agriculture	4.05
Sainik Bihar Vistar	Agriculture	0.50
Vivekananda Nagar	Sector park	0.60
Adarsh Nagar Colony	Sector park	0.80
Vivek Nagar	Sector park	2.02
Shanti Nagar	Sector park	2.02
Mulayam Nagar	Sector park	0.60
Goraksh Nagri	Regional Park	0.60
Mahadevapuram (Bashasratpur east)	Utility services	2.43
Shakti Nagar	Community facilities	20.24
Shivaji Nagar	Community facilities	2.43
Shakti Nagar	Agriculture	4.05
Shubham colony	Agriculture	2.02
Rajiv nagar	Agriculture	4.85
Parvati Nagar	Agriculture	2.02
Saket Nagar	Agriculture	2.02
Siddhartha Nagar	Agriculture	4.05
Total		111.12

Source : Gorakhpur Master Plan, 2021 published by town and country planning Dept, Uttar Pradesh and Gorakhpur Development Authority, Gorakhpur

Deterioration of the aquatic land and maintenance

About 50 year back there were 103 small and big lakes in the city of Gorakhpur. Their number declined to 20-25 due to encroachments and land fillings largely because of personal interests, prevalent corruptions and inactions. These water bodies used to function as reservoirs of water during rainy season and played an important role in maintaining the temperature of the city. But due to lack of maintenance by Government, these lakes have become problems. The wastes, filth, dirty water and faeces of the entire residential locality accumulate near and around such water bodies and nurture aquatic plants (Jal Kumbhi) in them, and slowly these water bodies become non existent due to deposition of sediments.

Lack of Departmental Convergence

Lack of inter departmental coordination is the biggest barrier in the proper implementation of well planned schemes in the city. The problems and solutions are interlinked and can only be addressed with departmental convergence. The schemes/plans fail largely due to lack of integrated planning. For example after construction of road is complete by PWD department and municipal corporation , the information and telecommunication department starts digging up the road for extension of cable. There are many such examples e.g. water works (Jal Kal) and water corporation (Jal Nigam) are responsible for water supply but due to weak coordination of these departments in planning and implementation, the decayed pipelines lying in the city are not getting repaired and replaced.

Loose support structures

The loose support structure of the city is responsible for improper management of water accumulation, electricity supply and solid wastes. The pipe lines for water supply and water drainage installed in the year 1968-69 are today lying in decayed state. Sewage facility caters only 22% of city area. 40% of city area has no piped water supply. At every crossing of the city the poles of the electricity are in decayed form and the wires coming out of these appear to be like nests of the birds. The electric supply in the city ranges 14-18 hours per day only.

Lack of long term policies/plans/schemes

Well planned and long term development policies and their ineffective implementation contribute in enhancement of various problems of the city. Although Gorakhpur development Authority prepares land utilization plan for 30 years but various aspects like rain, temperature, pollution etc are not considered in such plans. Hence, the plan generally remains as `Land Use Plan' of the city.

Thus, there are direct effects of the three major identified risks within its own areas. However, the cumulative effect with the inter-connections of the three risks ultimately cause serious problem for the citizens of Gorakhpur city.

Key Issues

Some of the key issues of the Municipal Corporation of Gorakhpur regarding infrastructure management are as follows:

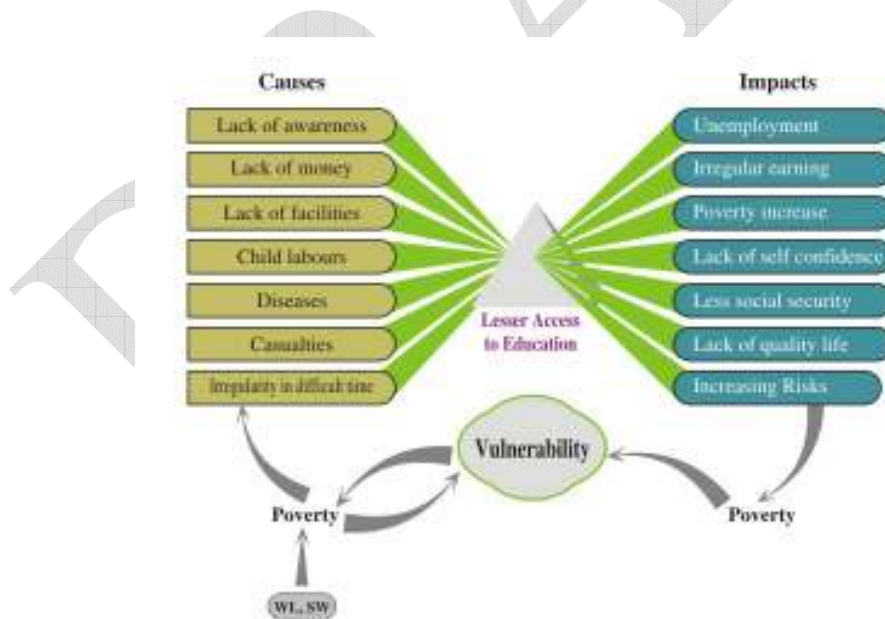
- *There is no centralized sewage network system in the city.*
- *Total length of under ground sewerage is about 55 km.*
- *229 open drains are the main source of conveyance of liquid waste water in the city.*
- *Present sewer infrastructure including sewer network is old and need renovation and enhanced coverage. Only 22 % of the city area i.e 30 sqkm. is served by underground sewerage system, rest of the population depends upon septic tank and soak pit and open defecation.*
- *Only one out of every five persons has the access to the sanitation facility.*
- *Daily 300 tons of solid waste is generated in the city*
- *Household is contribution in the generation of solid waste in the city is maximum. It accounts 168.13 ton per day.*
- *Average per capita waste generation in the city is about 0.270 gram.*
- *The city has not provided adequate number of dustbins for storage of wet and dry wastes for the clearance through their regular primary collection process.*
- *Due to unplanned development, the number of buffer zones, in form of water bodies, in the city has been reduced drastically from 103 to 25.*
- *The 25 unauthorized colonies developed by Gorakhpur development authority in the city has acquired 111.12 ha public lands.*
- *20 percent geographical area of the Gorakhpur city is being inflicted with acute water logging problem.*
- *The GMC has recognized 59 water logging points in the city.*
- *Lack of accountability and vision of local administration is the major bottleneck in the proper implementation of the programme.*

■ IMPACT OF RISK AND VULNERABILITY

The present developed infrastructure and projected climatic change for the city will definitely increase the vulnerability of people especially the urban poor. Due to its physical and human constraints, the problem of water logging in Gorakhpur city has now become a common phenomena but the damage and losses from this water logging are the consequences of human action. The rapid influx of people and urbanization will aggravate water logging situation. So it is imperative that the planners and ULBs think over it. In the following section impact of risk on the citizens of Gorakhpur city has been assessed.

Education

The state of education is not very satisfactory in the city of Gorakhpur. According to census of Government 78% people are educated in the city. In the old inhabited city, densely populated and among poor people, the education is only from 40-45%. It reflects that the lack of education is more in low income group. Education is crucial in developing capacities of people. There is clear links between enhancing risks and vulnerability of people due to hindrance in access to education.



On one side, education gets affected by the identified problems of the city (water logging etc.), on the other side, it also affects/influences. As it is clear from the diagram that people are deprived of the education due to lack of services, other priorities and resources. In adverse situation, generally aggravated due to water logging etc. and hence diseases and non availability of facilities they leave the studies in the middle. The

concept of Child labor is prevalent maximum among low income groups which, in turn, becomes obstacle in the studies of children and force them to earn money from the childhood days. This results in poverty, unemployment, insecurity, lack of confidence and non availability of qualitative life which increases their sensitivity towards the risks and vulnerability in turn.

This chain/order continues on and on and due to this the number of people affected keeps on increasing slowly. Lack of education ultimately enhances the vulnerability of people.

The effect on various categories

All the socio-economic categories of the people have to endure the bad effect of lack of education because it plays an important role in their development. There are various mechanisms by which different economic group cope with the situation which is aggravated due to effects of risk. The people of high income group are capable enough to overcome this vulnerability through monetary cushions. However, the major impacts are on the middle and especially on low income groups. The situation of the low income group remains worst, on which following points were derived from the study conducted:

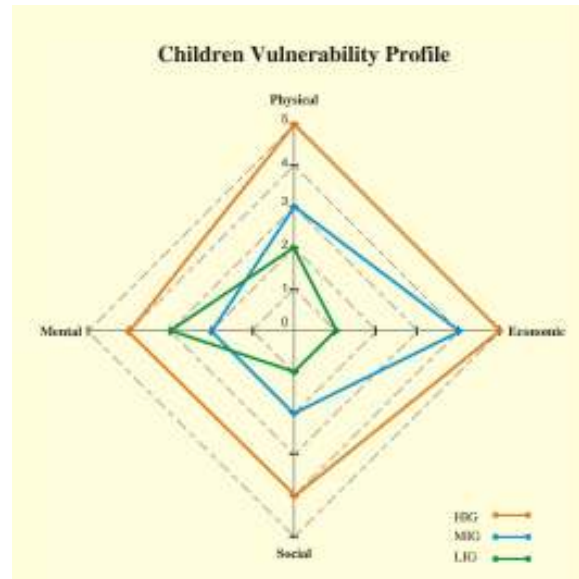
1. The problem of to and fro movement for schools during water logging
2. Increase in burden of cleanliness in houses due to water logging and hence school becomes a lower priority
3. Inability to generate income in waterlogged times and hence unable to pay for education
4. Wander in search for food(catching fish, selling things/material etc)
5. Not been able to study due to lack of electricity
6. Ill health
7. School building inundated

The position of children from educational view points

The education brings about all round development of children and without it the whole life is affected. If the main aspects of educational goals social, economical, mental and physical states of the children are analyzed then analysis emerge in the web diagram given below. Here the meaning of physical state is related with their health and normal growth. Economic state is related to their sources of income, capacity of being able to bear expenditure and money related positions. The mental state includes their mental capacity, development, tension and thought processes while the social state is meant for their identity, social reputation-honor, mixing up with the people and establishing self in the society.

In the waterlogged and enhanced risk conditions, children's education and overall development is affected. Analysis of such linkage, in various socio-economic groups, was made.

Whereas, the social and economic level in HIG remains in sound situation, the Middle income group children face problems on economic and physical fronts. However, on the low income groups all the four aspects are in low conditions and hence their vulnerability due to any additional external situation (like floods/water logging) remains quite high.



Water Quality

Surface Water

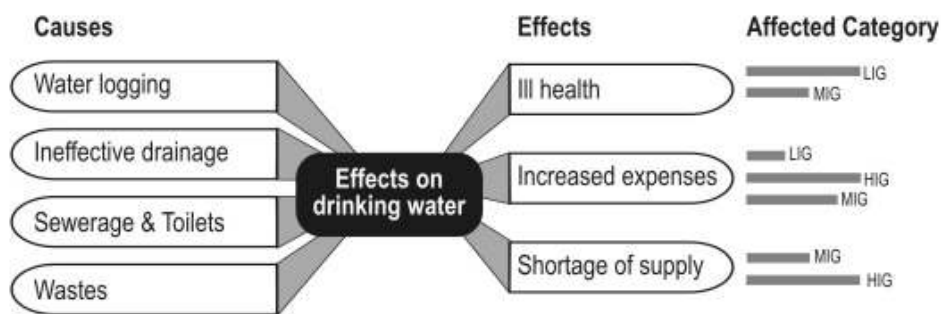
The alarming increase in the level of water pollution is a serious threat, which has to be taken up with utmost priority. The pollution level of the major water reservoir in and around the city is going on increasing rapidly. The study of water quality indicated that the sulphate and the chloride level in the Ramgarh lake, which is the only big lake in the city, has risen to 800 milligram per liter and 400 milligram per liter respectively. On the other hand, level in the Ami river which flows from the south west of the city has reached to 900 milligram per liter and 500 milligram per liter respectively. Excess of sulphate content in the water causes severe gastrointestinal problems and that of chloride causes problems related to bones. The continuous use of this polluted water is definitely a serious threat to health. This has not only caused a serious threat to the living beings but also to the flora and fauna. The river Rapt is also being hit by the increasing pollution as the main source of pollution is the sewer and the domestic waste being flown in to the river and same is the case with the ramgarh lake.

Ground Water

The ground water table in the city is high (50-80 ft) and hence chances of pollution due to seepage is high. The pollution level of the ground water in the city is also increasing day

by day. The high water table and wide spread phenomena of water logging in the city increase the feasibility of water contamination. According to the study, in the areas where water logging is long lasting, the water has already been contaminated up to a depth of 200-250 ft. The increasing numbers of patients of cancer, hepatitis, typhoid, gastritis proves the fact. The most sensitive areas in the city are Ghantaghar ,Golghar, Nausarh and Baxipur. The level of TDS in some areas of the city has risen to 1200. The most alarming situation is in the areas of Ghantaghar, Golghar, Baxipur, and Nausarh . The TDS level found in Baxipur and Nausarh is between 1100-1200, Ghantaghar is between 900-1000, Golghar Tiwaripur and Mohaddipur is around 900 whereas the TDS level in Aryanagar is around 750. The level of TDS in other areas is also increasing and way above the standard mark. The experts observe that the water with increased TDS level contains phosphorus, arsenic, Lead, cadmium, calcium, nickel, magnesium and many more elements which are hazardous and could cause serious damage to health. (Hindi Daily, Umar Ujala, 5 June, 2009).

From the analysis of inherent causes of water pollution in the city, it is deduced from the study that due to plenty of soak pits and uncemented toilets in the city, the dirty liquid percolates down the earth and contaminates the ground water, also affecting private hand pumps.



In some places the liquid of toilets straight away goes to drains, the water of the private hand pumps and India Marks-II hand pumps fixed near it get polluted because there is not much distance between drain water and place of hand pumps. This condition is principally found, in densely populated colonies of the city where distance in between drains/soak pits and hand pumps is hardly 15 ft. In some of the places it was reported that people dig bores and connect domestic waste water to flow in ground water which also causes direct contamination of water.

Health

Gorakhpur is lying in tarai area of trans-Saryu region. It is characterized by good quantity of rainfall. Moisture and humidity are the parts of the climate. Flood and water logging are common and human interference has made it worst. Under such circumstances mosquitoes, flies and other insects are in plenty in the city. A large number of diseases

are found here which are caused by dampness, moisture, water logging, open toilets, wastes/rubbish lying uncovered and improper arrangement of sewage etc.

The prominent diseases of this area are as follows:

1.Malaria	7.Itch/Eczema	13.Encephalities
2.Flue	8.Bowls/pimples	14.Asthema
3.Fever	9.Hair fall	15.Rheumatic pain
4.Joint pain	10.Jaundice	16.Small pox
5.Stomach ache	11.Cholera	17.Ellergy
6. Gas	12.Diorroea	18.Yellowness on teeth

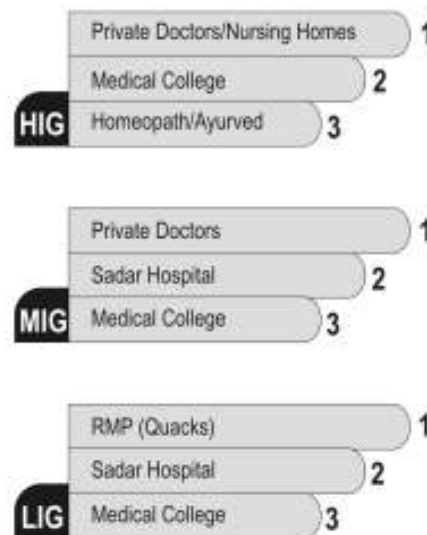
Source: Based on Group-SLDs, 2009

Primarily there are more diseases in the city of Gorakhpur caused due to drinking water and vectors. The situation of health care in the city is also not adequate. Health related facilities are available at private level but Government facilities, on which lower economic groups depend, are quite inadequate. It is quite difficult for the people belonging to middle and low income group to bear the treatment costs in private health care set-ups. Only high income group can avail these facilities properly and take the complete benefit of it.

Although Japanese Encephalitis is not affecting city population, the patients from adjoining sub-urban, peri-urban and rural areas are coming to city for the treatments.

The dreadfulness of this disease can be imagined on the basis of official sources that in the last 27 years the number of the patients admitted only in the city's BRD Medical College was 10416 and 2878 out of these died. According to print media report, in year 2005, there were around 3500 people who suffered from Encephalitis, 60% of them were children.

People of every income group have their own preferences with regard to health facilities. Generally they prefer the facilities on the basis of their own convenience, capacity to pay and easy availability of facilities.



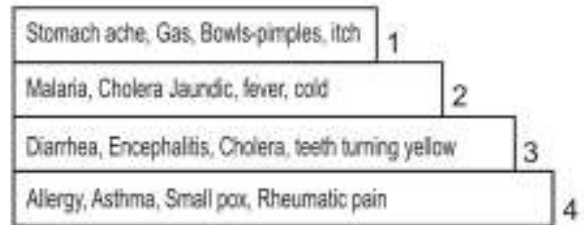
Problems

1. Due to lack of money Low income group can not avail proper treatment.
2. In Sadar (Government) hospital, poor people have to purchase medicines on their own because most of the medicines are not found.
3. Private Doctors insist several medical tests which involve more cost.

4. The distance of the medical college from majority of the areas is too much hence; it is not possible to reach there for treatment except in any critical condition.
5. During the time of disaster health team or Doctors visit were reported to be quite inadequate.
6. Availability of sufficient numbers of beds in the hospital for patients is a serious issue. Usually they are admitted for treatment by spreading bed sheets on the floor.
7. Proper care is affected due to shortage of Doctors.

The effect on health

There is direct influence of climate change on health. Gorakhpur city is very sensitive area with regard to diseases due to its climatic conditions and quality of drinking water. Severity of epidemics claim the lives of hundreds of people.

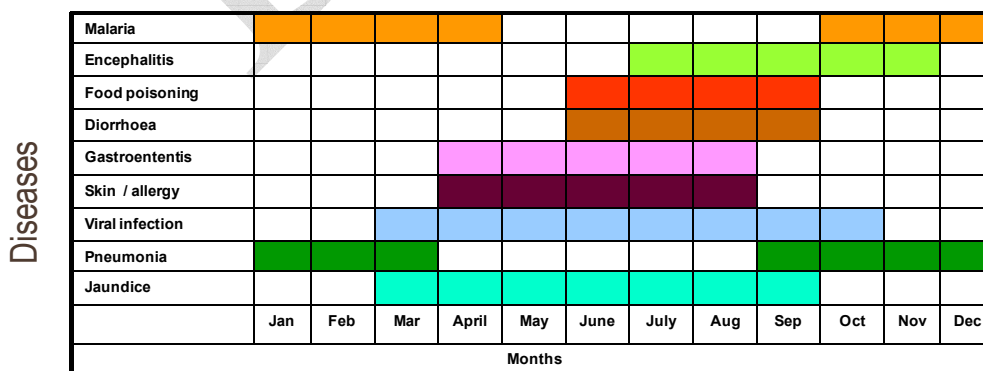


During the study, on the basis of number of patients due to various diseases they were serially arranged and rated. The most prevalent health problems as graded by people was water-related. The contaminated surface and ground water tend to increase the problems year by year.

The seasonal analysis of the Diseases

Though these diseases exist throughout the year but there is a definite seasonality of diseases. The maximum diseases occur during rains and monsoon months. From the seasonal analysis of the diseases done by community members it was manifest that the period from April to September is very sensitive to diseases. Besides in April and October the problems get enhanced slightly. This is directly related to rain season generated water logging, wastes and filth, dampness and humidity. All such reasons make this period more vulnerable and 3-4 months of the year are highly vulnerable with respect to the diseases.

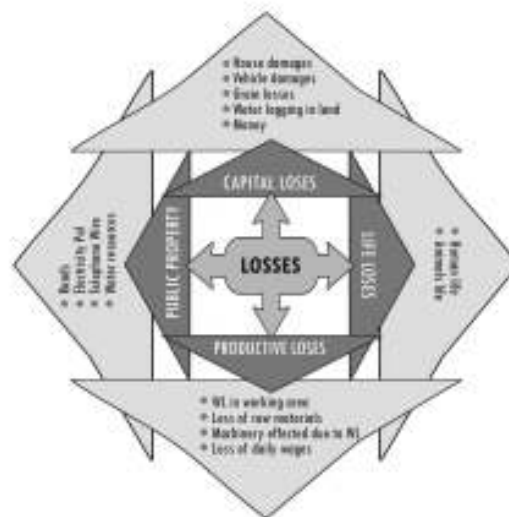
(Seasonality of Diseases)



Source: Based on Group-SLDs, 2009

The losses in difficult time

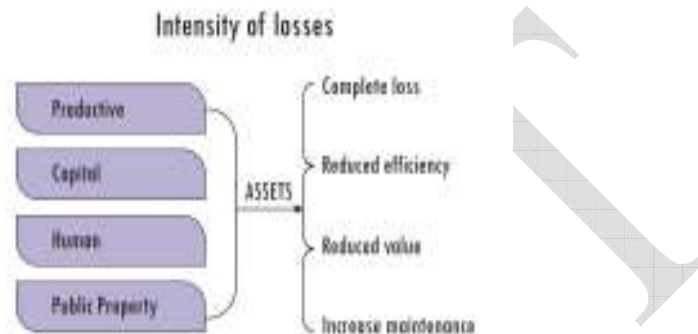
Gorakhpur city is engrossed with flood and water logging situation either at a large or small scale every year. As the city has no effective drainage arrangements the low lying and densely populated areas are worst sufferers. The whole city being low lying (specially 20% very low lying area) the water stagnation becomes a major problem during and after monsoon period. The affected area and duration of water logging both are continuously increasing in the city. From this kind of water logging problems, people of the city have to suffer losses, problems from deaths to theft and various small or big incidents are prevalent which enhances the vulnerability of people. The main identified problems and losses can be grouped as follows:



The damages can be analyzed by dividing them primarily in four categories :

1. **Capital loss:** House, car and two wheeler, food material, grains etc. are damaged or lost due to water logging. All categories of the people suffer from all these kinds of damages but in middle and lower income categories the effects are more because of lack of security and cushioning.
2. **Productive loss:** The occupational pattern in the city is such that a large population depends on small self-operated business. Shops, small production units like candies, packaging etc. and other such petty business are the source of livelihoods for 15% of population. Water logging causes the losses of such productive units. Not only the main business operators but also the labourers helping such units also get affected in such situation. Productive units like handlooms, weaving units etc. also get affected because of damage of raw materials, tools and equipments.

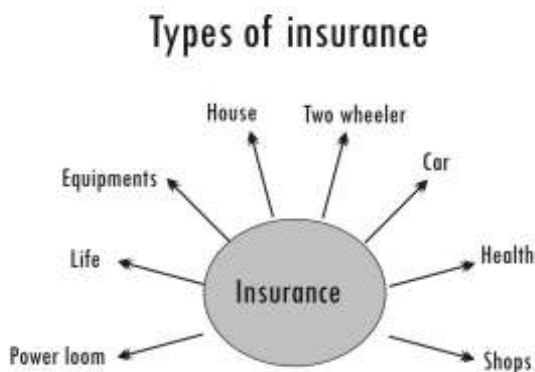
3. **Life losses:** This damage is fatal on the life of the animals and mankind, the accumulation of water in water logging area, drowning, bite of poisonous animals result in deaths. This loss cannot be compensated.
4. **Public property losses:** Due to prolonged water logging, roads, electricity wires, poles of telephone wires are destroyed causing loss of property. These property losses are not repaired for a very long time, hence public has to face the problems. Roads can not be repaired for a very long time.



The damages occurred under such circumstances are not always uniform. Many a time materials or goods get destroyed completely while on other times their working capacity, cost, quality etc, decline. There is considerable increase in cost of maintenance on these and hence the burden ultimately affects the daily life of the average person.

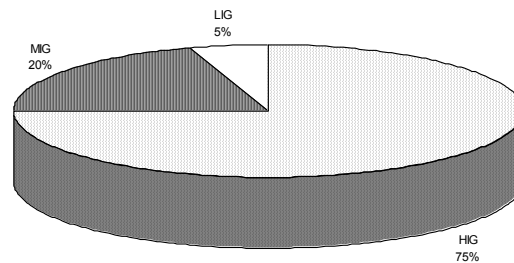
Insurance

In such high risk prone situation, robust insurance mechanism can help the communities significantly. However, looking at this aspect, it was revealed that the insurance system is not effective. There is provision of insurance for compensating loss of life and property but people do not have access and linkage with such insurance mechanism. The complexities of insurance claim also discourage the propel in accessing these schemes.



During the study it was discovered that insurance of property is limited to two or four wheelers. Merely 2 or 3 % of house owners have insured their houses. The property purchased by taking loan from bank gets insured itself; hence insurance has been seen in some places. However, after maturity of the compulsory insurance phase this insurance is not renewed. Situation of the health insurance is very low. As a whole, only 5% of the people have opted for one or other health related insurance.

Due to claim related problems and long procedures in accessing the services people have apathy towards health insurance. The kinds of insurance seen among various categories are as below:



Most vulnerable and vulnerability sensitive low income category has a coverage of only 5% insurance. There is no other alternate mechanism available to them for compensating their losses. One it is also a matter of serious concern that losses due to water logging is not covered in property insurance. The insurance in water logged areas is limited only in condition of accidents or theft. This is also one of the reason that people do not take particular interest in insurance.

Effect on livelihood

According to data available in the year 2001 total workers, main worker and their involvement in primary, secondary income generation is as follows:

Year	Total workers	Main workers	Marginal workers
2001	142619	127955	14664
No workers	Primary	Secondary	Tertiary
480082	4229	6431	131959

Source: Based on Census of India 2001

It can be said on the basis of above mentioned that 92.52 % people are principally associated with tertiary employment, services etc. Only 2.96 people are associated with agriculture or other activities related with agriculture. Due to identified risks, the livelihoods of people in the city are also affected. This aspect can be summarized as follows:



The impact of risks depends on permanent and temporary sources of livelihood. It emerged from the study that in the Middle Income Group the percentage of permanent and temporary income is 25 and 75 percent respectively. While in Low Income Group there is 15 percent permanent and 85 percent temporary income source. Those who have permanent source of income in low economic category are engaged in activities like cleaning house and utensils, maid servant, in schools, source domestic help, and work in the shops.

Though there is continuation of income throughout the year but average monthly income ranges between Rs. 400-800/-. There is also another important fact associated with it that these options are not assured to be permanent. If maid servant is unable to report to the work for few days on account of water logging or illness, then she is replaced.

Direct effect

The effect of risks is directly linked with livelihood of the people. When the roads are filled with water due to water logging, the movement of people is hampered. In such condition people find it hard to reach market and this exerts negative influence on market and livelihood.

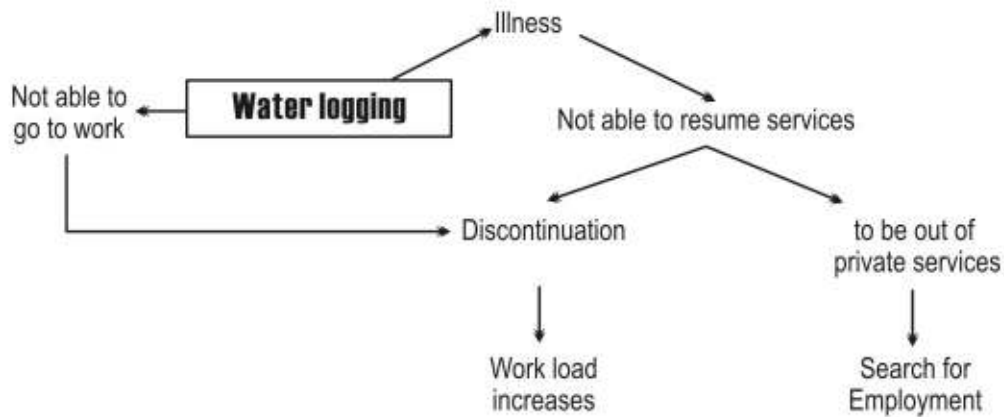
- There is direct effect of water logging on shops. From the study it has been derived that sudden rain fall causes overflow of water due to over spilling of shallow drains with low slope gradients and water enters in the shops which damages the materials of the shops and exerts adverse effect on the investment.
- There is direct influence of risk on daily wages which can be seen in tabular form.

Risks	Effect on work	Results
Water logging	<ul style="list-style-type: none"> • Reaching to work place is difficult • Unable to go to work due to water logging in houses and the earning of women is affected. 	<ul style="list-style-type: none"> • Lack of money for food, medicine etc. • Borrow money • Physical and mental tension • Out break of contagious diseases • Expenses on illness • Malnutrition • Reduction is physical capacity

Indirect effects

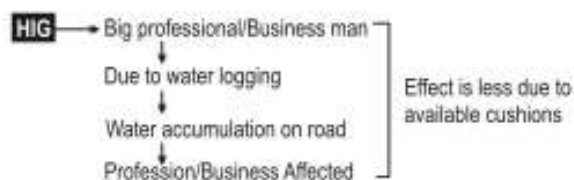
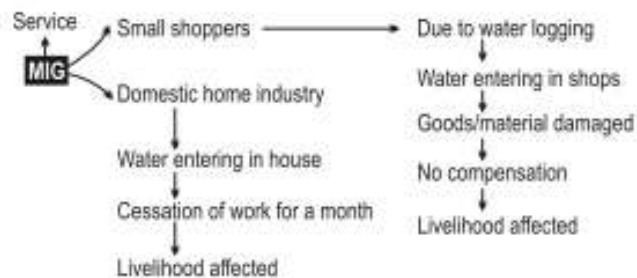
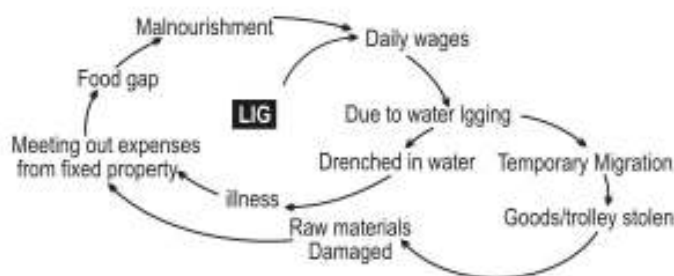
There is no direct influence on the people who are jobs which are permanent in nature. But there are some indirect effects which are as follows :

- Not able to go to work for even 6-7 days due to water logging situation.



Livelihood and Risks according to Income groups

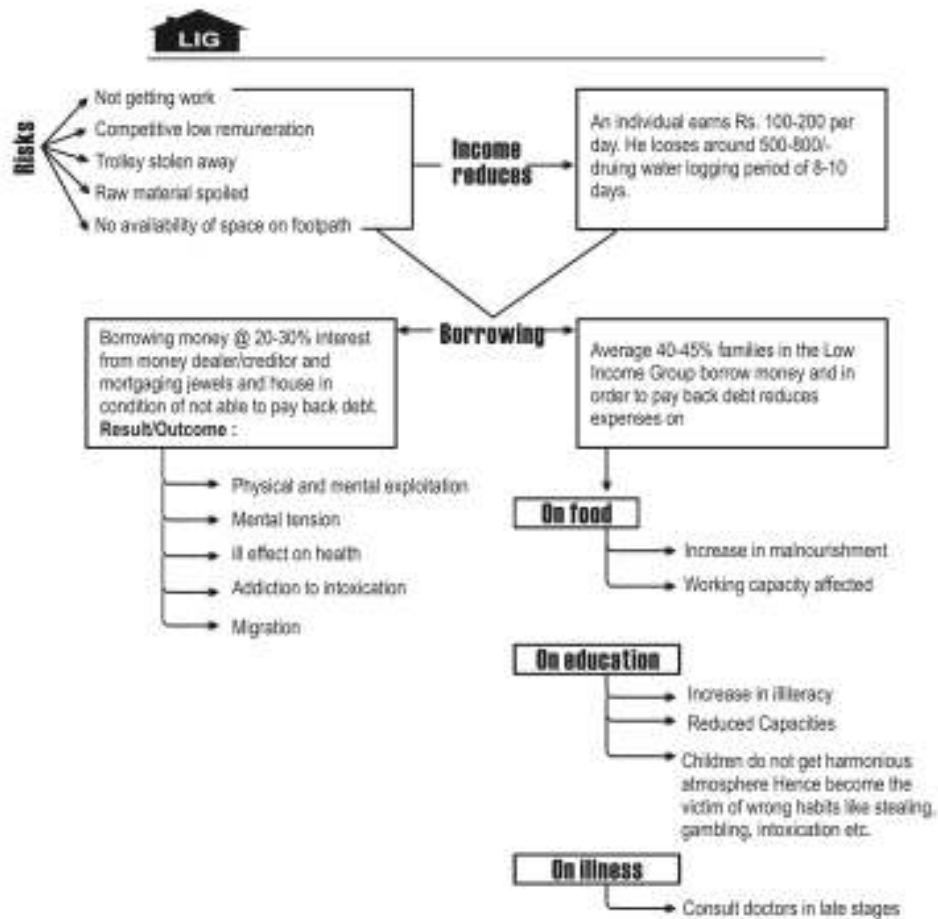
People belonging to various social, economic status of the city are affected by such problems but the effect on various groups varies according to the geographical locations, job types, cushioning capacities etc.

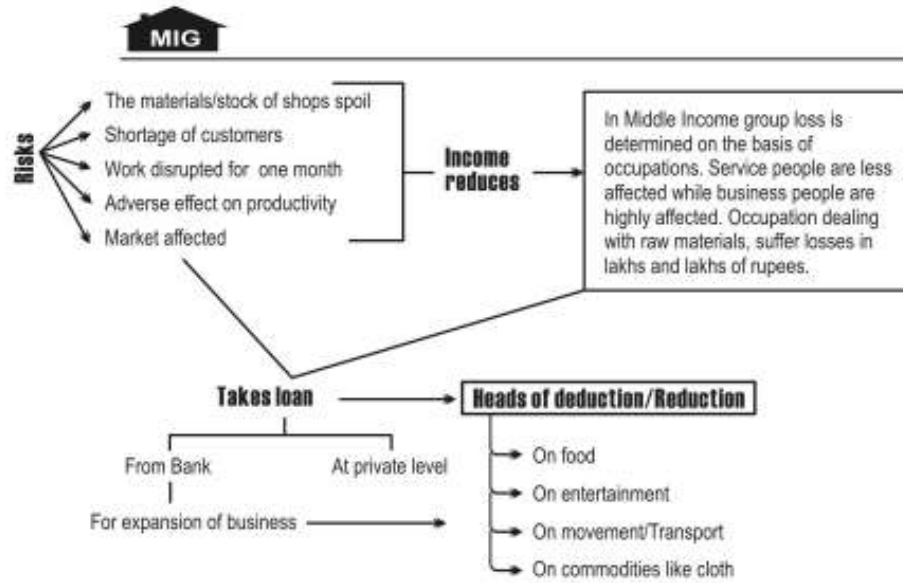


Effects were also made to observe the status of single and double income households in the city. It was observed that in the LIG, women workers were maximum (more than 30%) while only 5-10% females of MIG play their role in income generation.

Effect on employment and earning

How the income and work of different income groups are affected due to above mentioned can be cleared in this way:





Expenditure Pattern

The expenditure pattern of income in various income groups was reported as follows:



■ INSTITUTIONAL FRAMEWORK AND MAJOR CHALLENGES

There is large number of institutions in Gorakhpur responsible for urban development and service delivery. This section examines the key institutions responsible for service delivery in terms of their organisational structure and functions.

Institutions for Urban Governance and Service Delivery

Urban development and service delivery in Gorakhpur is the combined responsibility of a set of state level and city level institutions. These institutions and their key functions are listed in table segregated in terms of institutions functioning at the state level and city level.

Institution	Function
State level	
Public Works Department (PWD)	Construction of roads main roads and transport infrastructure including construction and maintenance of Government houses and Institutions
Town and Country Planning Department (TCPD)	Preparation of Master Plans including infrastructure for the state (rural and urban)
UP Jal Nigam (JN)	Water supply and sewerage including design & construction of water supply, sewerage networks and treatment plants. In the last two decades ‘pollution control of rivers’ has become one of their primary focus areas
UP Avas Vikas Parishad (AVP)	Nodal agency for housing in the state. Additionally involved in planning, designing, construction and development of almost all types of urban development projects in the state. Autonomous body generating its own resources through loans from financial institutions
UP Pollution Control Board (UPPCB)	Pollution control and monitoring especially river water quality and regulating industries
Poorvanchal Vidhut Vitran Nigam Limited	A co successor of Uttar Pradesh Power Corporation. The main function is to distribute to electric power in eastern area on Uttar Pradesh. It include 28 districts of eastern Uttar Pradesh
Irrigation department	Embankment maintenance and flood warning system

City level	
Gorakhpur Jal kal department	Nodal agency for water supply in the city. Key functions include O&M of water supply and sewerage assets. Jal kal department proposes tariffs and collects revenues – however, tariffs need to be approved by the UP Jal Nigam and the State Government)
Gorakhpur Municipal Corporation	Nodal agency for municipal service delivery and O&M. Its key functions include: Primary Collection of Solid Waste <ul style="list-style-type: none"> • Maintenance of Storm Water Drains • Maintenance of internal roads • Allotment of Trade Licenses under the Prevention of Food Adulteration Act • Collection of Property tax • O&M of internal sewers and community toilets • Management of ghats • Construction of Community Toilets
Gorakhpur development Authority (GDA)	Responsible for preparing spatial Master Plans for land use and development of new areas as well as provision of housing and necessary infrastructure
District Urban Development Authority (DUDA)	Implementing agency for plans prepared by SUDA. Responsible for the field work relating to community development–focusing on the development of slum communities, construction of community toilets, assistance in construction of individual household latrines, awareness generation etc.

The overall objectives of basic services rendered to the inhabitants are to develop socio economic environment or improving the quality of life and achieve the goal of welfare society. It is not possible for any individual institution to provide every service to their inhabitant. So convergence of duties among different institutions is essential to develop harmony among the institution to achieve the rational utilization of resources and sustainability in long term planning.

In the participatory exercises with communities through causal loop diagramming, the need of convergence was highlighted. In addressing the causes and sub causes of problems interventions of various departments are essential.

Causal loop Diagram

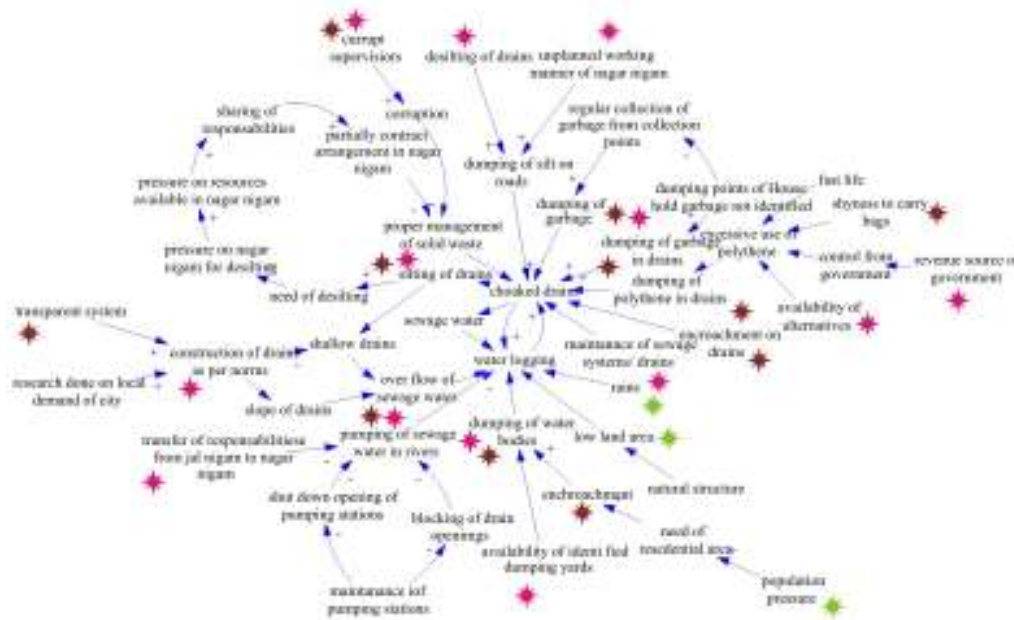


Diagram : Causal loop on Water logging

Institutional Roles and Responsibilities

Clarity of roles and responsibilities of institutions is a pre-requisite for good governance. This clarity is conducive for role separation that in turn is an enabling factor for a host of good governance practices like accountability, transparency etc – factors that lead to efficiency in service provision as well as efficiencies in institutions. As an introduction to examining issues of governance in Gorakhpur, the following table identifies the roles and responsibilities of the various institutions in terms of planning, implementation and maintenance. During the community survey a grading has been remarked for different responsible authority in context of risk in the city.

Risk	Related deptt.	Responsibilities	Grading
Water Logging	Muni. deptt.	• Construction of drains near road	★★
	Jal Nigam	• Extension of pipe lines for water supply	★★★
	Water Works department	• Proper management of supply water • Maintenance of pipe lines	★★★
	Street Light deptt.	• Arrangement of lights on roads • Maintenance and mang. of light points	★★★
	Electricity deptt.	• Electricity supply in the houses	★★
	Revenue deptt.	• Estimation and compensation of loss during water logging period	★★
	Railways	• Proper management of road etc within its area of responsibilities	★★★
	GDA	• Proper planning and developing Schemes	★★★
	PDS	• Timely distribution system of Kerosene oil and ration	★★
	sewerage/ Cleanliness	Muni. deptt.	• Construction of ditches at right level • Construction of roads and its repair
Sanitation Corporation		• Cleaning drains and roads	★★★
Health deptt.		• Providing health services	★★
Health Officer		• Sprinkling pesticides/medicine etc. for prevention of contagious diseases	★★
Zila Sankraman Vibhag		• Sprinkling pesticides/medicine etc. for prevention of contagious diseases	★★
sewerage/ Cleanliness	Cleaning worker of muni. Corp.	• Proper and timely cleanliness	★★★
	Cleaning worker on contract	• Proper and timely cleanliness	★★★
	Municipal Corporation	• To construct places of wastes disposal	★★★
	Corporator	• Maintains cleanliness in the area	★★

The above analysis is based on the quality of the services available to Low Income Group
Its symbol for indication are ★ O.K., ★★ Poor ★★★ Very Poor.

It may be noted that there are functional overlaps between institutions.

GDA (Gorakhpur development authority) is actively involved in the development of residential colonies and also provides the Infrastructure in these colonies as well as environmental services like construction of parks etc. The functions of the GDA include:

- Preparation of Master Plan and Zonal Development Plans for the city;
- Maintenance and improvement façade of certain buildings and abutting arterial roads;
- Acquisition, disposal and development of land;
- Construction of Housing (units/ colonies) to meet the housing demand of the growing population;
- Provision of infrastructure facilities (roads, sewers, water supply) as per the population needs; and
- Provision of bus stands outside the dense city pockets for proper transport infrastructure.

The GDA does not have a separate cell for handling complaints. All complaints have to be addressed to either the Joint Secretary or Secretary. Most of the complaints that GDA receives pertain to roads, water supply, street light maintenance etc.

Jal kal Department

Jal kal department is responsible for O&M of water supply and sewerage systems installed and transferred to it by JN and other state level organisations like DUDA, GDA etc. Although the Jal kal is legally a part of the GMC in practice, but technically separate entities. The water supply wing is well developed with separate administration, finance, planning and construction, operation and maintenance divisions. However, for sewerage services, such a structure does not exist and this function is considered to be a minor function for most water supply engineers. The organisation has been engaged in sewerage management for quite a number of years and therefore has the technical capabilities and manpower to plan, develop and maintain such facilities. The infrastructure and equipment available with the organisation are quite old and not much addition of equipment has taken place during last few years.

Jal Nigam

JN is a State Government organisation responsible for the management of water supply, sewerage and sewage treatment facilities. The main fixed assets of JN are the water works including own scheme's hand pumps. The sewage treatment works created under Ganga Action Plan are operated and maintained by JN. As per the UP Water Supply and Sewerage Act, 1975 the key functions of JN are :

- Preparation, execution, financing and promotion of schemes of water supply and sewerage and sewage disposal;
- To render necessary services in regards to water supply and sewerage to state government and ULB's and on request to private institutions;
- To prepare state plans for water supply, sewerage and drainage;
- To review and advise of tariff, taxes and charges on water supply;
- To access material requirements and arrange for their procurement;
- To establish state standards for water supply and sewerage services;
- To review annually the technical, financial, economic and other aspects of water supply and sewerage system of jal kal and ULB;
- To operate, run and maintain any waterworks and sewerage system on request by the state government;
- To access requirements of manpower and training in relation to water supply and sewerage services in the state;

Town and Country Planning Department

This office is responsible for the provision of various services in the city and is headed by the Commissioner. GDA and TCPD perform similar functions and the commissioner decides as to which of these department shall take up an assigned task.

Public Works Department

The State PWD is primarily responsible for construction and maintenance of roads, state government institutions and state government housing in the city. The CPWD is responsible for the construction and maintenance of only central government buildings and institutions.

District Urban Development Agency (DUDA)

DUDA has been constituted for effective execution of the SUDA undertakings in all the districts of the state. DUDA members include the DM or Chairman DUDA, Municipal Commissioner as Vice Chairman DUDA and other district level officers. It is primarily responsible for works relating to community development, in the respective districts of the state, which includes development of slum communities, construction of community toilets, assistance in construction of household latrines, creation of awareness etc. They also work for provision of sewers, tube-wells etc in slum localities. The assets thus created are finally handed over to Jal kal department for maintenance purpose. DUDA has also taken up a series of activities for infrastructure improvement in slums.

Overlapping of Roles & Accountability

Within the GMC at the departmental level, there are functional overlaps; for example, both PWD and the Street Lighting departments are undertaking the construction and maintenance of streetlights and municipal properties; GMC as well as PWD clean drains; etc. These overlaps cost the GMC in terms of revenues as well as manpower and are often subject to problem arising from a lack of coordination – a situation that is not conducive to institutional efficiency. The GMC faces a shortage of sanitation staff. The Public Health Department is responsible for cleanliness in several wards. The numbers of sweepers available in the GMC and the PHE are way below the standards set in the Government Health Manual. The key issue is to decide on the trade-offs between hiring full time staff versus outsourcing. The latter will mean that the liabilities of the GMC will be reduced but, experience of similar attempts in other municipalities have shown that outsourcing is difficult to implement both because of the legal aspects involved as well as the opposition from existing staff. While this is difficult to implement, the long term advantages of outsourcing definitely outweigh the initial teething troubles.

Despite the very large size of the GMC, all functions are performed out of the main office of the GMC. There is no decentralization in either the Execution or Elected Wings and therefore no Zonal Offices. This centralized approach is not very amenable to efficient working. The GMC has set up cells to handle customer complaints. All complaints have to be made either in person or through regular post. Up till now the GMC does not have a system of online grievance handling. The length of time for registering complaints and their resolution is therefore quite long and could be a deterrent for customers. Quite like the other development authorities, the GDA functions as the ‘Developer to the Government’. Functional overlaps are also seen in the implementation and maintenance functions that are performed by both the GDA and the GMC.

Key issues

Few prominent system deficiencies in ULBs are listed as follows:

- ***GMC and JS are public service organizations but they work in isolation and do not interact much with public or call for their opinion in operational matters and development issues;***
- ***All the organizations are primarily conducting breakdown maintenance work. Routine and preventive maintenance seems to be lacking;***
- ***Most of these institutions spend 30-40% of their expenditure on manpower at worker level. Several activities of GMC and JS are similar and carried out separately;***
- ***There are issues related to transfer and O&M of the assets created previously;***
- ***As a check against depleting ground water table, JS has submitted a proposal of imposing a tax on boring in the city. However, the authorities have not taken any further action on this;***
- ***Most of the institutions do not have proper asset records and no efforts have been initiated so far for asset inventory;***
- ***Though very soon some department have developed their websites but they are not very informative and still depend a lot on paper work; and***
- ***GMC is short of sanitation staff. Lack of manpower for sanitation services is leading to ineffective sanitation and solid waste facilities in the city.***

ADAPTIVE MEASURES

5

The discussion, so far indicates that people's livelihood are dynamic, complex and variable in character, with the poor in particular responding with the means they have available to the vulnerability they face. In Gorakhpur city people have developed their own autonomous adaptation measures to cope with flooding and water logging. In the following paragraph some glimpse of autonomous adaptation collected during the survey are as follow:

Boat of tubes

In the dense dwelling of old part of Gorakhpur city there is situated a ward Narsingpur lying at a distance of 1½ km from river Rapti. All big or small depressions or pits present in the area remain filled up continuously with the water for more than 8 months in a year. This area is prone to be engrossed with the problem of water logging even in a very light rainfall.

The water enters in approximately 60% of 400 houses of this ward in which live people of both low and middle Income group. On road 2 to 2½ ft high water is common. A big drain of city flows through this area and the regulator of the river Rapti are shut down so that high water level in river is stopped from entering into the city. This is a warning signal to the people that there will be water logging in their area.



The increased problem of the movements of the people affects their livelihood. In such situation the biggest problems which come across are purchase of food materials and medical treatment. People of Narsingpur have chalked out or invented a method at local level for coping with the problem.

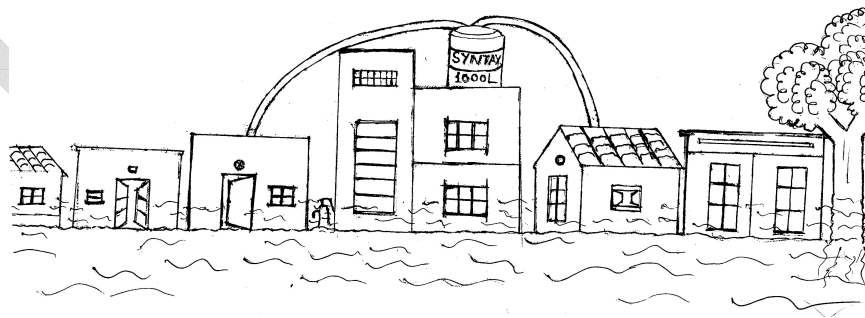
People collect tubes of trucks and big vehicles and tie them together tightly with the ropes all over. This way a boat of tubes is made. With this floating boat they reach even in narrow places. On this kind of boat people go out to purchase essential goods and in the time of sickness patients are taken to the hospital by seating them on it. This invention of the people has relieved the people suffering from the water logging problems.

Water Sharing

In the west of Gorakhpur city there is densely populated ward in vicinity of ward no-51 known as Narsinghpur. It is 1 km away from embankment. A big drain 2 ft wide passes through this region. Located near river and drain, the area faces water logging. There are 400 houses in this ward with a population of approximately 7000 people. Temple and Mosque are built nearby and Hindu and Muslims live together. The situation of water logging is horrifying. If it rains in any neighboring ward then water accumulates in Narsinghpur. The whole area gets flooded with the water up to 1 ½ to 2 ft. high and prolongs 4 to 10 days. 68% of the people of this area belong to Low Income Group, 30% Middle Income Group and 2% High Income Group. All of these are, in some way or other, affected by water logging.

During water logging, worst situation is visible among Low-Income Group in whose houses rain water enters and drains out after many days, leaving behind dampness, moisture and several diseases. In such period the condition of the drinking water gets pathetic because it turns smelly and brings filth along with it.

In addition no body can go out to collect drinking water due to water accumulation in the houses. The lack of pure and hygienic drinking water becomes a major problem.



In this ward, Shri A.R.Rehman, a teacher, lives who comes in high Income category. He has in his house a water tank with the capacity of 1000liters of water. Though he has the overhead water storage tank for his family, but during the time when water surrounds the whole colony and the drinking water gets scarce or limited in the neighboring houses, Mr. Rehman putting his own requirements and the family's requirements aside, connects a long pipe in this tank and provides drinking water to all neighboring houses. He does so

twice a day. The water from the house of A.R.Rehman does not distinguish Hindu-Muslim, poor and rich and tries to secure every body's life safe without any discrimination.

The Construction of the first floors

GDA authorized Taramandal area lying in south –east of Gorakhpur city is a low land area and remains in a state of water accumulation for four months during rainy season. It is newly inhabited area of Gorakhpur. Though it has not been transferred to Municipal Corporation but majority of people residing here belong to high income group. Due to new habitation and water accumulation, 90% of the house have constructed on elevated foundations. The fear of flood has deeply influenced the minds of the people. In the year 1998 the entire area was inundated and almost in all the houses water had entered. During the survey it was observed that after the flood of 1998 the inhabitants of this area are giving priority to construction of additional first floor, above their houses, and this addition has enhanced an investment of 30-35 % in the house construction. However, it gives the inhabitants a sense of safety.

The Use of houses as store house

Mufti Nagar situated in the mid of Gorakhpur city is a commercial area. Being an old area, its lanes are extremely narrow and its housing constructions are unplanned. It is the main center of whole sale in the city of Gorakhpur. The whole area gets inundated in rain of only half an hour due to bad condition of road of Govt, no proper arrangement of cleanliness, disposal of solid wastes and water drainage. The water enters into the shop and causes the loss of lakhs of rupees to the owners. They do not get any compensation for such loss. In order to avoid such risks people are constructing the houses over their shops. During the survey, people explained that by constructing additional room in their houses they use it as store room which help them in reducing the monetary loss in comparison to earlier situation.

Cemented door frame in front of door ceases water entry in the houses

Inhabited in the North West corner of the city, Jatepur North is identified as Ward No 13. In ward, on the basis of local nomenclature there is a colony known as Mansha bag colony comprising of around 300 houses. In the year 1990-91 this was a land of brick kiln .People purchased it at a trivial cost and built houses on it. Low land and somewhat unplanned development together, have pushed this village Jatepur North in a swamp of water logging. Here 77% houses are directly exposed to water logging. In the normal days there remains water up to ½ ft in the houses while in rainy season water accumulates up to 1-2 ft and remains there for 2-5 days. In the process of elevation of road the houses have gone down up to 3 ft. There is no proper means of water evacuation. People have started constructing border /frame of 2-2.3 feet high out of the main door to stop the flow of water inside the houses. At present, 93 houses have adopted this method.
