

Discussion on Drainage System and Urban Land Use Dynamics and Its Implication

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Abstract – Many natural streams, which are locally known as 'Jans', serve Jorhat area. The crucial thing to note is that the bed level is far higher than the bed level of the other natural cum man-made streams of the main river of this town of Bhogdoi. Draining storm water directly into the Bhogdoi River is challenging. Therefore, where sufficient gradient is available, it is suggested to drain out the storm water to the jans. The flood water is pumped away mostly through overland flow across the fields to rivulets in regions beyond the urban border. The surface drains and the natural waterways are transported through power and sewage. The rapid industrialization and increase in urban settlements, the indiscriminate disposal of waste and the exploitation of these natural channels pose significant risks to the life of natural waterways, resulting throughout water logging in the rainy season in certain regions. Many parts of the city experience water logging throughout the rainy season due to human intervention. Over the last few years, this issue has become more complex, as this waste disposal is causing tremendous siltation on the Bhogdoi Channel. The river Bhogdoi receives more flood waves in Jorhat than any other river on the south side of Brahmaputra. Comparison to the other rivers on the south bank in upper Assam, the flood level of the river is very lower.

Keywords – Drainage System, Natural Streams

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INTRODUCTION

Urban Drainage poses an archetypal of contemporary environmental problems and calls for the development of cost-effective and acceptable technological developments, including the evaluation of the effects of the current infrastructure, in order to identify sustainable alternatives. In comparison, as with every artificial mechanism that takes the place of a natural one, urban drainage replaces one aspect of the natural water cycle. So, the consequences are crucial to be known. Urban irrigation schemes have long remained a crucial urban resource for storing and moving flood water and waste water away from urban environments (Chocat et. al., 2007; Larsen & Gujer, 1997). Given the rise over the decades, planning the successful operation of the drainage mechanism remains to be a big challenge for planners. For example, impacts have always been recognised due to climate change and urbanisation, which may contribute to a major rise in the extent and severity of urban flooding in several regions of the world (Huong & Pathirana, 2013; Zhou et al., 2012). The creation of ecosystems and related infrastructure services needed for economic and social activities necessary for the livelihood of growing communities in the region concerned is

fundamentally defined by urbanisation (Saravanan, 2011).

Thus, with the development of houses, highways, parks and other services, urbanisation entails improvements in land use and enhances the availability of water for the consumption and release of waste water. In an metropolitan system, urbanisation and human activities create multiple destructive and permanent impacts on the natural ecosystem, such as climate change, air contamination, sediment and surface degradation, increased severity of floods and habitat destruction. Both the severity and duration of flooding have expanded human land usage in the urban world. Raw land is transformed and paved with pavements throughout the urbanisation process, creating an increase in the amount of runoff following rainfall that contributes to flash flooding. The rate of increase is a feature of the percentage of region covered by storm sewers, which is critical since they enable urban runoff to easily enter the stream channel from the impermeable surface. Human-induced land use / land cover activities have a far-reaching effect on local environmental and climatic environments and adversely influence the natural

and man-made climate by modifying air temperatures.

Urbanization is also connected to human and building scale, mixed land usage, dependency on cars with resulting changes in air quality, and other associated health and social consequences (Murali et al., 2013). The rise and urbanisation of communities will cause very significant problems for urban water supply. A proper design of the urban water conveyance system is needed for the rapid drainage of water from urban conglomerates, for which long-term rainfall data is necessary. Owing to increased impermeability, the spatial flow structure in the urban ecosystem is altered and the hydraulic efficiency of drainage into artificial channels, gutters, storm water drains and collection systems must also be enhanced. In addition, urban drainage, which plays the most important role in the transport of rainwater and waste water, does not cope with the growing population load and regular waste created by inhabitants who consider greatly in a more sophisticated way to understand changes in hydraulic characteristics, i.e. width, depth and velocity in response to changes in discharge (Yen & Aka Essentially, significant attention was paid to the hydraulic dimensions of urban drainage issues, especially regarding the estimate of harm caused by surcharge events. Knowledge of the environmental effects of urban drainage schemes has only recently increased and the estimation of the efficiency status of the receiving water source (RWB) has become a central concern (Freni et al., 2008).

Needless to mention, waste and urban wastewater management is an essential component of infrastructure planning and maintenance and is the gateway to the development of India's towns and cities. At the same period, issues with water quality often occur as a consequence of urbanisation, which raises the range and quantity of toxins and nutrients in water sources (Arora & Reddy, 2013; Wang et al., 2008).

As a consequence of a broader political awareness of biodiversity, water quality has become more and more relevant in urban drainage planning. Storm water runoff congestion leading to urban floods and solid waste management, followed by human pressure on soil, leading to the conversion of more open land into built-up areas, as is the case in Jorhat, are the daunting and increasingly rising problems of the urban areas of Assam. The research is therefore being conducted in order to overcome the mentioned challenges.

DRAINAGE SYSTEM OF JORHAT CITY

Tarajan, which begins from Chaodang Gaon and crosses Na-ali, Komar Bandha (K.B) Road Assam Trunk (A.T.) Road and National Highway (N.H) by-pass and joins Anthubhanga at Sensua Gaon, drains a large part of the storm water of the municipality

district. Mahuajan (sub-ordinate basin) also covers a certain portion of the area of the municipality that begins from Banshbari and flows to Tarajan through Atilagaon. While Anthubhanga begins at Barbheta Chapari and crosses the path to Agricultural University, K.B. Track, Railway Line North East Boundary, and joins Tarajan at Sarucharai. Rowriah begins with Baghshung T.E. Na-ali and crosses, K.B. A.T. and Lane. Path and meets Bhogdoi with the long streams down. In reality, at separate points outside the Master Plan region far down shore, all the streams reach Bhogdoi dam.

Transport and communication. 1.2.10 Transport and communication

Jorhat is related to the rest of the world with highways, railways and airways (Fig.1.7). However, transport in Jorhat is primarily concerned with road facilities being the primary mode of transport in the region, which is the key and important infrastructure for the national economy's growth and development. The introduction of Jorhat's Master Plan saw an 8 percent rise in surface road length with a 6 to 12 m road width within Jorhat (TCPO, Jorhat, 1990). All the major cities of upper Assam are linked by the National Highway (NH-37) via Jorhat. D established the first asphalt road in Jorhat. In 1876, Simmons was referred to as the 'Club Lane' linking the Jorhat Gymkhana Clubhouse to the City Centre.

GROWTH AND DEVELOPMENT OF THE JORHAT CITY

With the advent of the industrial revolution that contributed to the flowering of many urban centres employed through occupation diversification, they became the place of attraction for peripheral regions to remain. More population accumulation is accumulated from these centres. With each successive year, this demographic concentration in urban centres began to multiply in all ways of natural development and relocation, opening the way for forced urbanisation to spread horizontally and vertically. The ever increasing physical growth faced by many communities in the developed nations of today has inevitably culminated in urban sprawl. In reality, owing to the demographic boom and the expansion of urban growth, multiple social, political and environmental concerns began to brew. It has been incredibly necessary to provide a proper understanding of the challenges posed by rapidly urbanising communities. Therefore, it is important to research the different facets of urban-related problems such as solid waste, artificial flooding, sewage pollution, etc., and the impact of urban development as a whole, which in turn is responsible for preparing the fastest expanding urban areas in order to shape the built landscape in order to deal with the ever changing social and economic needs. A history analysis of a community is a necessary prerequisite for follow-up, requiring

comprehensive knowledge of at least the physical area, demographic dynamics, land use, etc. This chapter studies the origin of development accompanied by population growth pattern and density, which is an important part of analyzing drainage issues along with other physical factors, in order to step forward.

Origin of growth

Under the administration of few mighty 'Swargodeo' (Ahom kings), Jorhat's development has gone through a long history of the Ahom age (13th-18th century). During this time, under the umbrella of the Ahom administration, the people of the Brahmaputra valley established both external and internal trade, developing good ties with different tribes living inside and outside the region and in a way that contributed to shaping their economy

Development trend

It is well recognised that the pace of growth of an metropolitan region depends on the physical and cultural context in which the community, its scale and (economic, social) activities connect. One of the key factors to be taken into consideration in researching the growth and sustainability of a region is the trajectory of growth of population analysis for potential development. The trend of development can be identified through occupational composition, cultural contexts (educational, leisure, public health, etc.), population growth rate (distribution and density), links to other urban centres, and spatial extension. Besides this, the movement of citizens from rural areas to the city is the key snag in forecasting the population growth trend. It is clear that Jorhat District experienced 23,546 migrants with a percentage share of 2.36 percent of the total population of 9,99,221 during 2001.

URBAN LANDUSE DYNAMICS AND ITS IMPLICATION

Land use relates to human use of land resources, and shifts in land cover also represent the most critical environmental effects due to unsustainable human action (Yadav et al., 2012). "Another definition that has a great deal of value is that the use of land applies to" the actions of man on land that are specifically connected to resources "(Clawson & Stewart, 1965). "On the other hand, ground cover describes" the vegetation and artificial constructions which cover the surface of the field "(Burley, 1961).

SIGNIFICANCE OF THE PROBLEM

In essence, urbanisation is the characteristic construction of the ecosystems and related allied facilities needed for the socio-economic activities which are indispensable for the livelihood of the growing population of the region concerned. It should be remembered that urbanisation brings in changes

in land use with the development of houses, bridges, parks and other services and raises the availability of water for the consumption and discharge of wastewater, which in turn has had a significant effect on the natural hydrological processes prevailing in the region. Jorhat is endowed with a set of streams. Tarajan, Tocklai, Mahuajan, Anthubhangajan, Jan Jawkharia and Bhogdoi Dam, but none of these major drainage channels are sadly clear of undesirable burdens. The troubling truth is that in the absence of sufficient strict prohibitive steps to monitor it, which is the burning requirement, the operation continues to go on unabated. Furthermore, in the course of sustainable growth, the areas under the green belt begin to be transformed over time into houses to satisfy the ever-urban population, with barely any drainage provision. Once the land is transformed into built-up parcels, the space for rain water percolation is reduced and the volume of surface run-off rises, creating artificial flooding.

Moreover, because of the very low permeability of the salty clay soil in Jorhat, the percolation of rain water into the soil is very reduced. As a consequence, much of the water stagnates on the surfaces of the soil. Of course, failure to include irrigation, constriction or blocking of the irrigation region can also lead to this issue. The existence of an adequate management method for municipal solid waste is also a matter of profound concern, since such water has a direct adverse impact on drainage. It is therefore important to consider the drainage system, including its network, its morphology, the effect of rainfall on the flow pattern, the consistency of the water and the associated health threats, and at the same time to recognise the flaws and potential measures for the issue related to the city's ineffective drainage system. Providing knowledge on the state and complexities of urban land use to policymakers by the use of remote sensing evidence for such research, urban land use transition studies have been relevant for urban or municipal policymakers and decision-makers to take into account the effects of urban development

REVIEW OF LITERATURE

Roy & Saha (2011) worked extensively and provided a comprehensive scenario of different problems impacting urban development relevant to the evolving challenges of Siliguri municipal corporation, West Bengal, which offers valuable knowledge about the characteristics and effects of factors shaping a municipality.

Gupta & Singh (2012) is a strong account of the theoretical basis, explaining the trajectory of urban population growth from the global to regional background and the evolving pattern of land use. It has also cited the explanation behind such phenomenal development. In addition, land use / land cover and its spatiotemporal transition is studied on the basis of multi-resolution and multi-

temporal satellite data for various time periods. The urban sprawl method was analysed utilising three separate spatial data sources (historic city plan, remotely sensed satellite data, topographical maps and current maps and previous work) to better understand old and new century land use shifts.

In addition, according to the United States Geological Survey (USGS) classification, land use / land cover (LULC) classification scheme, ward wise LULC region statistics and LULC map of the municipality of Burdwan and thematic map (including layers: rail, canal, municipality region boundary, path, river, ward boundary and LULC classes) of the municipality area of Burdwan have been comprehensive and evaluated (Gupta & Ro).

Sharma (2010) worked extensively to display acute photos of the Jorhat city's historical growth and progress, enriched with a lot of useful details, helped to provide a comparative image of the city.

The ever-changing partnership between man and his nation recognises that it is the scale of the population and its growth rate that directly affects the region's economic prosperity, social well-being, cultural values and political stability, rendering it apparent to concentrate on the burden of the population on property. The distinct variations between the distribution that is more concerned with population spread and density with some form of man-land ratio are observed (**Chandana, 2007 & Hussain, 2003**).

Environmental pollution is related not only to industrial expansion, but also to the population's pressure on limited natural resources. The shortage of basic municipal services, such as drainage, water supply and urban accommodation, has contributed to waste disposal problems. This dilemma has been contributed to by the continuous population influx from rural areas to metropolitan areas. **Mishra (2012)** has recently carried out such studies.

The spatial scale of impact should be analysed not only according to the size of urban centres, but from variable to variable, as analysed by **Sharma (2013)** in his doctoral thesis "Elements of Urban Impacts on Rural Society in India," attempted to understand the magnitude of the spread of the power of the city and the urban trend induced as reflected in the fiscal, demographic and social characteristics.

Urban development patterns have been seen to be extremely useful in recognising the existing and potential development environment and thus preparing successful plans, including handling Jorhat's managed growth policies and systemic development (**Deka et al. 2012**).

Effective planning includes an awareness of both urban and drainage planning, as well as the particular social, technological, and environmental problems connected with it. The Jorhat Municipality

Board (JMB) and the Jorhat Development Authority (JDA) sought to plan and address the Jorhat City issues. In addition, Assam's Town and Country Planning (TCPO) has given strategic advice in collaboration with the municipality and is attempting to do the same. The Flood Protection and Drainage Department has also stepped forward and aided with re-sectioning, installing sluice gates, where possible, and diverting stream flows to mitigate floods with metropolitan areas. To solve the urban drainage issue, it is important to provide reliable data set on rainfall, flow path, natural and artificial drainage networks, slope, land use trend, population demand, proper dumping site, identification of outlet points from which the storm water will dissipate without hitch. In reality, attempt has been made to proceed with a valid assessment of the drainage issue of Jorhat, eventuated by some causative factors, via the notable works related to this report.

OBJECTIVES OF THE STUDY

1. To examine the effect of rainfall on the major drainage arteries' flow pattern/ soil runoff.
2. To quantify and assess the forms of solid waste (garbage), its generation trend and population density relationship and associated demographic component as the variables contributing to runoff congestion, and to investigate the city's water logging / artificial flood scenario and its implications.

CONCLUSION

Apart from the other factors or criteria mentioned in the previous chapters, Chapter-5 explains the causes that lead to the issue of urban drainage in Jorhat. In particular, this chapter covers the issue of solid waste and other allied problems compounded by excessive management of solid waste, such as artificial floods, evaluation of water quality that contributes to associated diseases. Detailed methods of waste evacuation, waste management and accumulation of disposal materials by individuals were considered affiliated with the facilities given by the Jorhat Municipality Board (JMB) while discussing the solid waste issue, waste generating sources, types of waste and its frequency of generation. It should be remembered that for wards 1, 2, 5, 11, 17, 18 and 19 this correlation is used, since these wards fall within the region of developed drains covering an area of around 38 percent and there is a very weak association for all wards computed together. This is partly attributed to the fact that some of the wards covering a region of around 27 percent are deprived of drains and have badly constructed drains in 35 percent of the places. In reality, more drains are needed for efficient carrying ability, particularly in areas devoid of drains, and it is also imperative to check the efficiency of established

drains at the same time. The major contributing parameter in the inundation of the city, which is always faced by the inhabitants of Jorhat, is also inefficient drains in a way.

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