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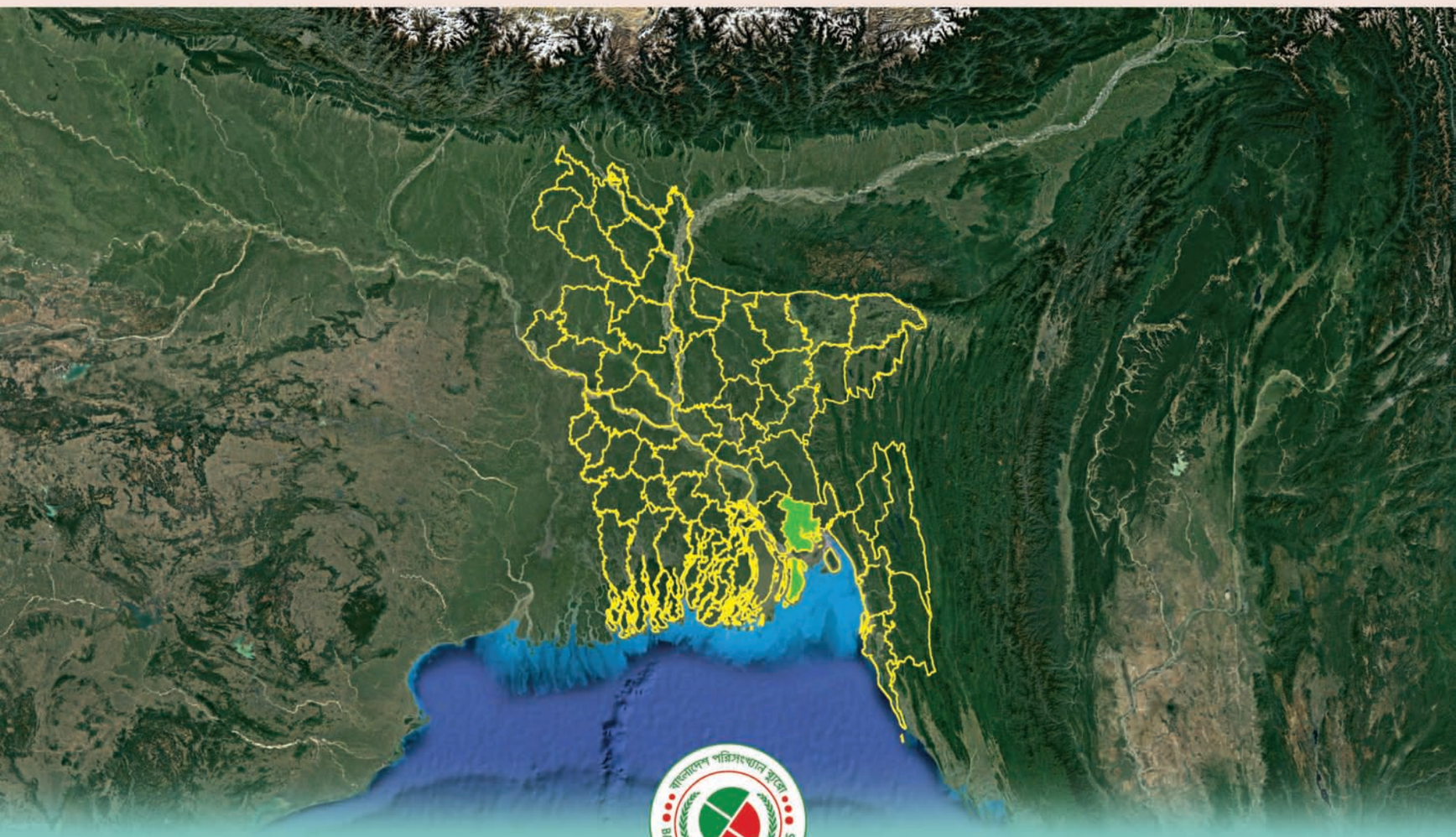
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

DISASTER PRONE AREA ATLAS BANGLADESH

NOAKHALI ZILA



BANGLADESH BUREAU OF STATISTICS (BBS)
STATISTICS AND INFORMATICS DIVISION (SID)
MINISTRY OF PLANNING

Cover Photographs (Front):

Map of Bangladesh highlighting the concern Zila

Cover Photographs (Back):

Stat4Dev Project

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ISBN: 978-984-34-4930-6

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NOAKHALI ZILA

June, 2020

BANGLADESH BUREAU OF STATISTICS (BBS)
STATISTICS AND INFORMATICS DIVISION (SID)
MINISTRY OF PLANNING
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

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Foreword

Bangladesh Bureau of Statistics (BBS), the National Statistical Organization (NSO), is responsible for collecting, compiling and disseminating of statistics on population, demography, and economics as well as on other social indicators to measure the trends of the country's growth and development. Conducting Population and Housing Census is one of the core activities of BBS. Beside this, BBS conduct lots of Inter-censual survey and generate lots of analytical reports for the users which are mainly used for planning and policymaking at the national and sub-national levels. These reports are widely used for poverty alleviation interventions and initiatives for the improvement of the people's quality of life.

Bangladesh has taken a holistic approach towards disaster management, where emphasis has been given for working together with all stakeholders to build strategic, scientific and implementation partnerships with all relevant government departments and agencies, other key non-government players including NGOs, academic and technical institutions, the private sector and development partners. The role of Government is mainly to ensure that risk reduction and comprehensive disaster management programmes are in place. Given emphasis on that, BBS took an initiative to produce disaster prone area atlas for 15 coastal districts of the country. These atlases will focus on the existing situation of hazards, risk and disaster proneness of the districts and at the same time it will help to visualize the vulnerability through map and statistics. The disaster prone atlas of Noakhali District is one of the output of such initiative.

Let me take privilege to thank UNFPA for providing financial and technical support to Stat4Dev Project of BBS under which this Atlas is prepared. I would like to thank the working group comprising relevant experts from Government of Bangladesh, Research Organizations and International Organizations for their technical backstopping in preparing the maps and the Atlas. I also would like to express my sincere thanks to the Director General of BBS, Project Director, GIS and his team for their sincere efforts in successful completion of this tremendous job. Thanks are also due to the distinguished members of the technical committee and report review committee for their valuable guidance in finalizing of the Atlas.

Dhaka: June, 2020

Saurendra Nath Chakrabhartty

Director General
Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning
Government of the People's Republic of Bangladesh

Preface

Bangladesh Bureau of Statistics (BBS) already has been entered into a new through the enactment of the Statistics Act, 2013. As per this Act, BBS is mandated as the Standalone agency for generating official statistics. The law has also empowered BBS to provide guidance to other agencies for producing official Statistics and authenticate statistics generated by them. The Act also given responsibility to BBS to prepare Integrated Geographical Information System (GIS) to foster integration of GIS with Statistics. According to Statistics Act 2013, BBS has prepared the national Strategy for development of Statistics (NSDS) aimed at capacity building of the nationwide use of statistics with a special focus on Environment, Climate Change and Disaster related quality statistics. Following that mandate, previously BBS Published small area atlas for 64 districts. Now BBS is going to prepare the disaster prone area atlas for 15 coastal districts of the country for the first time. The disaster prone area atlas of Bangladesh is a tool to enhance decision-making to reduce the economic and social impacts of natural disaster in the country. It is intended to provide a wide range policymakers with appropriate risk information in order to strengthen the capacity of the country to develop disaster risk reduction and management. It provides tool in identifying, showcasing and disseminating information to make sound decisions to enhance the planning and development process. The atlas serves as a catalyst for the holistic approach of building resilient communities. The disaster prone area atlas of Noakhali District is one of the outcome of our disaster prone area mapping exercise.

I am grateful to UNFPA for their technical and financial assistance and to the representatives of universities; research organizations for their valuable guidance in preparing the Atlas; My sincere thanks to Mr. Md. Zahidul Hoque Sardar, Project Director; Md. Maksud Hossain, Deputy Director and other colleagues of Stat4Dev Project of BBS for their relentless effort in preparing the Atlas and for bringing out this atlas. The members of the editorial committee deserve special thanks for their input in the technical improvement of the atlas.

I think this atlas will be useful to the policymakers, researchers and development partners to meet their demand for mapping the country. Any constructive suggestion for further improvement of this report will be highly appreciated.

Dhaka: June, 2020

Mohammad Tajul Islam

Representative
UNFPA Bangladesh

Message

I am glad to know the Bangladesh Bureau of Statistics (BBS), under the Statistics and Informatics Division (SID) of the Ministry of Planning of the Government of Bangladesh, has taken the initiative of publishing the Disaster-Prone Area ATLAS prepared by the UNFPA-supported project with BBS. An ATLAS is a handy tool to identify and reveal the exact location and geophysical and socio-economic characteristics of a geographical area. I believe this Disaster-Prone ATLAS will give a clear understanding of spatial and temporal occurrences of natural calamities and will be beneficial in mitigation strategies and preparedness plans, allocation of resources for a response, and will provide the decision support system in disaster management.

UNFPA assists the national efforts at building and sustaining capacities for knowledge management and data/ statistics systems, for integrating population dynamics into national planning and monitoring systems. It commits UNFPA Bangladesh to strengthen national capacity for the production and use of age, sex and location disaggregated population data, in line with the Sustainable Development Goals (SDGs) and International Conference on Population and Development (ICPD) beyond 2014. The 2030 Agenda for Sustainable Development, adopted in 2015, has placed the highest priority on ensuring that "no one is left behind", calling on national statistical systems to disaggregate national indicators and monitor and redress inequalities as a matter of human rights. This aspiration places a high demand on national data ecosystems, and on data disaggregation by age, sex and location in particular.

Climate change is one of the greatest challenges facing humanity today. Due to its geographical location, geological and climatic conditions, Bangladesh is one of the most disaster-prone countries in the world. UNFPA is working with the Governments and other development partners to understand population dynamics better, how they affect the changing climate and how people can become resilience in the face of these changes. This disaster-prone area ATLAS has visualized through maps and statistics of the existing situation of hazard and the risk of Noakhali district.

I would like to express my sincere appreciation to the Director General of BBS, Project Director, and his team for their sincere efforts in successful completion of this tedious job.

Dhaka: June, 2020

Ms. Asa Torkelsson

Project Director
Stat4Dev Project
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Ministry of Planning

Acknowledgement

I am delighted to acknowledge the active role of officials concerned in undertaking the exercise for preparation of Disaster Prone Area Atlas. It is worth-mentioning that the staff members of BBS have professionally and successfully completed the Atlas by overcoming all the challenges.

I would like to express my humble gratitude and thanks to Saurendra Nath Chakrabhartty, Secretary, Statistics and Informatics Division (SID), Md. Amir Hossain, Director General, Bangladesh Bureau of Statistics, Ms Mahmuda Akhter, Additional Secretary (Development), Statistics and Informatics Division (SID), for their valuable suggestions, patient guidance, and all-out support for completion of the disaster prone area atlas.

Thanks to UNFPA Bangladesh for their generous support to BBS for conducting National Population Census and other outputs, like preparing disaster prone area maps, using census data for the very meaningful use by different government and non-government agencies.

Particularly I am grateful to Md. Maksud Hossain, Deputy Director, Md. Firoz Ahmed Sardar, Statistical Officer and other Stat4Dev project's officials who were the active members of this Atlas team.

I have the pleasure to express my deepest gratitude to Mr. Rezaul Roni, Associate Professor, Department of Geography and Environment, Jahangirnagar University, who gave his full effort in preparing this Atlas. My great appreciation is due to the members of the project management team of stat4Dev project for their relentless efforts in this exercise.

I am deeply indebted to various stakeholders and agencies concerned who always provided their valuable suggestions and comments for successful completion of the Atlas and data collection from field.

Hope, users and readers will continue to forward their suggestion and comments for further improvement of those documents.

Dhaka: June, 2020

Md. Zahidul Hoque Sardar

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Chapter 1

Introduction

1.1 Background

Bangladesh is broadly distinguished as one of the world's countries most susceptible to climate change and one of the most vulnerable countries of the world in terms of natural and anthropogenic hazards. As per the World Risk Report 2015, Bangladesh has been identified as the sixth most natural disaster-prone country among 173 countries in the world. The geography and climate have made the country vulnerable to different meteorological, hydrological and geological hazards. Natural hazards are a direct result of increased rainfall in the monsoon season, rising sea levels from climate change, and tropical cyclones. The occurrences of natural disasters in the nation are supposed to increase because of climate change. Each disaster brings about devastating effects on the nation's agriculture, water supply, food resources, health and shelter. It is predicted that the effects of climate change, in the future, will generate more than 20 million climate refugees. Bangladesh is among the countries most predisposed to extensive flooding, tornados and destructive cyclones. Additionally, the water in Bangladesh is frequently contaminated with arsenic due to flooding and the high arsenic contents in the soil. It is estimated that nearly 77 million people in Bangladesh are exposed to toxic arsenic from drinking water (WHO, 2000).

Bangladesh Bureau of Statistics (BBS) already has been entered into a new era through the enactment of the Statistical Act 2013. As per the Act BBS is mandated as the stand-alone agency for generating official statistics. The law has empowered BBS to guide other agencies for producing official statistics and also to authenticate statistics generated by them. According to Statistical Act 2013, BBS has prepared the National Strategy for Development of Statistics (NSDS) aimed at capacity building of the nationwide use of statistics as well as Environment, Climate Change and Disaster-related quality statistics.

1.2 Objectives

As a consequence of the above NSDS, BBS is going to prepare 15 coastal districts disaster-prone area atlas based on field verification and updating GIS map with other related information. Each disaster-prone area atlas will represent a single district and existing situations of hazard and risk are visualizing through maps and statistics.

1.3 Scope of the work

Geographically, the survey covered the entire district for the selected 15 coastal districts area. to cover disaster-prone areas (mauzas/mahallas) a mauza/ Mahallah list containing the dominant mauzas/Mahallah across the disaster-prone areas under 17 districts were generated. The risk analysis was done at the extent of both the national and local levels. It will focus on the main disaster namely flood, salinity, storm surge, excess rainfall, cyclone, thunderstorm and windstorm.

1.4 About the national disaster atlas

The main deliverable of the project is the district-specific disaster-prone area atlas. The atlas contains general information about the demographic and climatic characteristics of a specific district. It describes the main elements at risk and the

hazard profile of the local level based on settlements. The information was collected from the local level community and compiled to construct the maps. It contains an analysis of the risk and vulnerability of the district. The disaster-prone area atlas of Bangladesh is a tool to enhance decision-making to reduce the economic and social impacts of natural hazards in the country. It is intended to provide a wide range of decision-makers and policymakers with appropriate risk information to strengthen the capacity of the country to develop strategic risk management strategies. It provides an excellent tool in identifying, showcasing and disseminating important information needed to make timely and sound technical decisions to enhance the development process. The atlas catalyzes the holistic approach of building resilient communities.

1.5 Expected benefits to the nation

At the end of this Atlas, a lot of information on disaster and risks will be available and be able to define the disaster profile of specific districts of Bangladesh. Such a disaster risk profile will help to better coordinate all disaster management related initiatives proactively at national and local levels, leading to the reduction of disaster risk for all Bangladeshi citizens.

1.6 Key stakeholders

The National Disaster Atlas is intended to benefit a range of stakeholders and potential users. Mainly, the key decision/policy-makers will be able to ensure policymaking and decisions are based on robust risk information. The atlas will benefit donors and development partners by informing them of their respective project formulation and design and risk-proofing development interventions. It will also ensure risk-informed planning by Planners in the government institutions, non-government organizations and the private sector. Besides, the academe is one of the expected beneficiaries and users of the atlas specifically as a basis or reference for further researches and academic papers. Moreover, the private sector will also benefit from the atlas as its findings could guide them in disaster risk proofing their investments. The humanitarian actors could also utilize the atlas as a guide in identifying hazard-safe areas where humanitarian interventions are placed and implemented. The Districts and the local communities will by and large be the main beneficiaries and users of the atlas.

As herein listed, these stakeholders were grouped into ministries, governmental institutions, regional organizations, and international organizations (including UN Agencies and NGOs). Some of the other stakeholders, particularly the regional organizations, participated in the project by providing data required in the assessment including thematic inputs in the use of software, and modeling, including the development of the methodology and analysis. In particular, the UNFPA, aside from providing funding support to the project, have extensively provided technical guidance and assistance to the risk assessment process through its in-house disaster risk assessment expertise.

1.7 Key concepts and definitions

Disaster.

Disaster means any such incidents mentioned below created by nature or human or created due to climate change and its massiveness and devastation cause such damage to cattle, birds and fisheries including life, livelihood, normal life, resources, assets of community and the environment of the damaged area or create such level of hassle to that community whose own resources, capability and efficiency are not sufficient to deal this and relief and any kind of assistance is needed to deal that situation, such as: (a) Cyclone, northwester, tornado, sea high tides, abnormal tides, earthquake, tsunami, excessive rains, shortfall of rains, flood, erosion of river, erosion of coastal area, drought, excessive salinity, excessive pollution of arsenic, building slide, landslide, hill slide, gushing water from hills, hailstorm, heat wave, cold wave, long term water logging etc.; (b) Explosion, fire, capsize of vessel, massive train and road accident, chemical and nuclear radiation, pilferage of oil or gas, or any mass destruction incident; (c) Disease causing pandemic, such as pandemic influenza, bird flue, anthrax, diarrhea, cholera, nCovid-19 etc.; (d) Harmful microorganism, poisonous materials and infection of life active object including infection by bio based or biological infectious object; (e) Ineffectiveness or damage of essential service or disaster protection infrastructure; and (f) Any unnatural incident or a misfortune causing massive life loss and damage (Disaster Management Act 2012).

Disaster risk

The potential disaster losses in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time. The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses, which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least.

Disaster risk reduction

Disaster Risk Reduction (DRR) is the development and application of policies and practices that minimize risks to vulnerabilities and disasters, applies to manage and /or responding to current disaster risks.

Early warning system

It is a major element of disaster risk reduction. It prevents the loss of life and reduces the economic and material impact of disasters. To be effective, early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate alerts and warnings and ensure the constant state of preparedness (Ibid).

Exposure

People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

Hazard

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. There are hazards of natural origin and related environmental and technical hazards and risks. Such hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological and technical sources, sometimes acting in combination. In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis.

Natural hazard

Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Natural hazards are a sub-set of all hazards. The term is used to describe actual hazard events as well as the latent hazard conditions that may give rise to future events. Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration, and area of extent. For example, earthquakes have short durations and usually affect a relatively small region, whereas droughts are slow to develop and fade away and often affect large regions. In some cases, hazards may be coupled, as in the flood caused by a hurricane or the tsunami that is created by an earthquake.

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. The resilience of a community concerning potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both before and during times of need.

Return period

A return period, also known as a recurrence interval or repeat interval, is an estimate of the likelihood of an event to occur. It is a statistical measurement typically based on historical data denoting the average recurrence interval over an

extended period. The theoretical period is the inverse of the probability that the event will be exceeded in any other year. For example, a 25-year flood has a 1/25 = 0.25 or 25% chance of being exceeded in any one year. Despite the connotations of the name "return period", it does not mean that a 25-year flood will happen regularly every 25 years or only once in 25 years (Wikipedia, 2015).

Risk

Risk means hazards, factors of dangers and the possible harmful situation created due to the internal process of the environment or assembling and capability. (Disaster Management Act, 2012)

Risk analysis

The process to comprehend the nature of risk and to determine the level of risk (ISO 31010).

Risk assessment

A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. Risk assessments (and associated risk mapping) include a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.

Vulnerability

Vulnerability means any such existing socio-economic, geographical and environmental condition of any community, which may make the expected capability of the community vulnerable, weak, unskill and limited to adapt to the effect of natural or human-created hazard or any adverse reaction.

Natural Disaster

A natural disaster is a major adverse event resulting from natural processes of the Earth; examples include cyclones, drought, floods, erosion, volcanic eruptions, earthquakes, tsunamis, and other geologic processes. A natural disaster can cause loss of life or property loss and damages, and typically leaves some economic loss and damages, the severity of which depends on the affected population's resilience, or ability to recover. Following is the description of some of the natural disasters (with their code number) in Bangladesh.

Drought

Bangladesh faces unpredictable drought hazard in the dry monsoon due to inadequate and uneven rainfall. It varies from place to place, however, and the northwestern region of Bangladesh suffers most from the drought almost regularly in a two-year cycle. It is unusual dryness of the soil, resulting in crop failure and shortage of water for other uses, caused by significantly lower rainfall than average over a prolonged period. Hot dry winds, shortage of water, high temperature and consequent evaporation of moisture from the ground can contribute to conditions of drought. This may have initiated the process of desertification in those districts where the affected areas maintain high temperatures, non-availability of surface water due to drying out of water sources, crops die out and there is a crisis of fodder as well. For people who are directly dependent on rainwater, drought is a big problem.

Flood

Flood is one of the major natural disasters in Bangladesh. In general, the normal inundation of flood-free areas by water caused by excessive rain and spillage from the overflown riverbanks is called a flood. Floods bring about immense havoc to the lives of the people. Flooding is a natural phenomenon in Bangladesh and occurs on an annual basis. The rivers are huge by global standards and can inundate over 30% of the landmass at a time. Bangladesh is prone to serious and chronic flooding. Even in an average year, 18% of the landmass is inundated and previous floods have affected 75% of the country (as in 1988). 75% of the country is below 10m above sea level and 80% is classified as floodplain as Bangladesh is principally the delta region of South Asia's great rivers. Bangladesh floods regularly, recent notable and catastrophic floods have occurred in 1988, 2004, 2007 and 2010. Floods cause erosion of chars (islands) by flooding rivers, cause landlessness amongst Bangladesh's poor; environmental refugees, loss of property, lives, epidemic, other water-borne diseases, lack of drinking water, loss of agricultural land and crops, communication disruption are some of the major effects of this natural disaster.

Water Logging

Bangladesh's high vulnerability to frequently occurring natural disasters is known worldwide, a lesser-known new phenomenon - water logging - has been disrupting the livelihoods of people during the past two decades. The phenomenon involves the deterioration of drainage conditions in several southern coastal rivers leading to temporary to permanent inundation of floodplains along those rivers, causing enormous difficulties towards maintaining livelihoods and disrupting land-based productive systems including crops. The problem has become severe in the southwestern parts of Bangladesh, especially along the Kapataksma river system covering parts of Jashore, Khulna and Satkhira districts. Waterlogging is also becoming an issue in the central southern Noakhali district, where gradual chocking of the Noakhali rivulet (i.e., khal) has given rise to temporary waterlogging every year.

Cyclone

A large-scale closed circulation system in the atmosphere with low barometric pressure and strong winds that rotate counterclockwise in the northern hemisphere and clockwise in the southern hemisphere. The system is referred to as a cyclone in the Indian Ocean and South Pacific, hurricane in the western Atlantic and eastern Pacific and typhoon in the western Pacific. Cyclones are the most devastating of natural disasters. Generally, the disasters faced by the coastal areas are related to tides, river flows and weather conditions leading to cyclonic winds. A major hazard that occurs in the coastal areas is mostly due to weather conditions associated with depressions of varying severity. The hazards due to cyclones are associated with elements such as depressions, cyclone surges, the effect of wind speed, hazard areas, etc. High winds cause rough conditions and high waves during the time of depression over the sea and cause damage and loss throughout the land they pass over. In Bangladesh, the main cause of damage and loss is the severe cyclonic storm with Hurricane intensity. In Bangladesh, most of the cyclones occur during the pre-monsoon (April/ May/ early-June) and post-monsoon (late-September/ October/ November) period. The pre-monsoon period is the sowing or broadcasting season for Aus rice and the post-monsoon season is the harvesting season for Aman rice in the coastal areas. Hence, the impact of cyclones is severe in terms of economic loss, as well as the loss of lives and property.

Tornado

The two transitional periods between southwest and northeast monsoons over the Indian sub-continent are characterized by local severe storms. The transitional periods are usually referred to as pre-monsoon (March-May), and post-monsoon (October-November). It is the pre-monsoon period when most of the abnormal rainfall or drought conditions frequently occur in different parts of Bangladesh. Also, there are severe local seasonal storms, popularly known as nor' westers (kalbaishakhi). Severe nor'westers are generally associated with tornadoes. Tornadoes are embedded within a mother's thundercloud and move along the direction of the squall of the mother storm. The frequency of devastating nor'westers usually reaches the maximum in April, while a few occur in May and the minimum in March. Nor'westers and tornadoes are more frequent in the afternoon.

Storm/Tidal Surge

Storms are caused by atmospheric disturbance involving perturbations of the prevailing pressure and wind fields, on scales ranging from tornadoes (1 km across) to extra-tropical cyclones (2000-3000 km across). This causes a rise in sea level that result in the inundation of areas along coastlines. The movement of ocean and sea currents, winds and major storms causes these phenomena.

Thunderstorm

A thunderstorm, also known as an electrical storm, a lightning storm, or a thundershower, is a type of storm characterized by the presence of lightning and its acoustic effect on the Earth's atmosphere known as thunder. Thunderstorms occur in association with a type of cloud known as a cumulonimbus. They are usually accompanied by strong winds, heavy rain

and sometimes hail, or, in contrast, no precipitation at all. Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of over 20 km (12.45 miles). As the rising air reaches its dew point, water droplets and ice form and begins to fall through the clouds towards the Earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of cold air and moisture that spreads out at the Earth's surface, causing the strong winds commonly associated with thunderstorms, and occasional fog.

River/Coastal Erosion

A combination of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the earth's surface. The energy in a river causes erosion. The bed and banks can be eroded making it wider, deeper and longer. River erosion and submerging of the coastal lands are the natural phenomena being one of the main natural disasters. River and coastal erosion cause much more destruction to the socioeconomic mechanism than any other natural disaster. Loss of life may not happen due to erosion but it makes people undone. It causes massive financial loss and damages. The immense pressure of the downwards tide, current force and twirl, waves and tides, storm, tidal surges, lack of trees on the riverbank causes erosion to the coastal islands every year. The collision between downwards current of freshwater and uprising sea level creates strong twirling that causes erosion to the coast. Moreover, due to combined sudden flood, heavy rain, and downwards freshwaters causes a collision to the riverbank and cause erosion to the riverbanks and coastal areas. Deforestation and lack of plantation in the riverbanks and coastal areas are also complemented by riverbank and coastal erosion.

Landslide

Landslides are a complex-disaster phenomenon that can be caused by earthquakes, volcanic eruptions, heavy rainfall (typhoons, hurricanes), sustained rainfall, heavy snowmelt, unregulated anthropogenic developments, mining, and others. In Bangladesh, landslides are mostly triggered by heavy rainfall. However, underlying causes of landslide include deforestation, hill cutting, unregulated development work, etc. Moreover, poverty and landlessness force poor people to live in risky hill-slopes. However, recently landslide has emerged as a major hazard, particularly after the Chattogram Landslide 2007. Due to heavy rainfall from 10 -11 June 2007, landslides and collapsed walls caused widespread damages in six areas of Chattogram city and different Upazilas of the District.

Salinity

Saline water intrusion is mostly seasonal in Bangladesh; in winter months, the saline front begins to penetrate inland, and the affected areas rise sharply from 10 percent in the monsoon to over 40 percent in the dry season. Coastal districts such as Satkhira, Khulna, Bagerhat, Barguna, Patuakhali, Barishal are the victims of salinity intrusion. Agricultural production, fisheries, livestock, and mangrove forests are affected by higher salinity in the dry season. It is observed that the dry flow

trend has declined as a result of which sea flow (saline water) is traveling far inside the country resulting in contamination both in surface and groundwater. The population of pure freshwater fish species decline and species that are more tolerant survive and dominate changing the composition of the ecosystem and affecting the livelihoods of the people dependent on the freshwater resources.

Hailstorm

Hailstorm is a very curious geographical and climatic phenomenon. A hailstorm is named such, because during the storm, hail or balls of ice fall in huge quantities on the Earth. It is nothing but irregular lumps or balls of ice. The specialty of a hailstorm is that both hail, i.e. balls of ice, and rainwater fall during the storm, at the same time. The hailstorms are not exactly storms but are a side effect of a much bigger storm, the thunderstorm. This phenomenon originates from thunderclouds that are known as Cumulonimbus clouds. When the existing temperature of a mass of air currents falls rapidly over decreasing altitude, it results in a hailstorm. The hailstones are formed due to the process of freezing and grow over time. They are carried by the updrafts or the air currents moving in the upward direction until they become large for these currents to continue carrying them. Hailstones must have at least 3/4 inch of diameter to become severe and cause a substantial amount of damage and loss to life and property. Being a nature's phenomenon and a type of natural disaster, hailstorms are unavoidable. The impact of hailstones can cause widespread damage and loss to vulnerable plants, crops, infrastructure and equipment that is stored outside. Hailstones have the potential to destroy animals and human life upon impact if strong enough.

1.8 Data and Map source

The development of a comprehensive disaster risk profile requires foremost a good understanding of the general context and background of the country. Accordingly, many country data has been gathered. These data were organized in a dataset and converted into GIS formats. The data includes administrative entities, population, infrastructure, buildings and settlement, livelihood, health, education, elevation and topography and land use countrywide. It is important to note that the data availability constitutes a main challenge and constraint for the preparation of this atlas. The subsequent page demonstrates a table detailing data collected from different institutions, governmental, international organization and UN Agencies.

Table 1.1: Database Inventory

S/N	Type of data	Format	Content	Source
1	DEM	Point-based GIS shapefiles	Digital elevation model of 10 meter	BWDB
2	Topographic Maps	Image	Images covering the specific area produced in 2010	SoB
3	Land Cover Map	GIS Shapefiles	Land use land cover information	MoL

4	Education facilities location	GPS locations	Specific locations and other related information	GPS survey
5	Health facilities location	GPS locations	Specific locations and other related information	GPS survey
6	Administrative boundary	GIS Shapefiles	Admin boundary with Geocode	BBS
7	River Network	GIS Shapefiles	Detail river network with the name	BWDW
8	Meteorological data	Spreadsheet	Daily Temperature, Rainfall, Humidity with station location's latitude and longitude	BMD
9	Demographic data	Spreadsheet	mauza specific Various demographic related data	BBS
10	Soil salinity	Point-based GIS shapefiles	Salinity measurement for the specific location of the study area	BARC
11	Disaster information	Spreadsheets	Various disaster and damage related information	Field survey

Chapter 2

Methodological Framework for Hazard and Risk Assessment

2.1 Understanding country situation and baseline data compilation

The risk assessment process was an extensive inventory and compilation of existing data and information related to hazards and elements at risk. It involves an understanding of the country's disaster risk management framework, practices and institutional set-up. It entails collection of baseline data of the country such as administrative boundaries, infrastructure, socioeconomic data (e.g. demographics, poverty index, employment, agriculture, etc.), spatial data (e.g. Digital Elevation Model, geology, soil, land cover, land use, road network, etc.) and meteorological data (e.g. rainfall, temperature, etc.). This process also include collection of historical disaster events and the damage and losses they caused. The collected data are compiled and structured in different datasets according to its nature, format and contents. Subsequently, the datasets are integrated in the Geographical Information System (GIS) platform and processed into maps and spatial formats. Some of the baseline data are presented in figures and tables. These maps, figures and tables are presented in chapter 3.

2.2 List of Disaster and disaster calendar

Each district has different hazards and occurred in different time. To identify the different hazards in particular district one questionnaire form was produced to collect the data from field and compiled together. The table shows the disaster calendar for the Noakhali district.

Upazila Name	Disaster Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Begumganj	Cyclone			Y	Y	Y	Y	Y	Y	Y	Y		
	Excess Rainfall				Y	Y	Y	Y	Y	Y			
	Thunderstorm			Y	Y	Y	Y	Y	Y				
	Windstorm			Y	Y	Y	Y	Y	Y				
Chatkhil	Cyclone				Y	Y	Y	Y	Y				
	Excess Rainfall							Y	Y	Y			
	Flood									Y	Y	Y	
	Thunderstorm				Y	Y	Y	Y					
	Windstorm				Y	Y	Y						
Companiganj	Cyclone			Y	Y	Y	Y	Y	Y	Y	Y		
	Excess Rainfall					Y	Y	Y	Y	Y			
	Flood							Y	Y				
	Thunderstorm			Y	Y	Y	Y	Y	Y				
	Windstorm			Y	Y	Y							

Upazila Name	Disaster Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hatiya	Cyclone			Y	Y	Y	Y	Y					
	Excess Rainfall						Y	Y	Y				
	Thunderstorm			Y	Y	Y	Y	Y	Y				
	Windstorm			Y	Y	Y	Y						
Kobirhat	Cyclone					Y	Y	Y	Y				
	Excess Rainfall				Y	Y	Y	Y	Y	Y			
	Flood					Y	Y	Y	Y				
	Heavy Fog	Y	Y										Y
	Thunderstorm			Y	Y	Y	Y						
	Tidal Bore						Y	Y	Y				
	Windstorm			Y	Y	Y	Y	Y					
Noakhali Sadar	Cyclone				Y	Y	Y	Y	Y				
	Excess Rainfall					Y	Y	Y	Y	Y			
	Flood						Y	Y	Y				
	Thunderstorm				Y	Y	Y	Y	Y				
	Windstorm				Y	Y	Y	Y	Y				
Senbagh	Cyclone			Y	Y	Y	Y	Y	Y				
	Excess Rainfall							Y	Y	Y			
	Flood							Y	Y	Y			
	Thunderstorm				Y	Y	Y	Y					
	Windstorm				Y	Y	Y						
Sonaimuri	Cyclone					Y	Y	Y	Y				
	Excess Rainfall						Y	Y	Y				
	Flood					Y	Y	Y	Y	Y	Y		
	Thunderstorm					Y	Y	Y	Y				
	Windstorm				Y	Y	Y						
Subarnachar	Cyclone			Y	Y	Y	Y	Y					
	Excess Rainfall							Y	Y	Y			
	Flood							Y	Y	Y			
	Thunderstorm				Y	Y	Y						
	Windstorm				Y	Y	Y						

2.3 Hazard assessment and mapping

Hazard assessment and mapping is the first step of the risk assessment process. It involves characterizing the hazards in terms of its spatial distribution, frequency and intensity. It covers four major hazards that are prevalent in Noakhali District namely, cyclone, thunderstorm, coastal flood and windstorms. Specific hazard intensity maps are produced per hazard. The hazard maps identify the hazard-prone areas, describe the physical characteristics of the hazards and characterize the hazards in terms of magnitude, frequency, duration, extent, intensity and probability. The hazard assessment and mapping phase also entails building of plausible scenarios for each hazard and developing hazard intensity maps.

2.4 Exposure assessment

Identifying and assessing the elements at risk is the next step in the risk assessment process. Exposure assessment is an intermediate stage of risk assessment, which links the hazard assessment with the targeted elements under consideration for the risk assessment (ADPC, 2013). The elements at risks in this study, also labelled as sectors of activity, are population, building, critical facilities such as health and education facilities, infrastructure (e.g. roads) and agriculture (Table 2.1). Exposure was quantified and expressed as the number of disaster affect the community (or human lives).

Table 2.1: Elements considered in the assessment per hazard

Type	Population	Settlement
Flood	√	√
Windstorm	√	√
Coastal flood	√	√
Thunderstorm	√	√
Cyclone	√	√
Salinity	√	√
Excess Rainfall	√	√
Strom surge/tidal bore	√	√
Water logging	√	√
Tornado	√	√

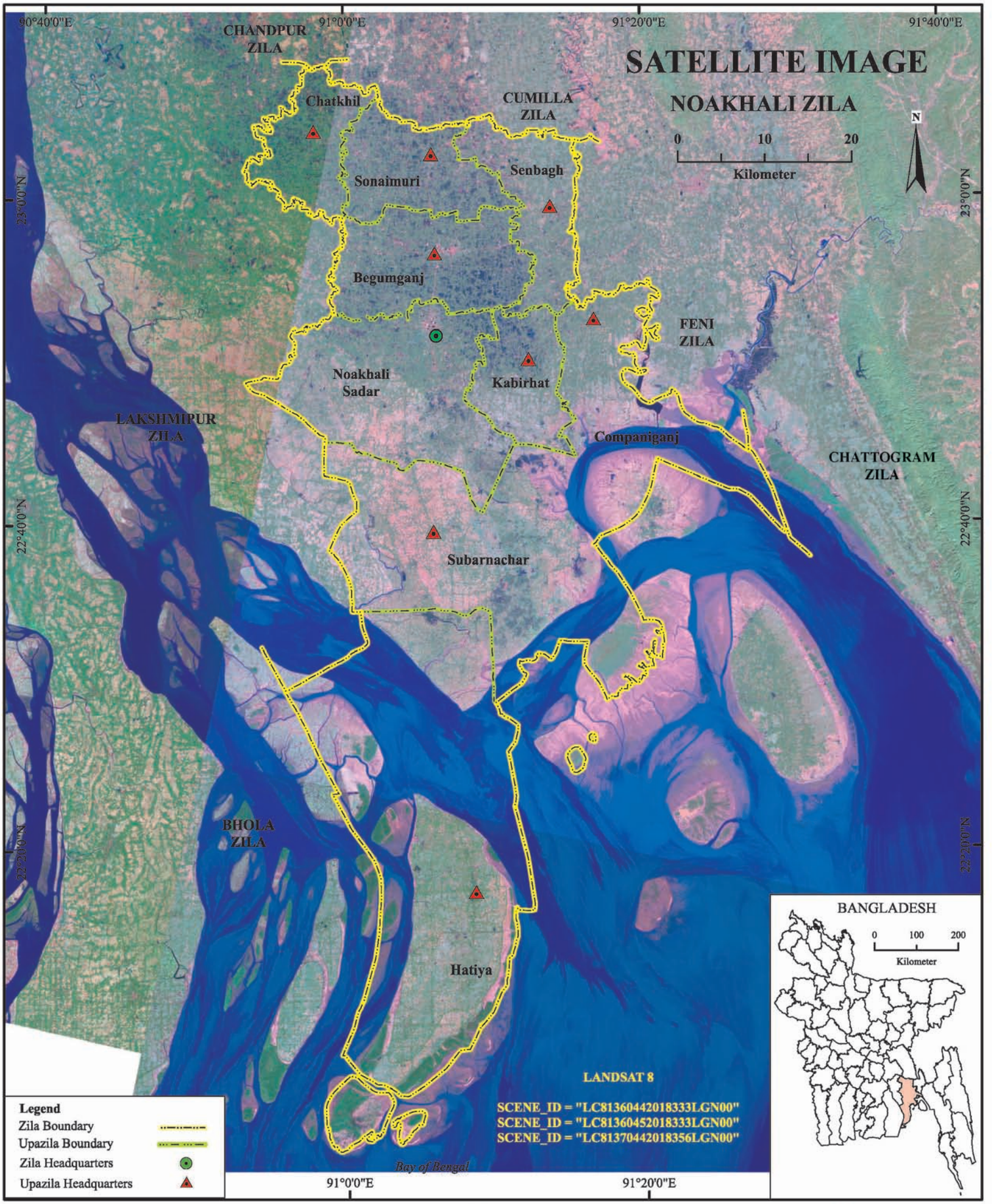
The exposure assessment is aimed at creating a national database of elements at risks. It qualifies the elements located in hazard-prone areas. The goal is to develop a comprehensive profile of elements at risk and analysis of their exposure to various natural hazards. The analysis is carried out based on available data.

2.5 Satellite Imagery and processing

The cloud free multi-spectral LANDSAT 8 OLI images of December 2018 were used for bank line detection of Meghna River. The LANDSAT 8 OLI image have 11 bands with 16-bit radiometric resolution and the spatial resolution was 15 meter. The most familiar water indices NDWI was used to detect the land-water boundary for Meghna River. Moreover, to visualize the whole district, the false colour composition (Natural with Atmospheric Removal – 7 5 3) on LANDSAT 8 OLI was used but for individual upazila level. The details of the images are given below:

Sl No	Product ID	Orbit Row/Path	Acquisition date
1	LC08_L1TP_136044_20181129_20181211_01_T1	44/136	11/12/2018
2	LC08_L1TP_136045_20181129_20181211_01_T1	45/136	11/12/2018
3	LC08_L1TP_137044_20181222_20181227_01_T1	44/137	27/12/2018

Satellite Imagery and processing



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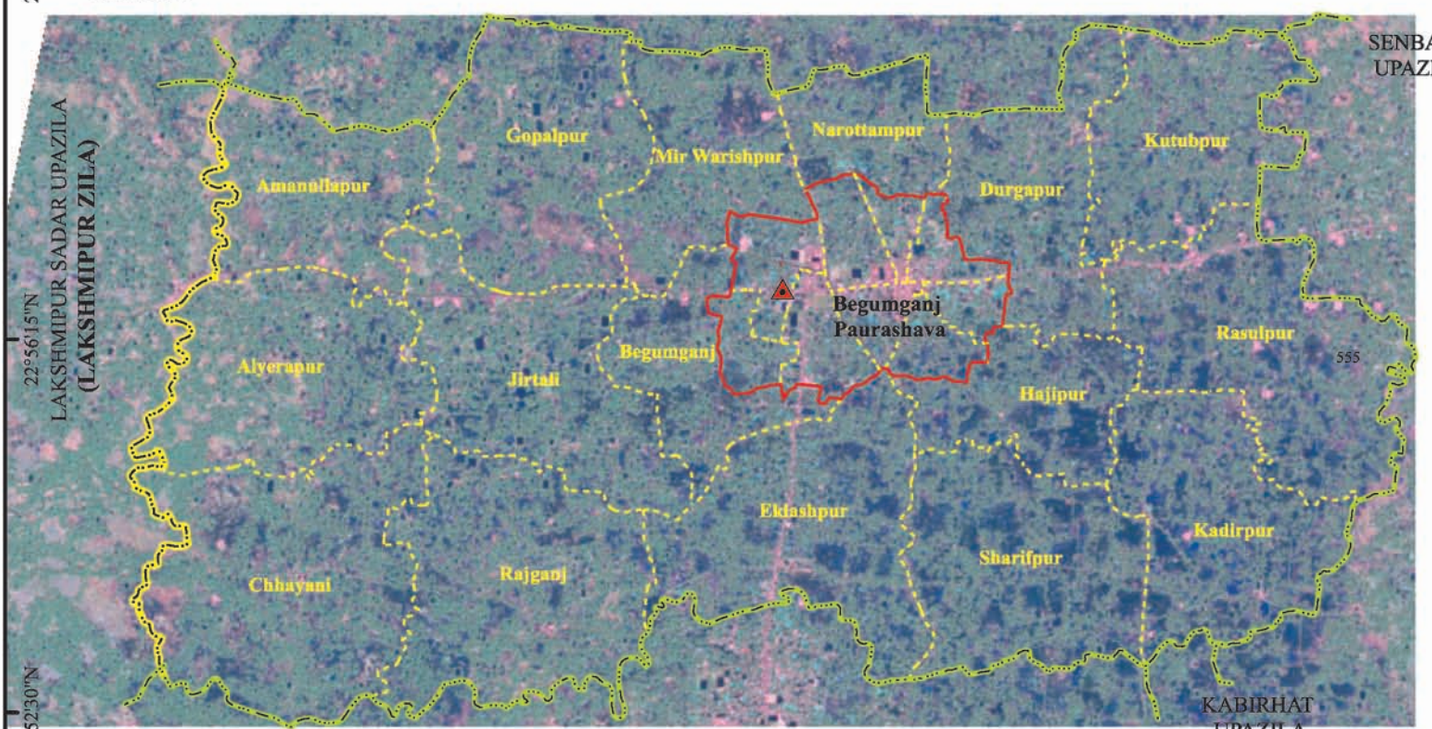
SATELLITE IMAGE

BEGUMGANJ UPAZILA



Legend

- Zila Boundary
- Upazila Boundary
- Paurashava Boundary
- Union/Ward Boundary
- Upazila Headquarters

NOAKHALI ZILA

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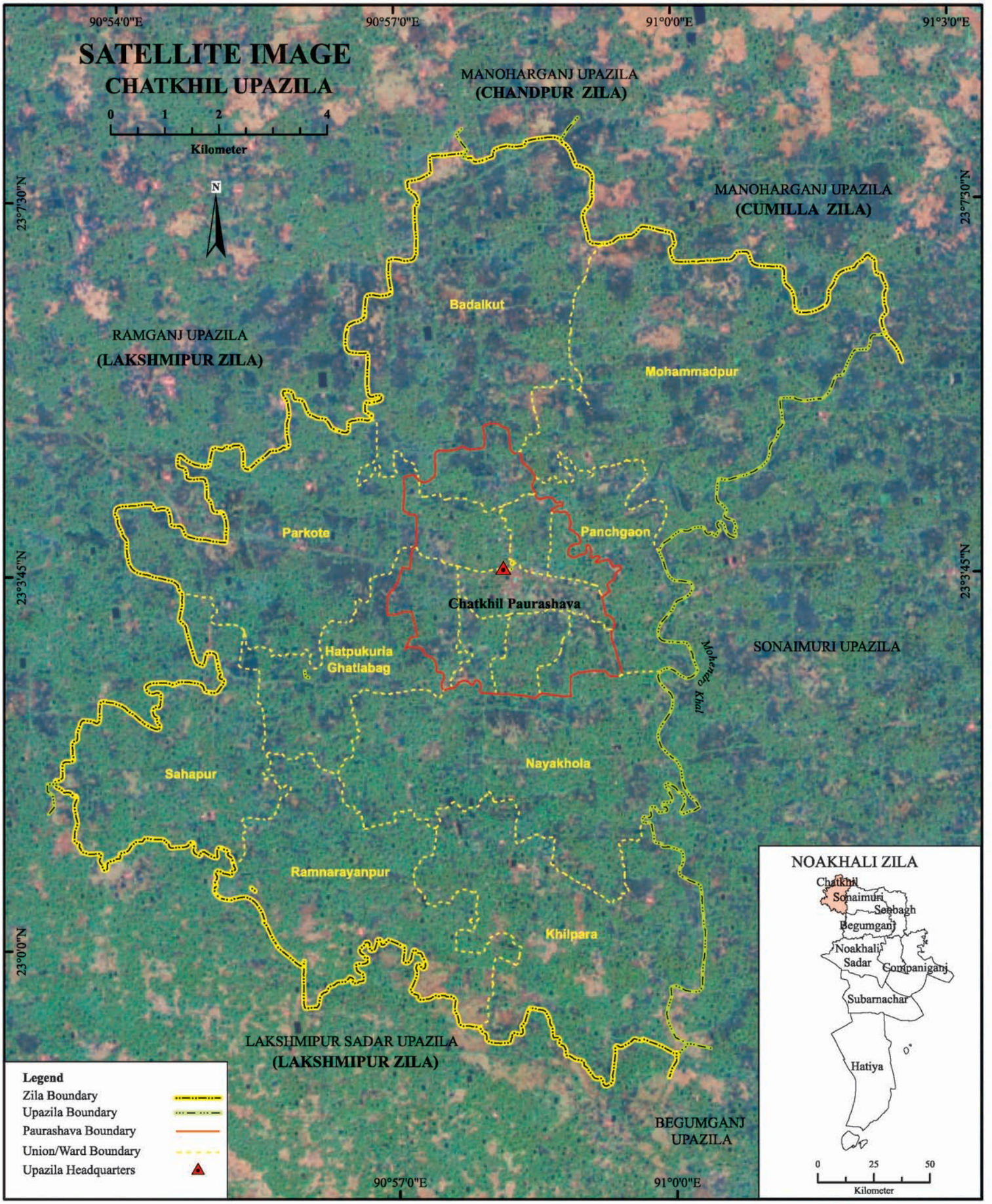

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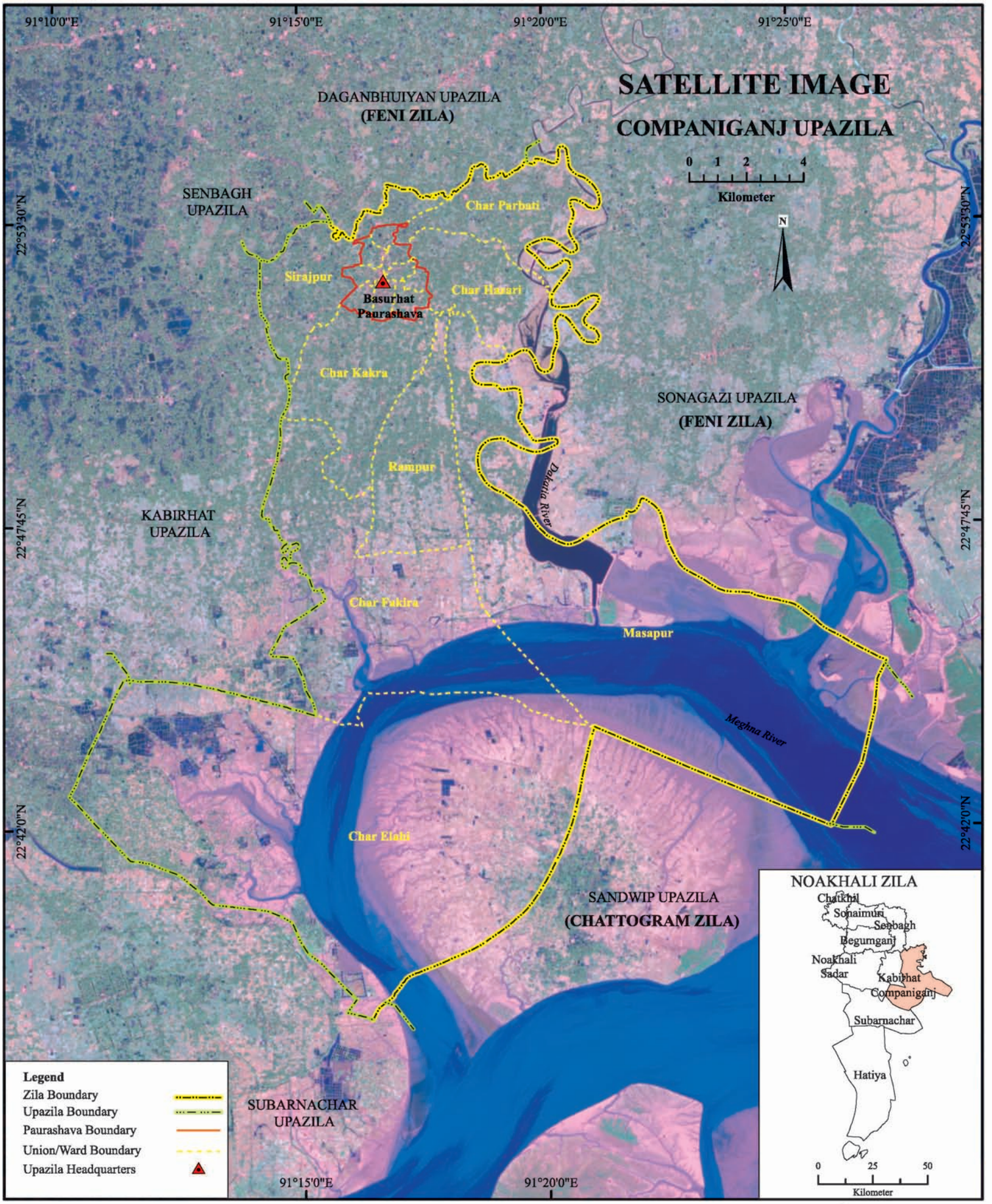

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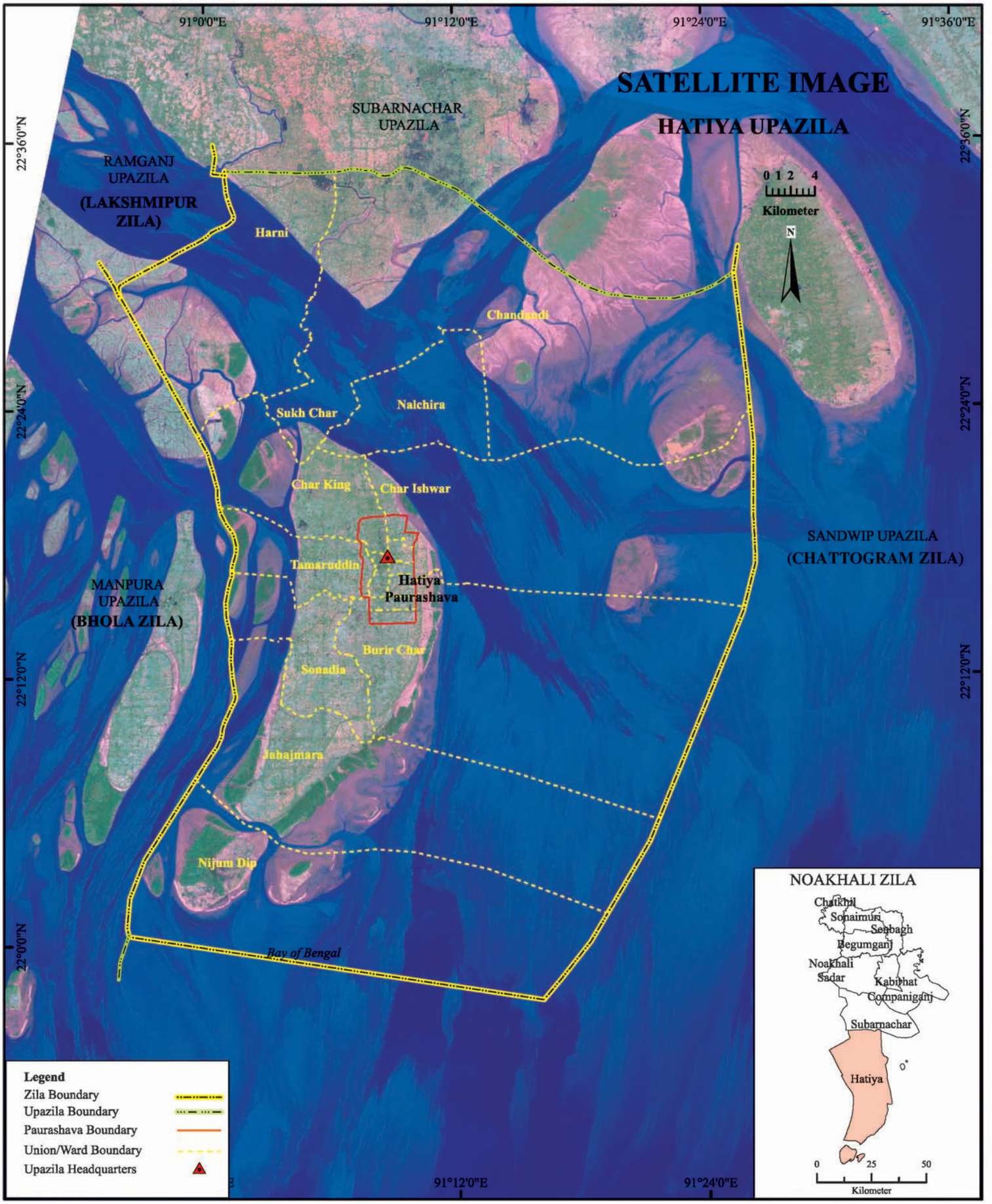

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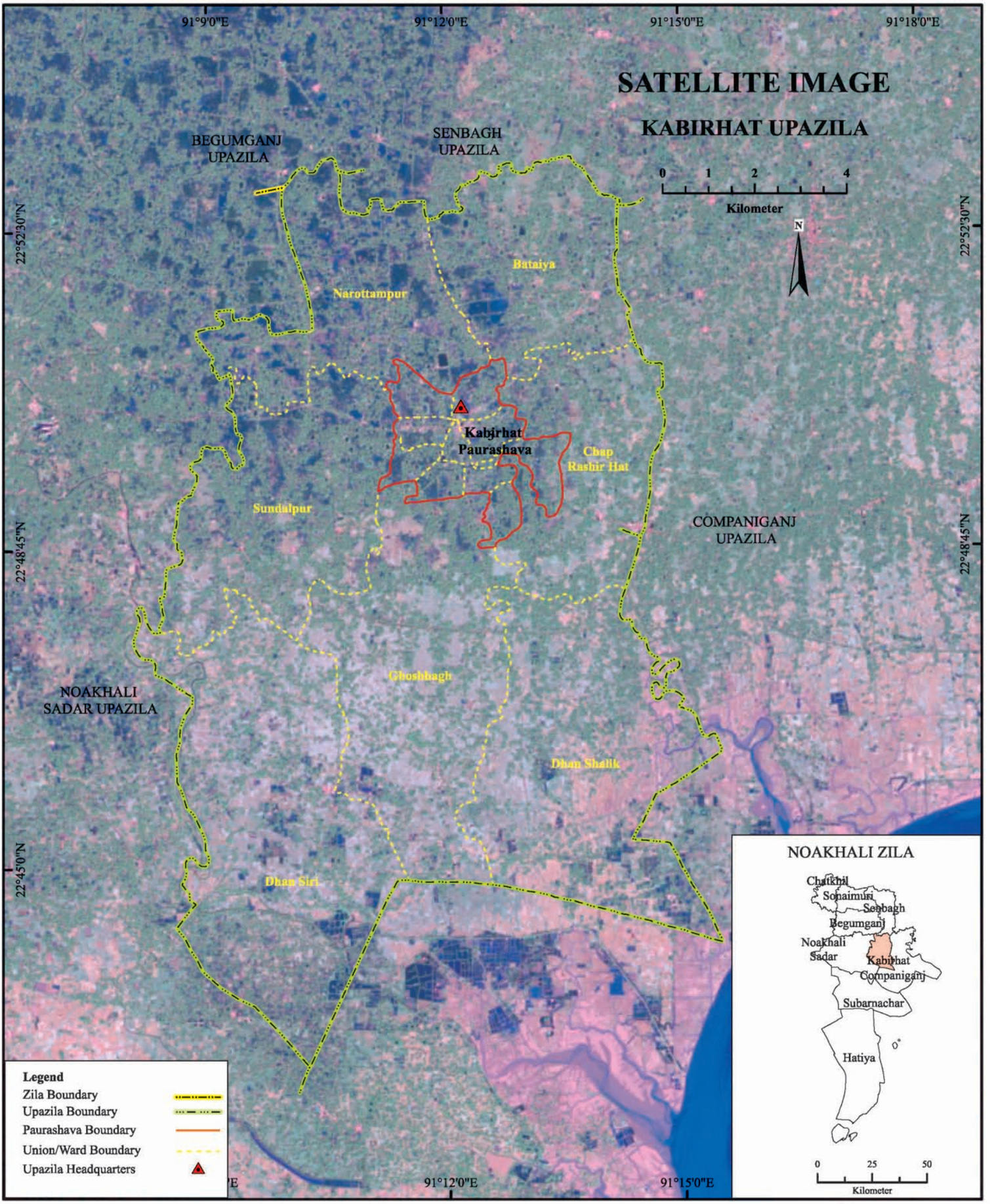

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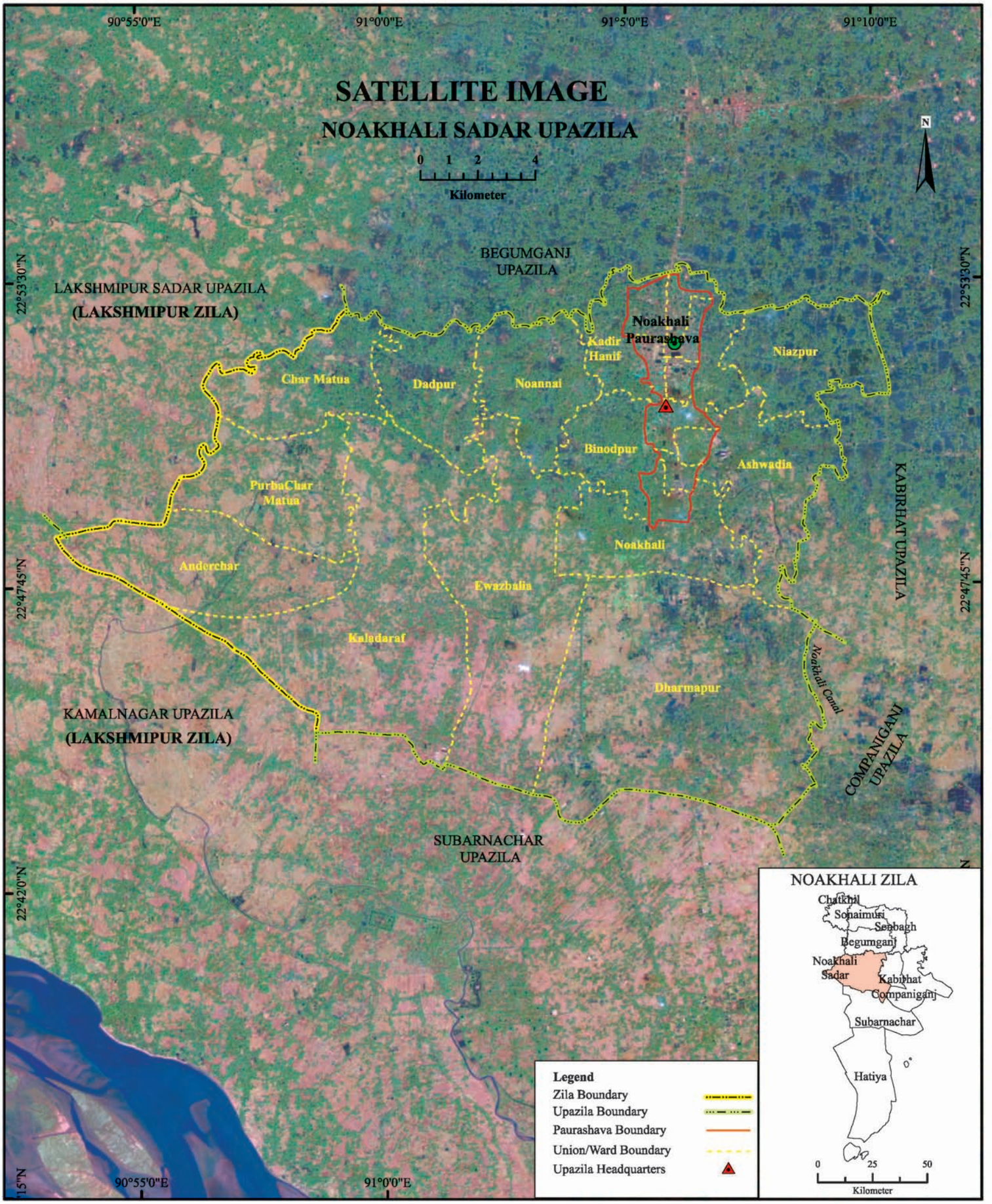

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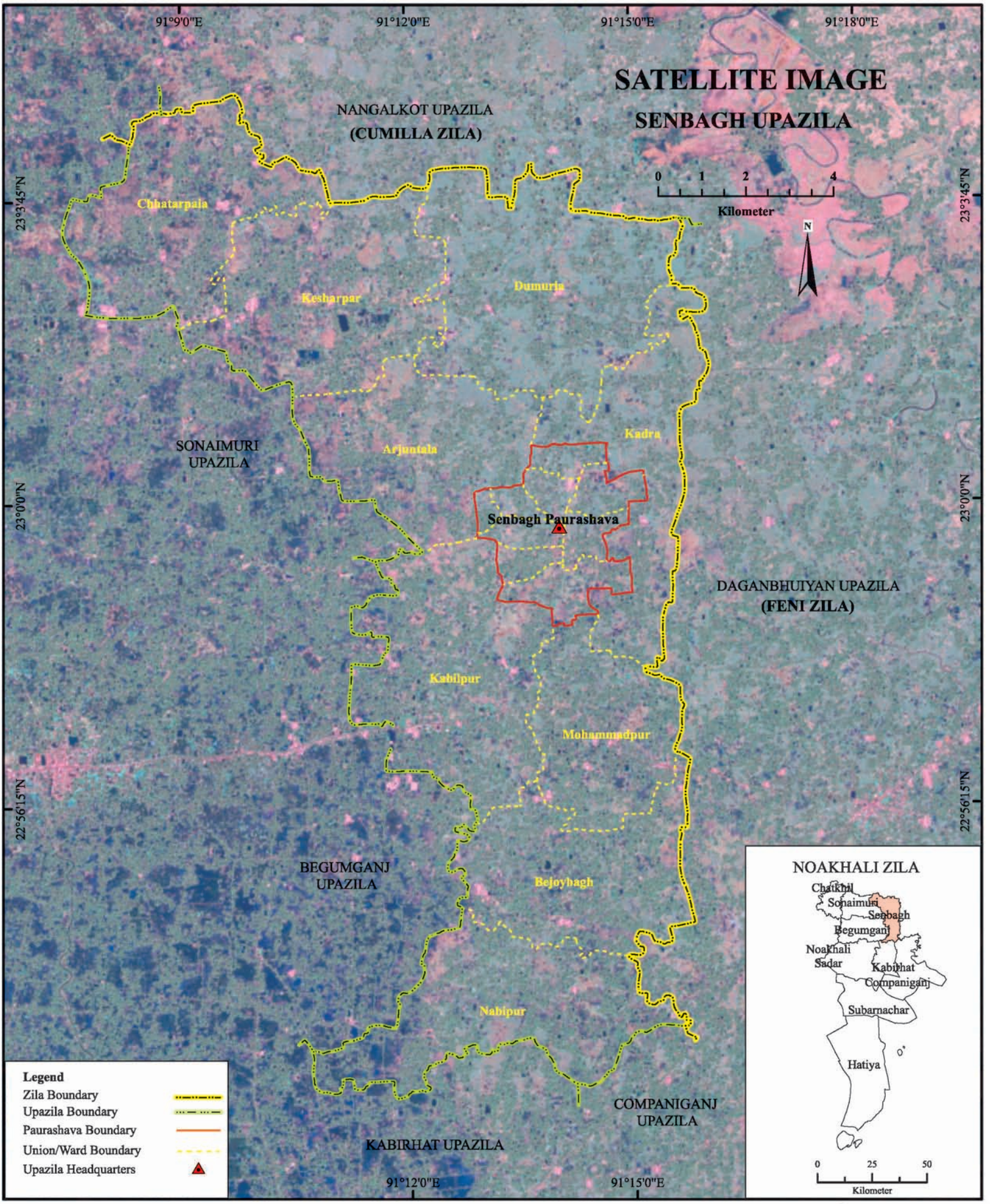

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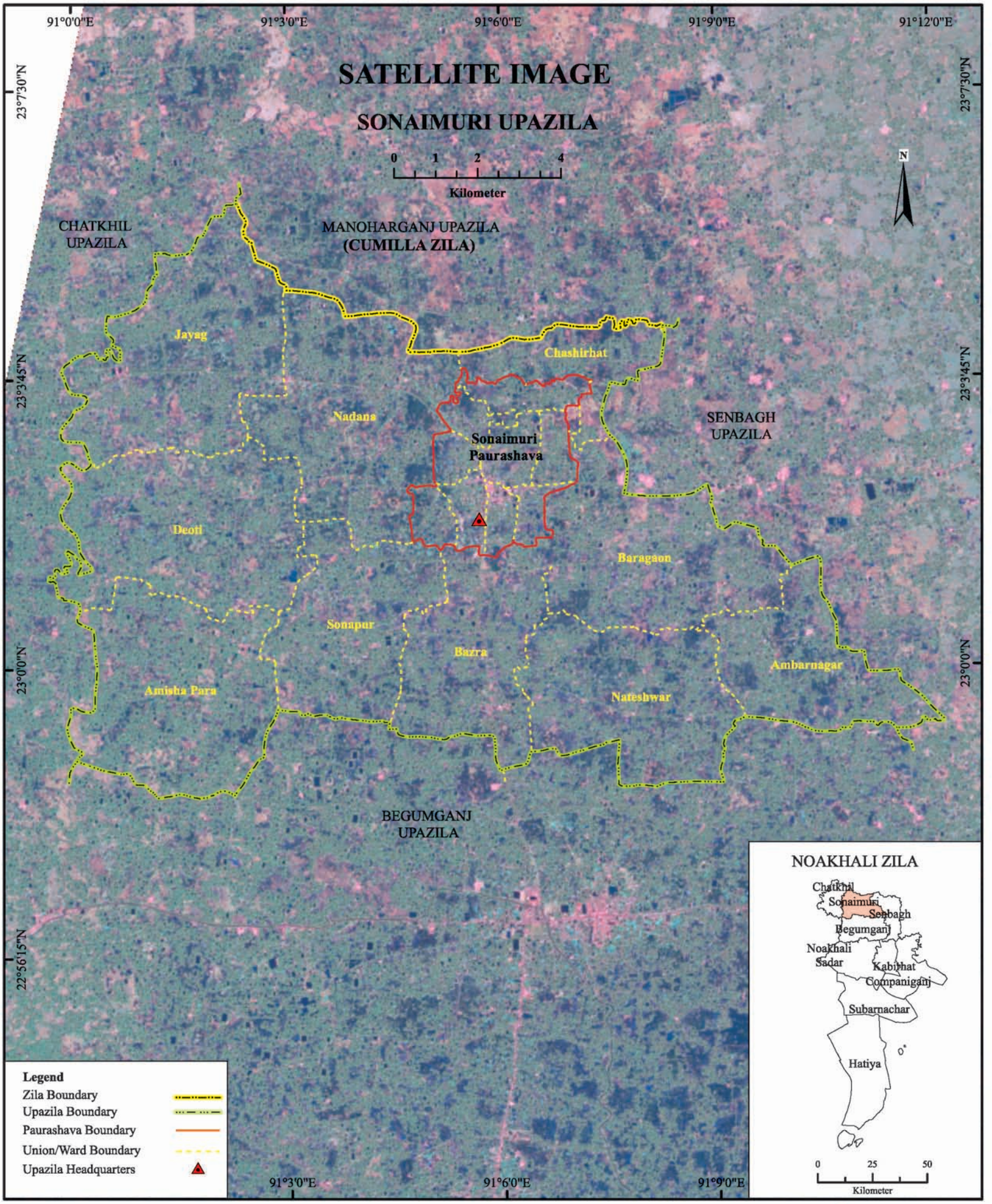

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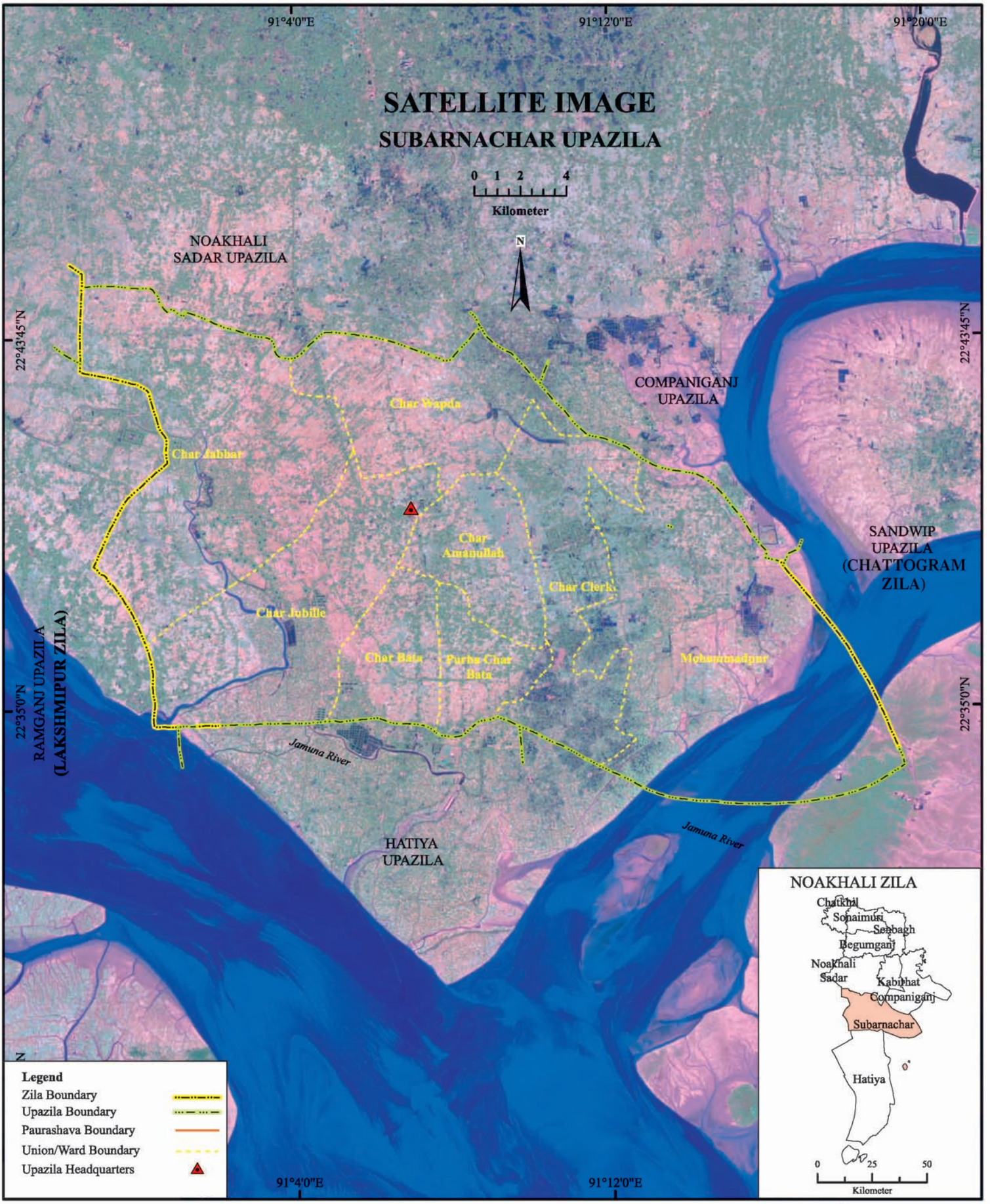

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Chapter 3

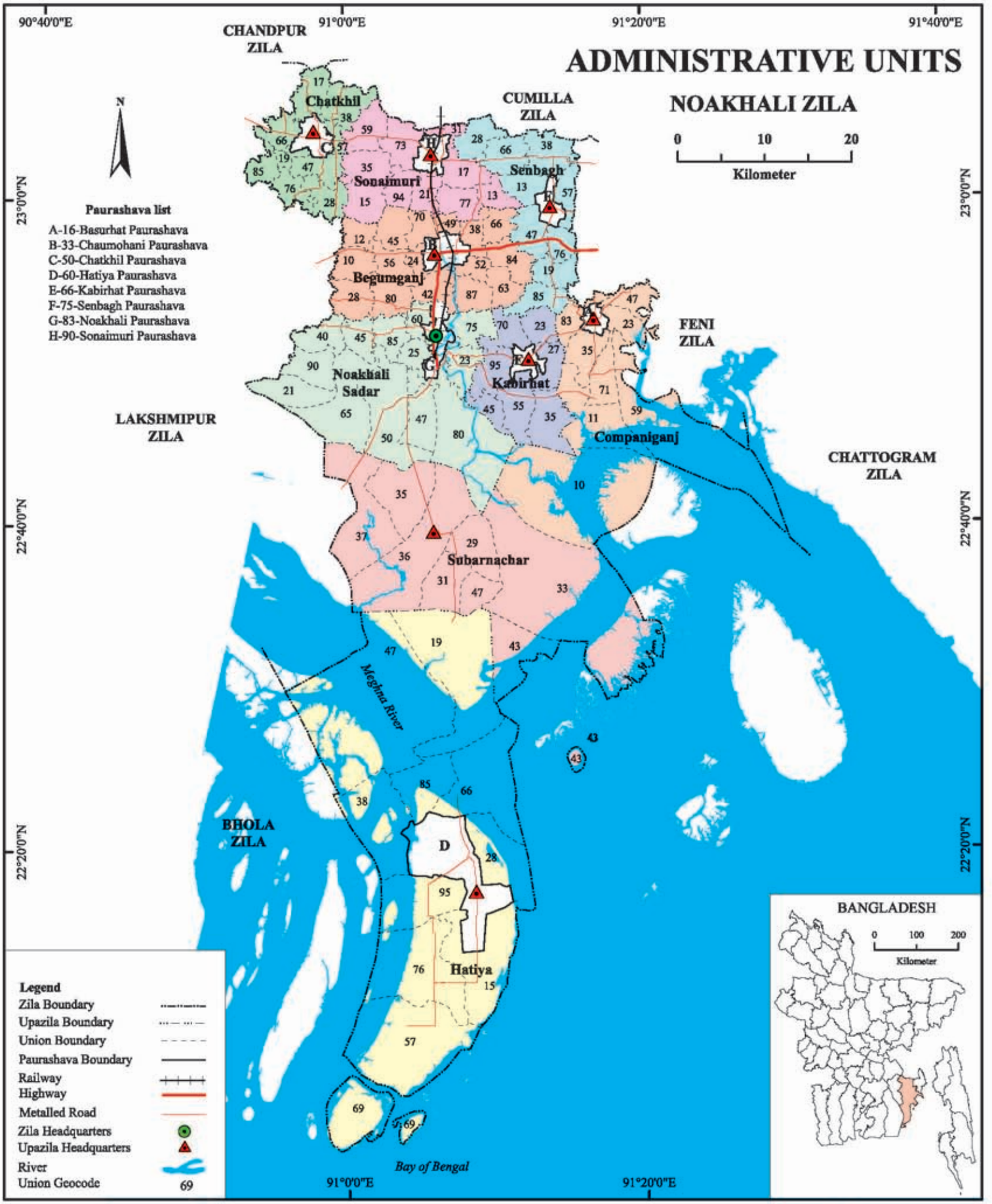
Basic Data and Base Maps of Noakhali District

3.1 Geography and administrative division

Noakhali, the deltaic zila is situated at the fringe of the Bay of Bengal. It became a zila in the name of Bhulua or Bhola (south Shahbazpur) comprising of areas from the neighboring Cumilla (Sudharam, Begumganj and Lakshmipur), Bakerganj (Dakshin Shahbazpur and host of islands) and Chattogram (Hatiya and Sandwip) on the 29th March 1822. The zila headquarter was situated on the Bank of Noakhal meaning New Cannel, which might be the origin of renaming the zila as Noakhali. Cumilla Zila bound it on the north on the east by Feni and Chattagram Zilas, on the south by the Bay of Bengal and the west by Bhola and Lakshimpur zilas. It lies between 22°07′and 23° 08′north latitudes and between 90° 53′and 91° 27′east longitudes. The total area of the zila is 3,685.87 sq. km. (1423.00 sq. miles) of which 1557.18 sq. km. is under reserve forest.

The zila consists of 9 Upazilas, 91 unions, 946 mauzas, 987 villages, 8 paurashavas, 72 wards and 123 mahallas. The Upazilas are Noakhali Sadar, Begumganj, Chatkhil, Companiganj, Hatiya, Senbagh, Kabirhat, Sonaimuri and Subarnachar. The word "District" is familiar with the Bengali word "Zila".

Geography and Administrative Division



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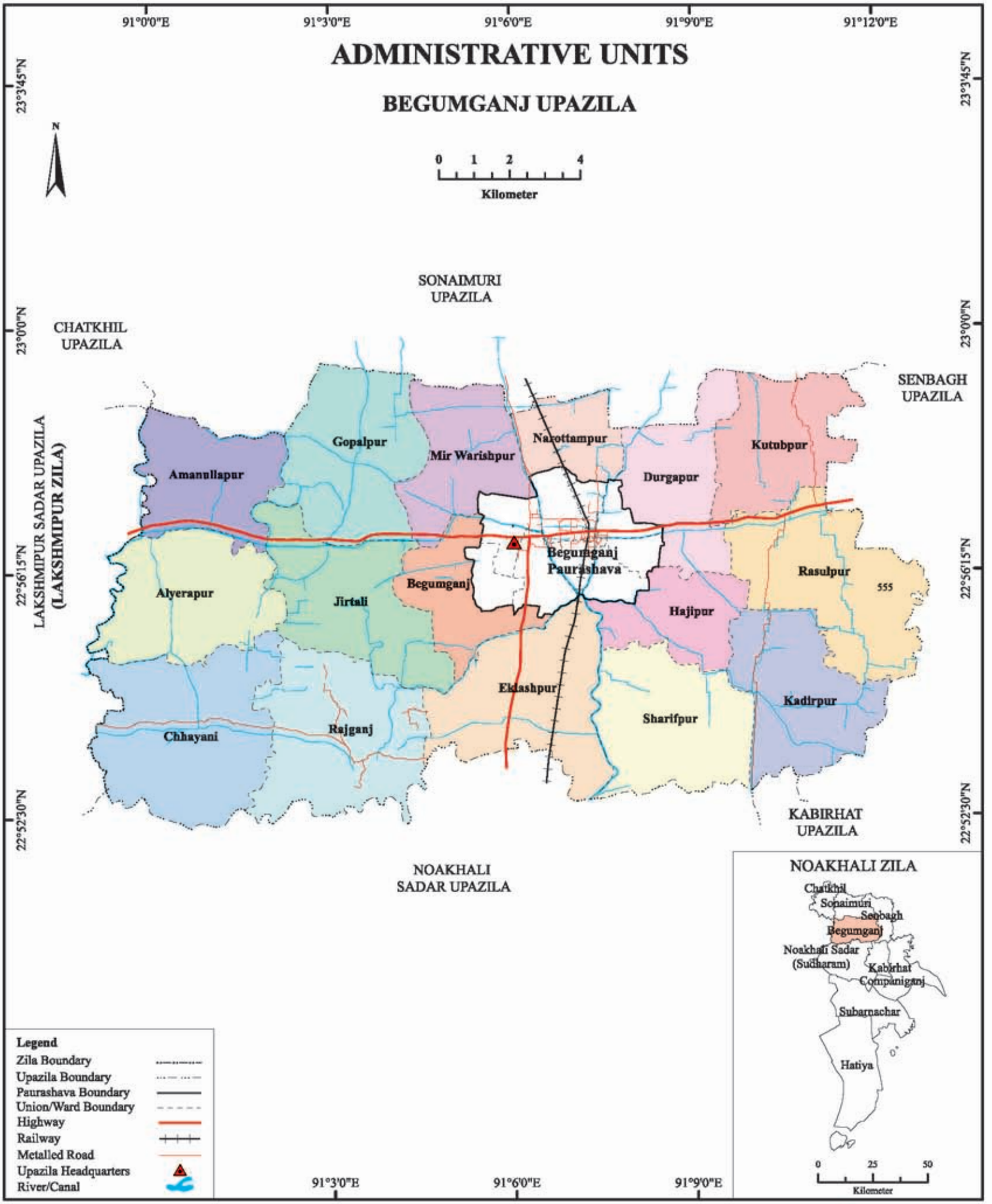

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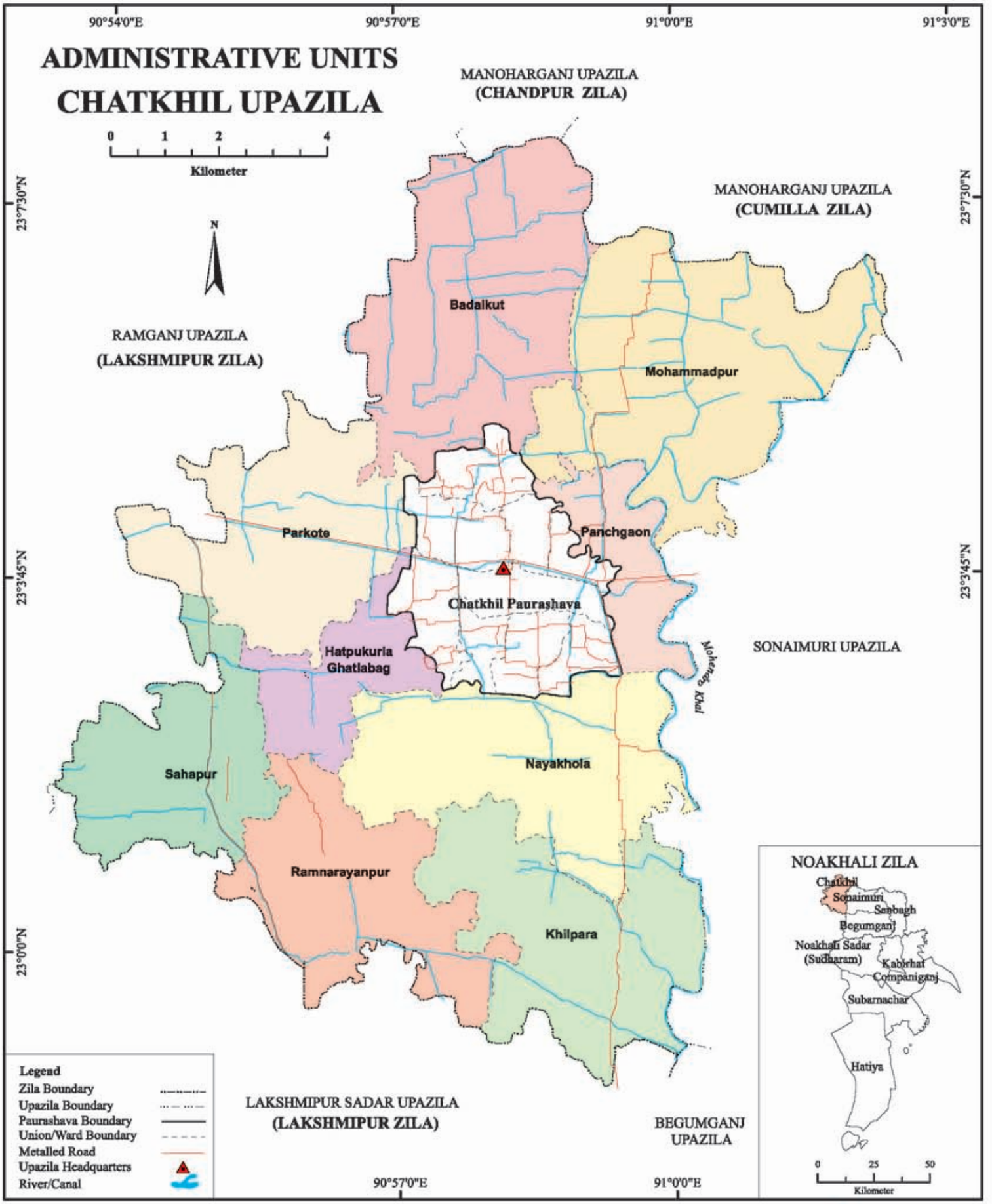

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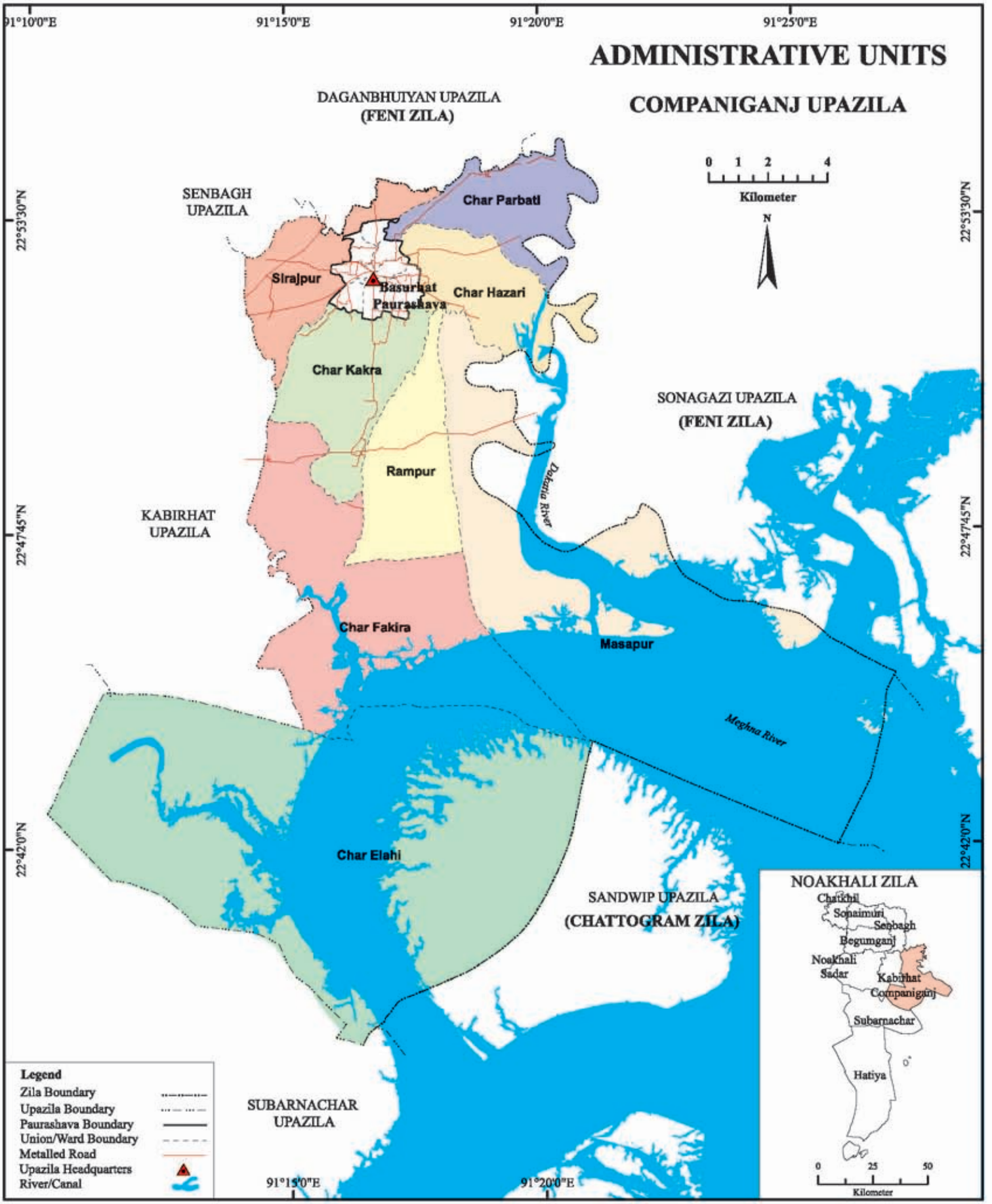

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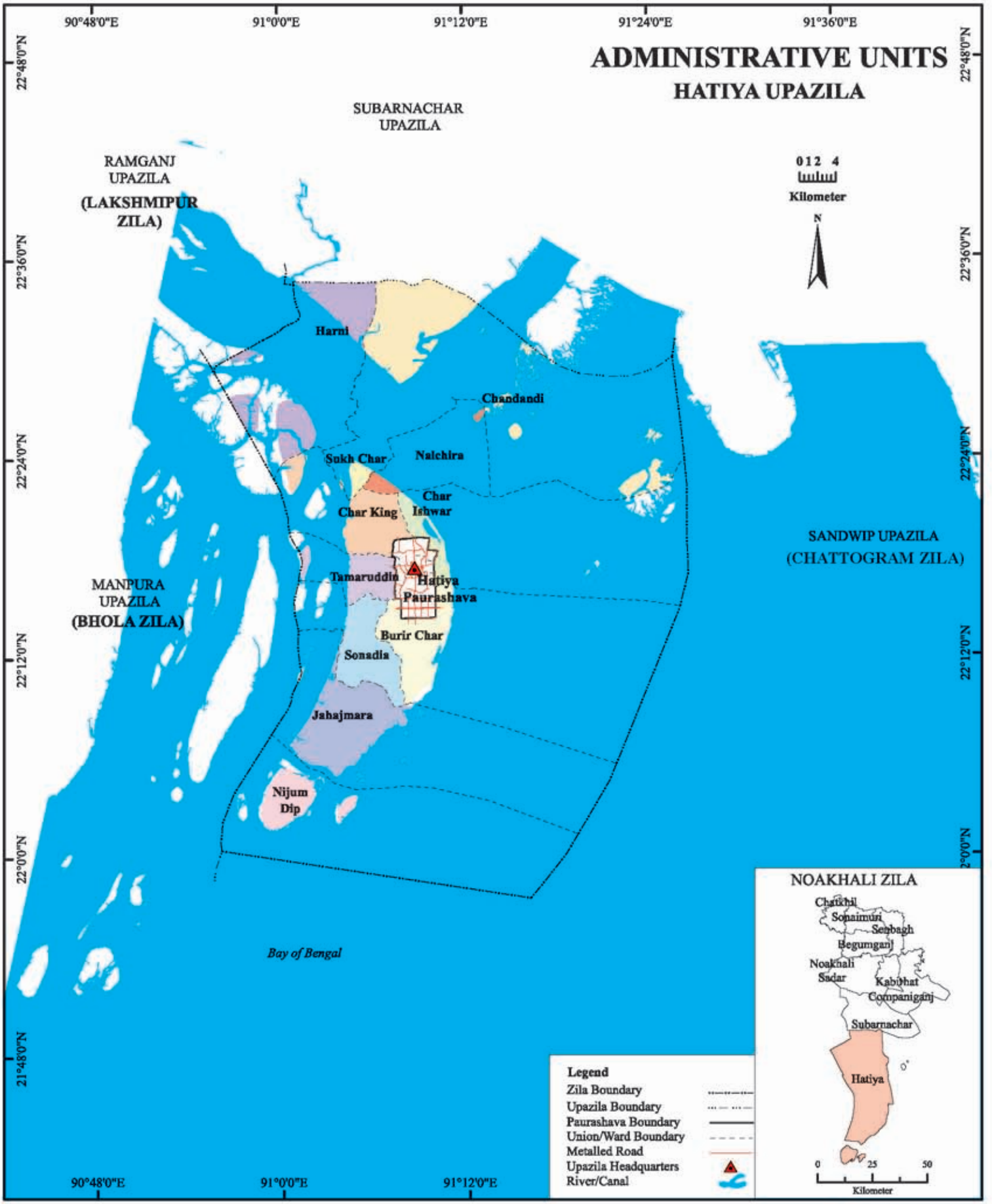

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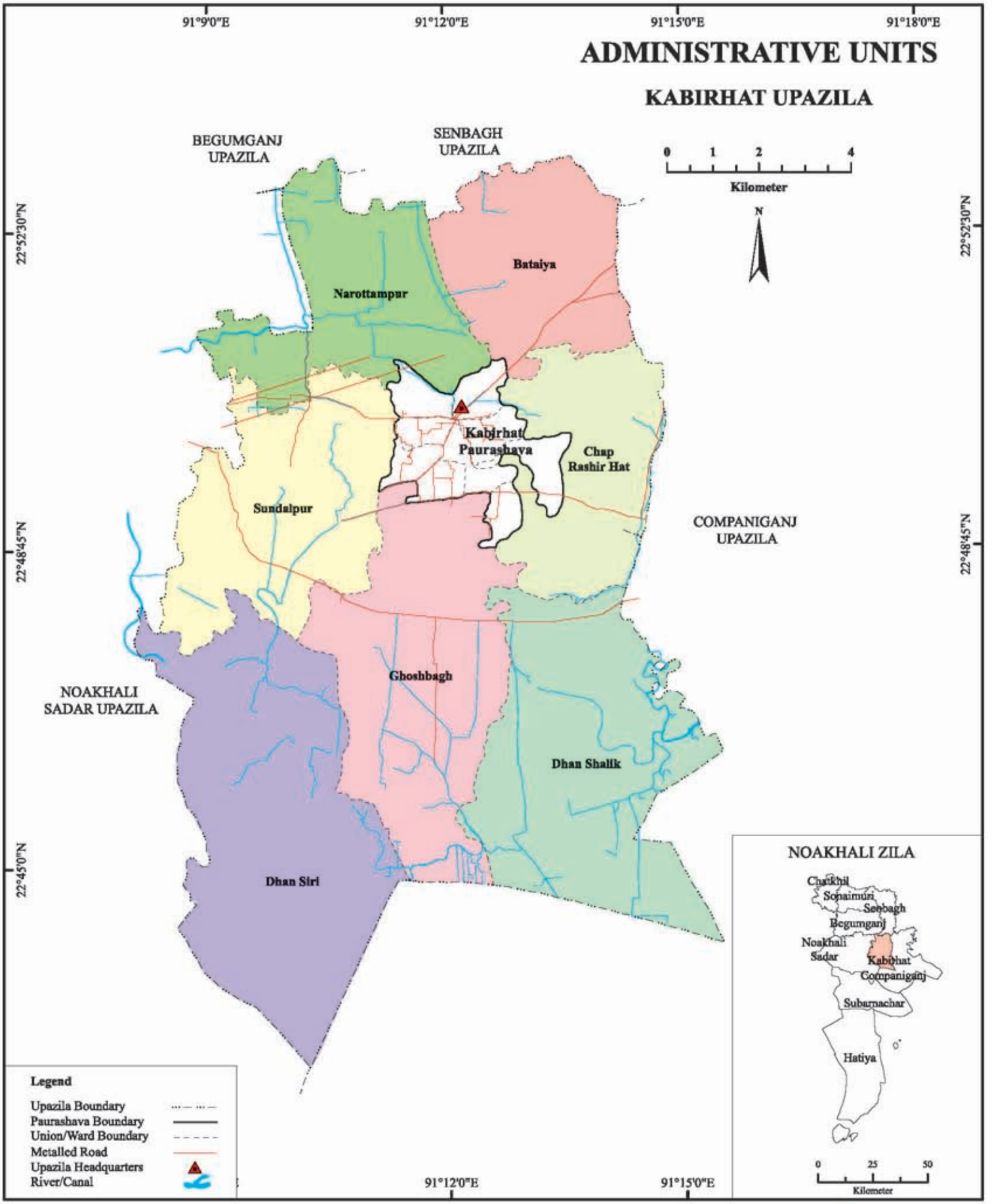

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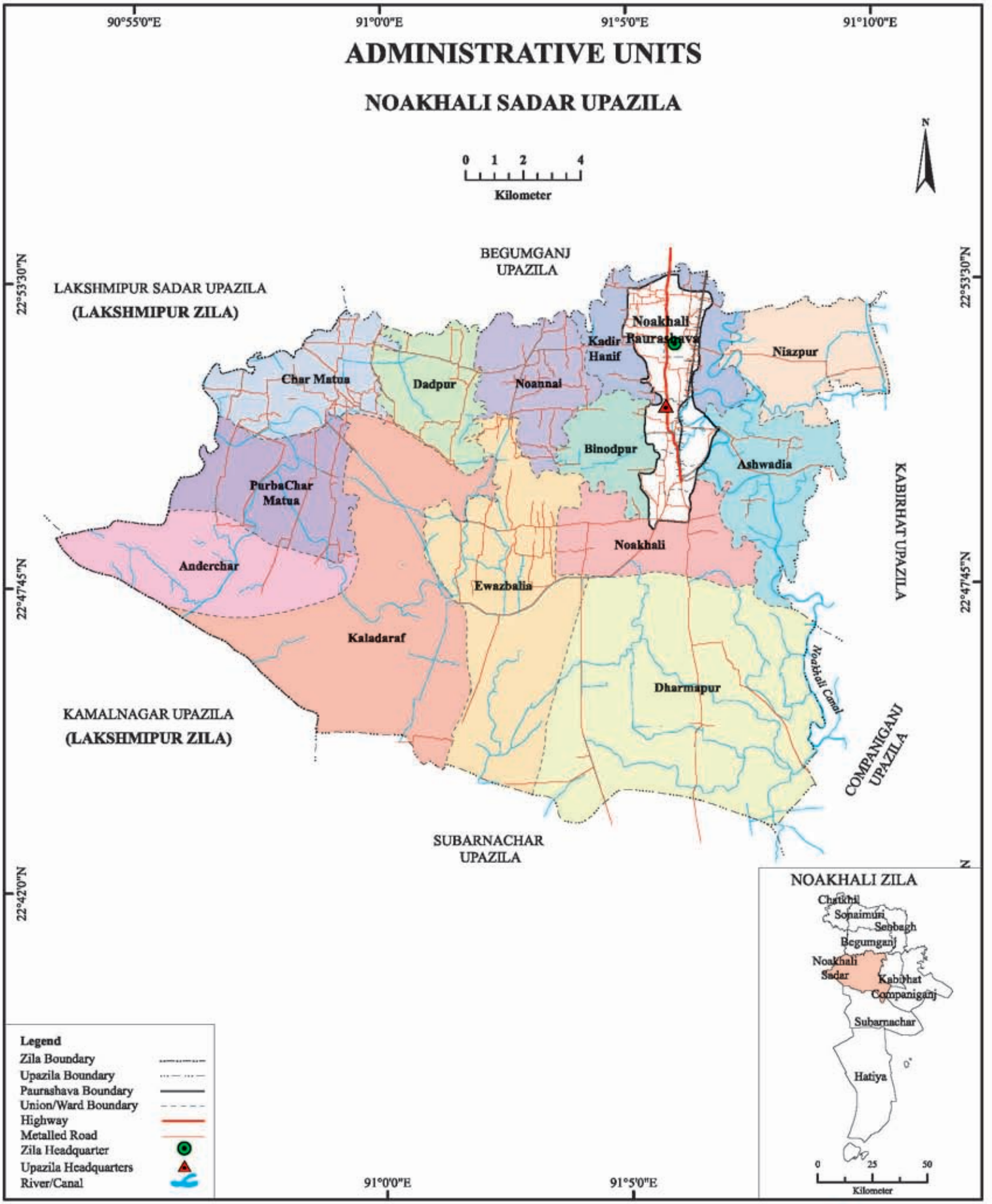

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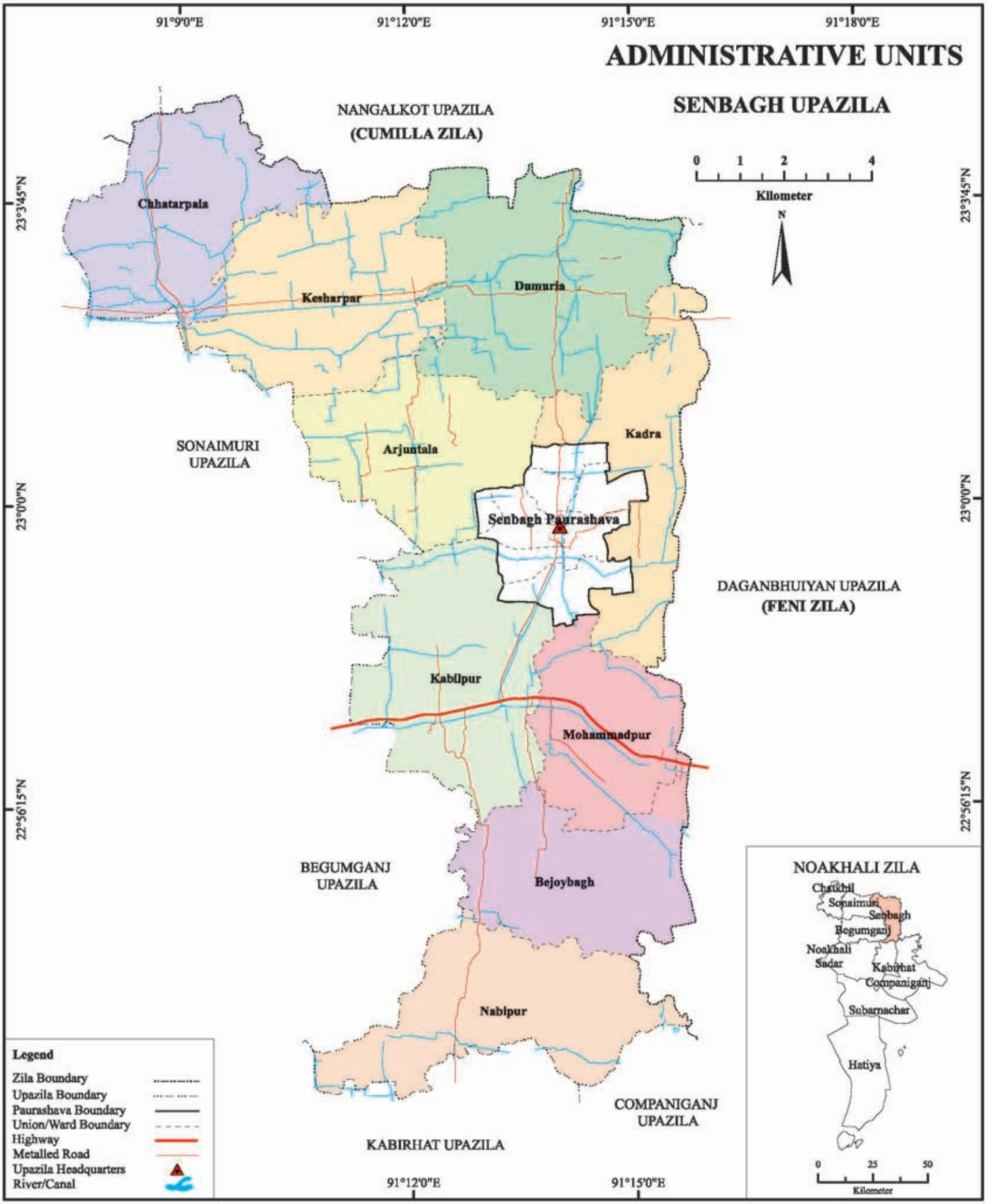

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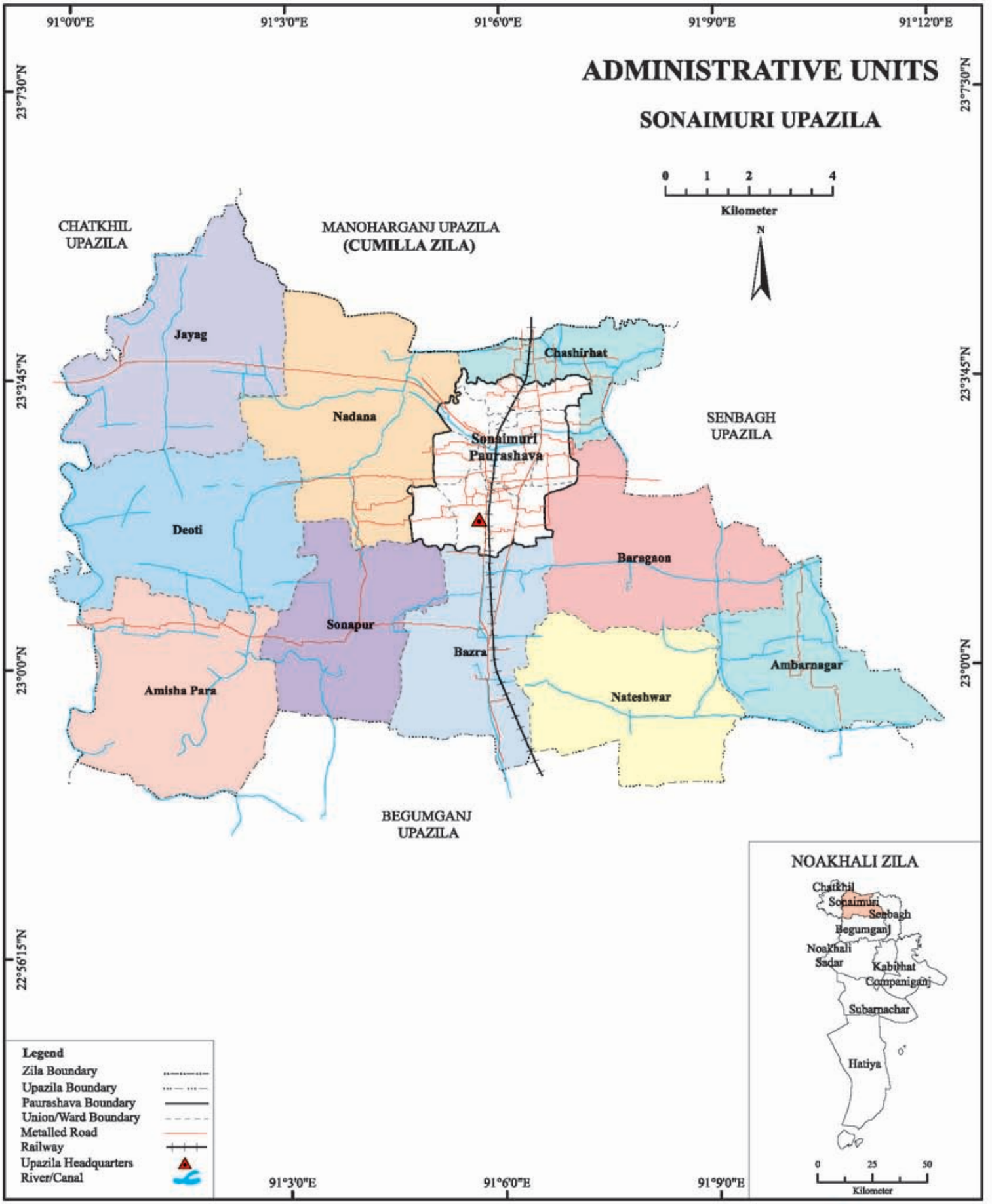

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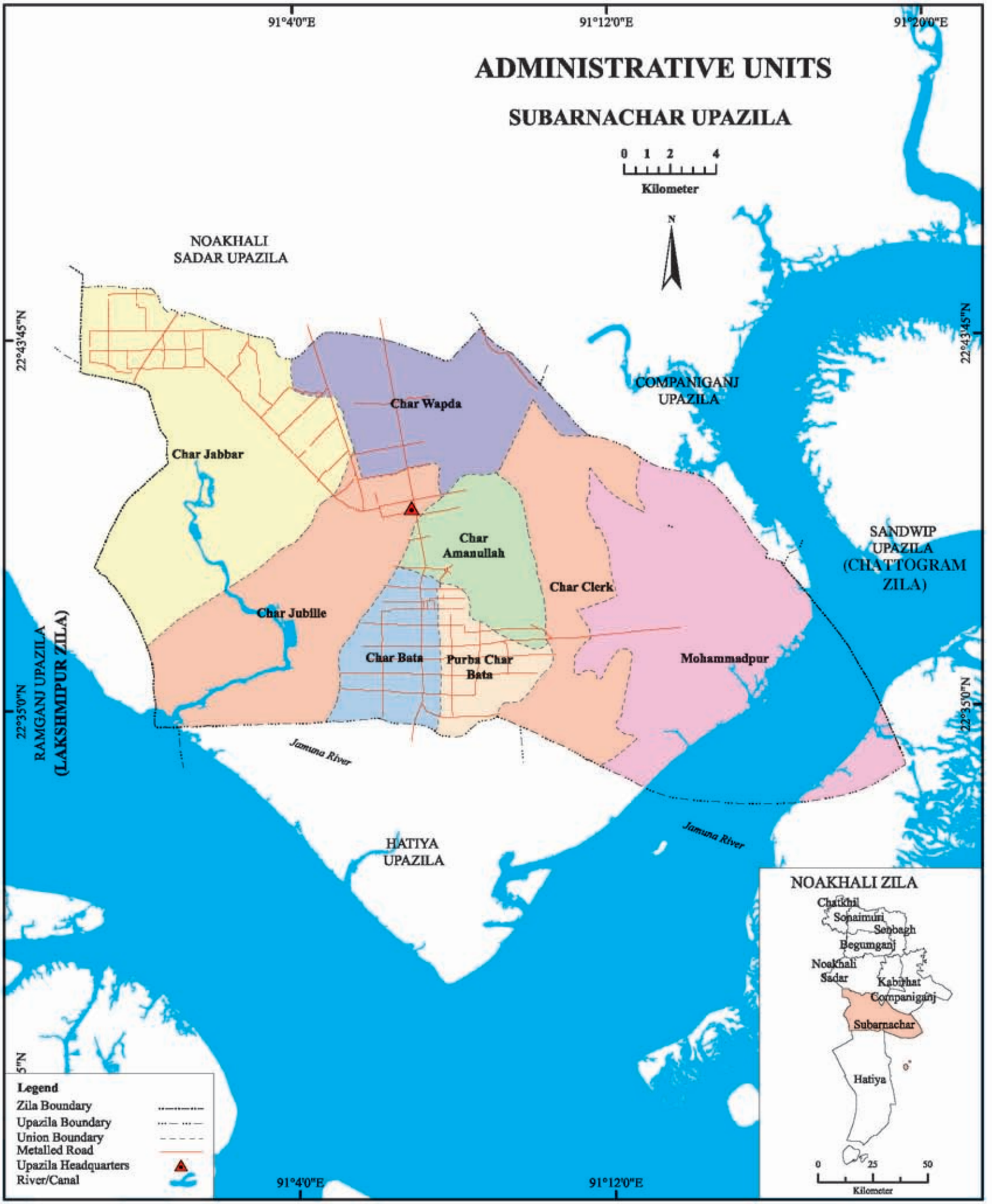

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3.2 Population and Households

The total number of households of Noakhali zila, as enumerated in Population and Housing Census 2011, is 593918 of which 93703 (15.78%) are in the urban area and 500215 (84.22%) in the rural area. The type of household shows that there are 590808 (99.48%) general (dwelling), 459 (0.08%) institutional and 2651 (0.44%) other households in the zila.

Table 3.1: General Household by Residence of Noakhali Zila, 1981 - 2011

Residence	2011		2001		1991		1981	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Zila	590808	100	451880	100	371684	100	301083	100
Urban	92119	15.59	61418	13.60	35928	9.67	28215	9.37
Rural	498689	84.41	390162	86.40	335756	90.33	272868	90.63

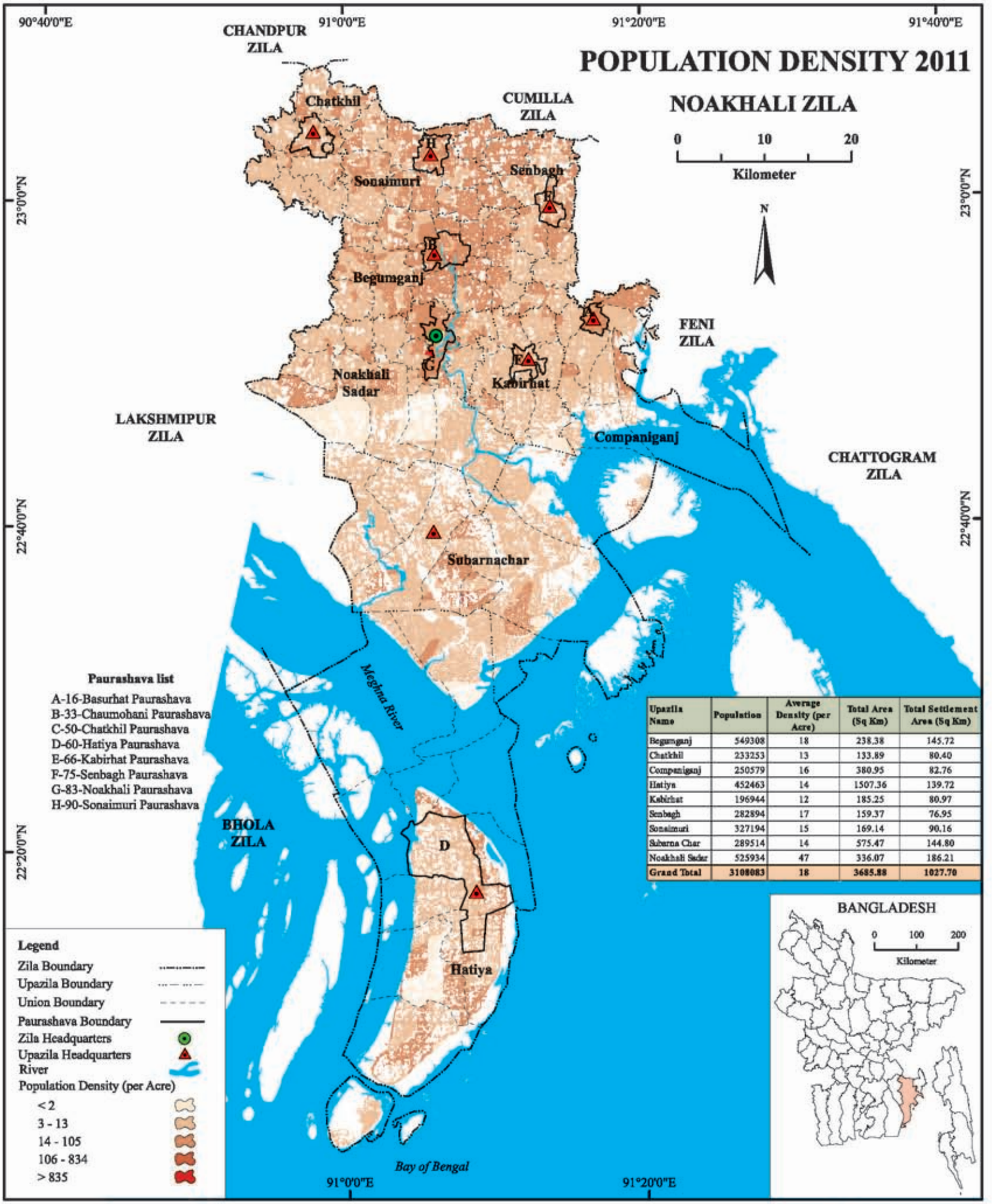
The increase in households during the decade 2001-2011 is 30.74% in the zila, 49.99% in urban and 27.82% in rural areas. It is also observed in the table that the household has been increasing since 1981 both in urban and rural areas. The increasing trend for urban households reflects the pattern of migration from rural to urban areas. The upward trend of the urban household over the decades registers a record of 87.27% during 1981-1991 suggesting very rapid urbanization in Noakhali zila. The percentage change in urban areas exhibits a downward slope of 70.95% and 49.99% over the decades 1991-2001 and 2001-2011 respectively. The rural household recorded the highest 27.82% expansion during 2001- 2011 as compared to 23.05% in 1981-1991 and 16.20% in 1991-2001.

The total population of the zila, as enumerated in the 2011 Census is 3108083 of which 496700 (15.98%) constitute urban population and the remaining 2611383 (84.02%) constitute the rural population. It is observed that the total population of both urban and rural areas has been increasing but the percent contribution to the total population by rural areas has been showing a little decreasing trend since 1974. This particular phenomenon is mainly attributed to the expansion of urban areas and possibly due to the migration of a section of people from rural areas to urban areas.

Table 3.2: General distribution population characteristics of Noakhali Zila, 2011

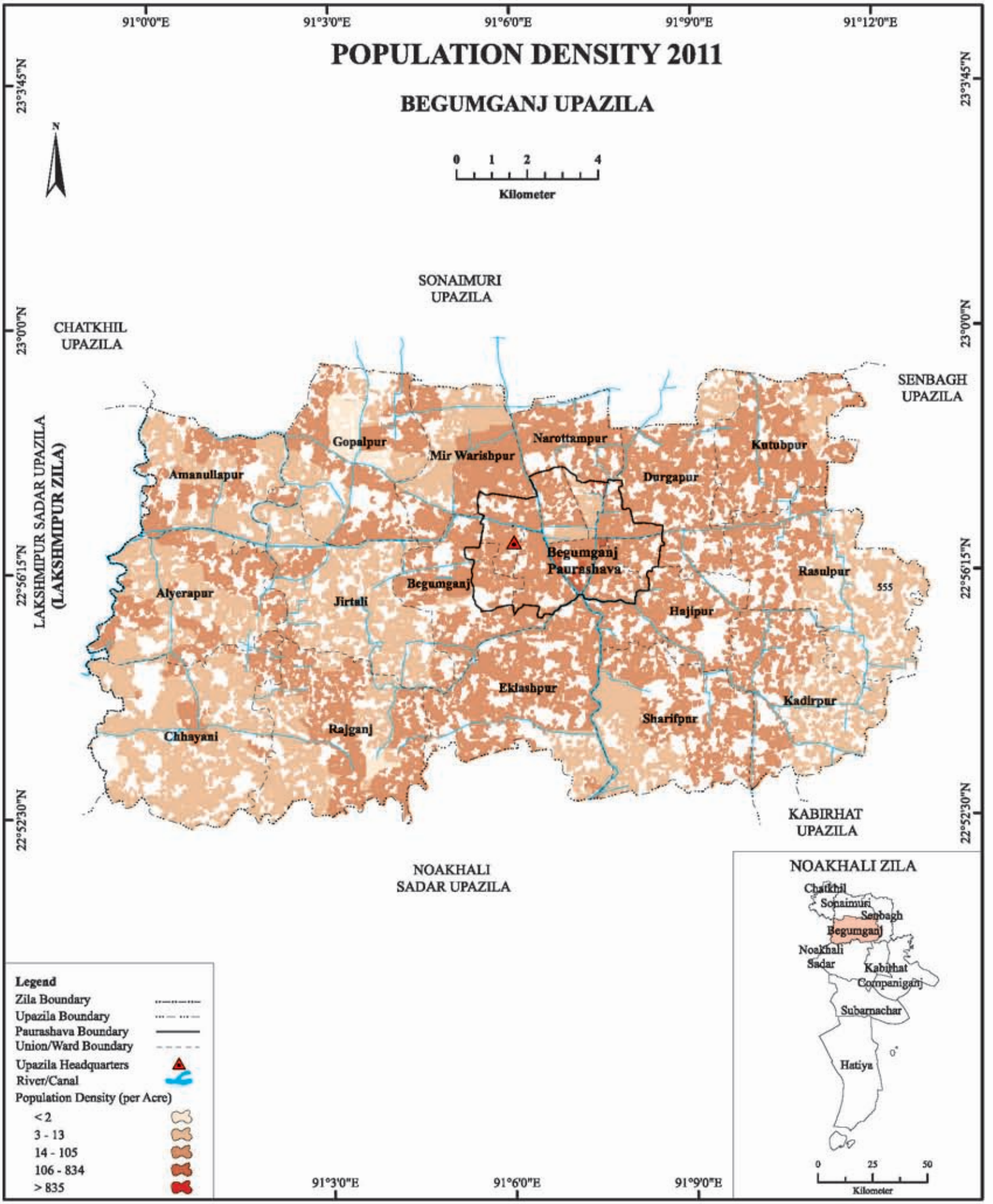
Upazila	2011					
	Total		Urban		Rural	
	Number	Percentage	Number	Percentage	Number	Percentage
Begumganj	549308	17.67	132948	26.77	416360	15.95
Chatkhil	233253	7.51	31395	6.32	201858	7.73
Companiganj	250579	8.06	29877	6.01	220702	8.45
Hatiya	452463	14.56	86514	17.42	365949	14.01
Kabirhat	196944	6.34	17448	3.51	179496	6.87
Senbag	282894	9.10	26807	5.40	256087	9.81
Sonaimuri	327194	10.53	34218	6.89	292976	11.22
Subarnachar	289514	9.31	6651	1.34	282863	10.83
NoakhaliSadar	525934	16.92	130842	26.34	395092	15.13
Zila Total	**3108083**	**100.00**	**496700**	**100.00**	**2611383**	**100.00**

Population and Households



Upazila Name	Population	Average Density (per Acre)	Total Area (Sq Km)	Total Settlement Area (Sq Km)
Begumganj	549308	18	238.38	145.72
Chatkhil	233253	13	133.89	80.40
Companiganj	250579	16	380.95	82.76
Hatiya	452463	14	1507.36	139.72
Kabirhat	196944	12	185.25	80.97
Senbagh	282894	17	159.37	76.95
Sonaimuri	327194	15	169.14	90.16
Subarna Char	289514	14	575.47	144.80
Noakhali Sadar	525934	47	336.07	186.21
Grand Total	3108083	18	3685.88	1027.70

Stat4Dev Project, 2020



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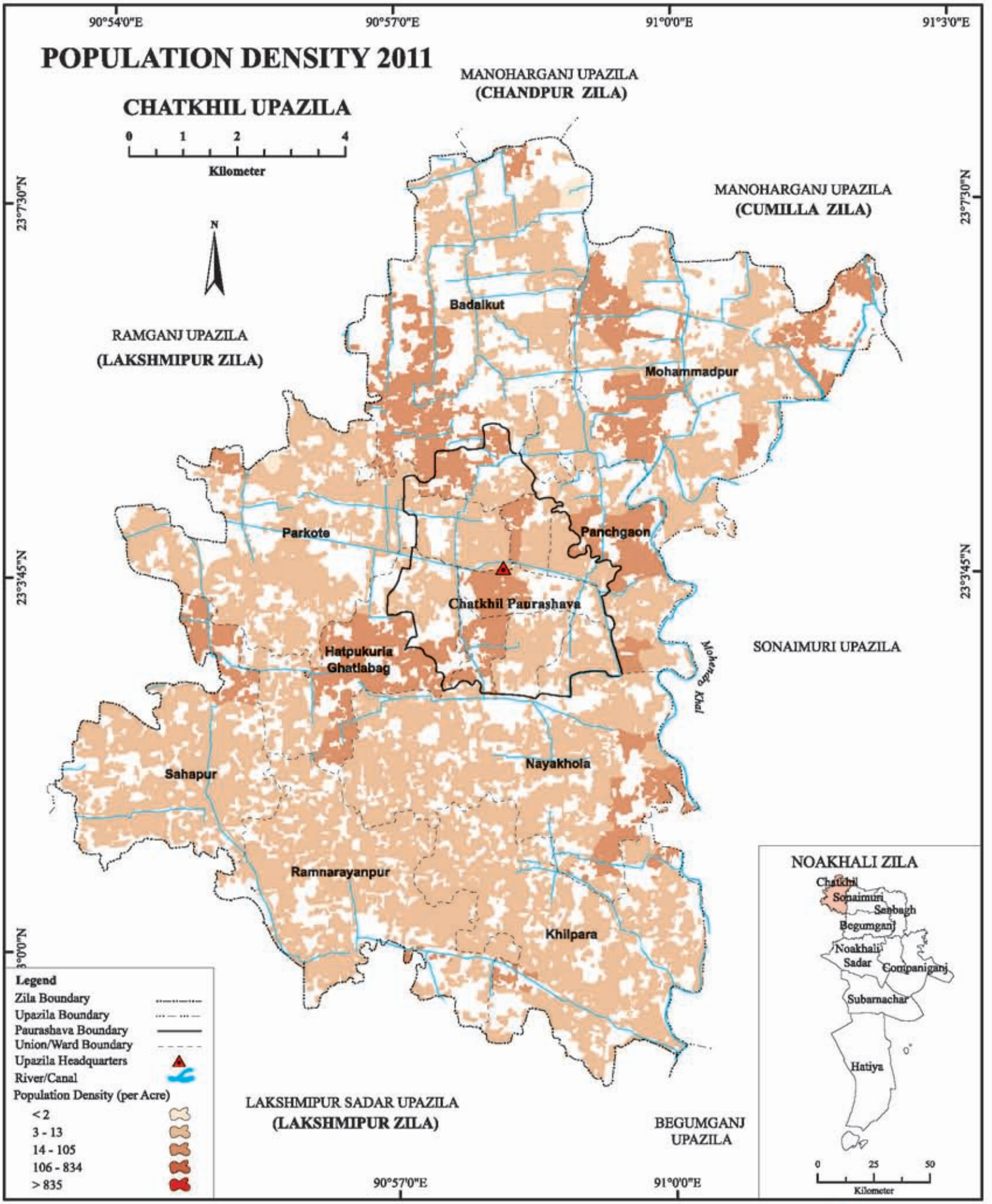

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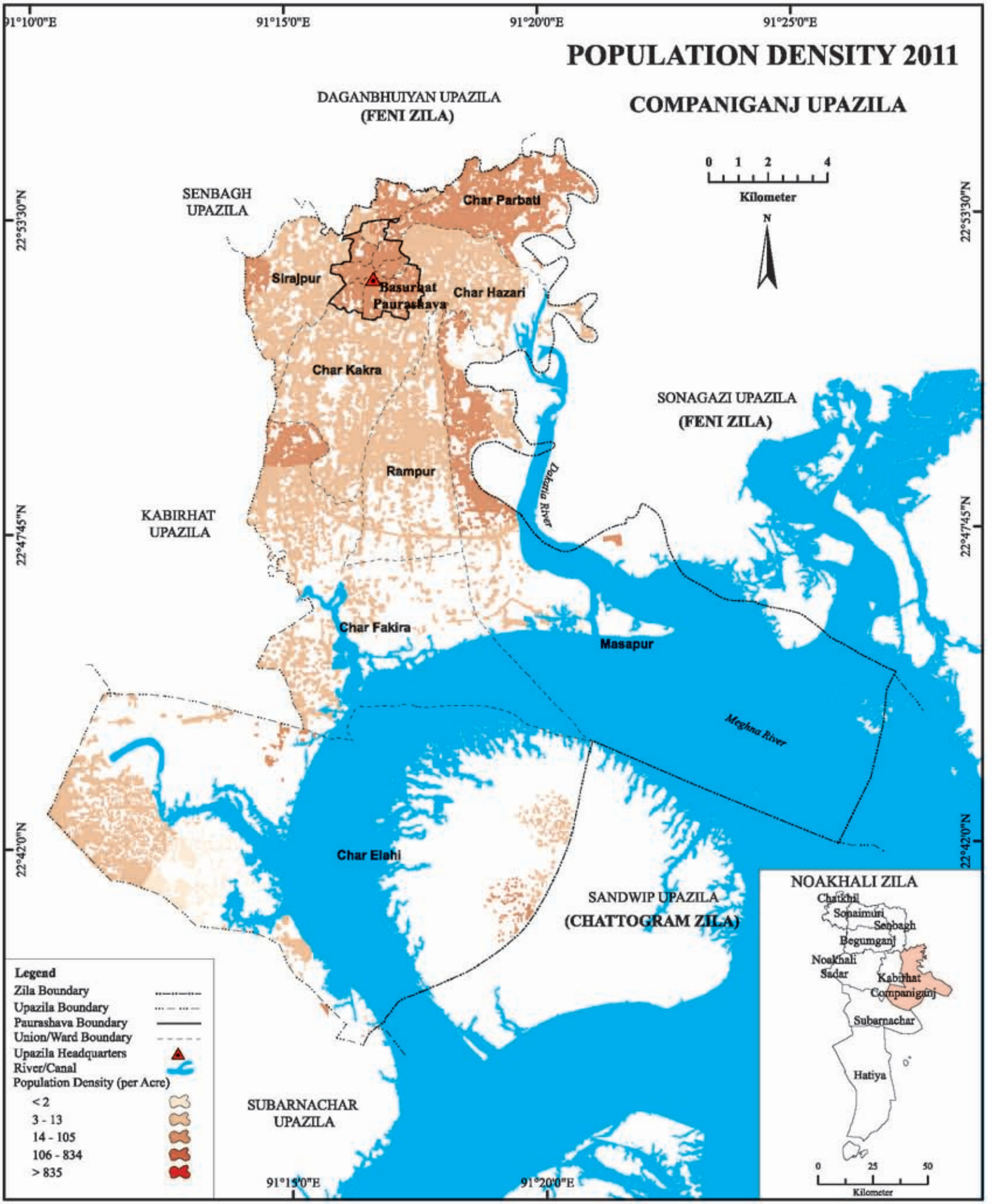

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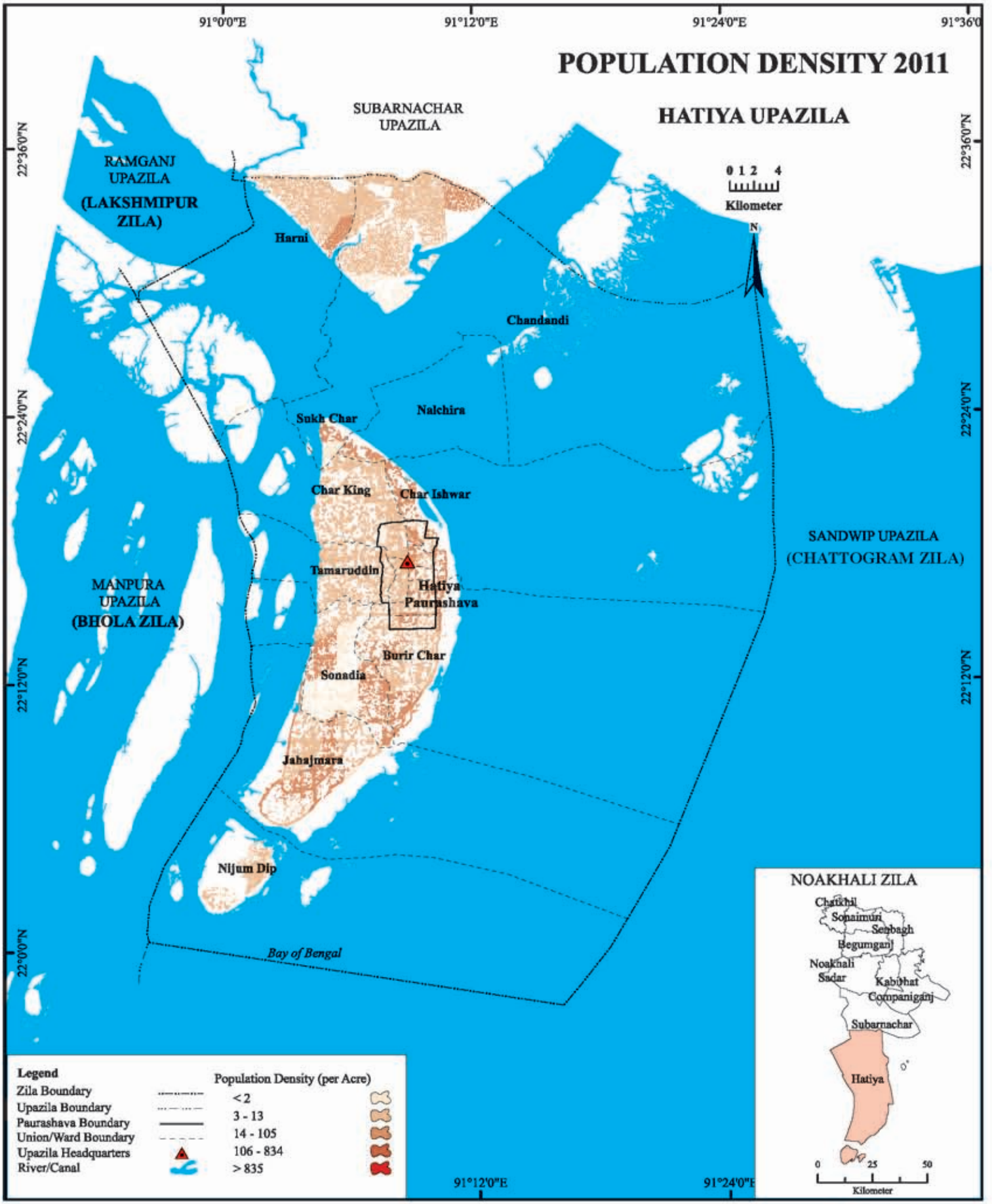

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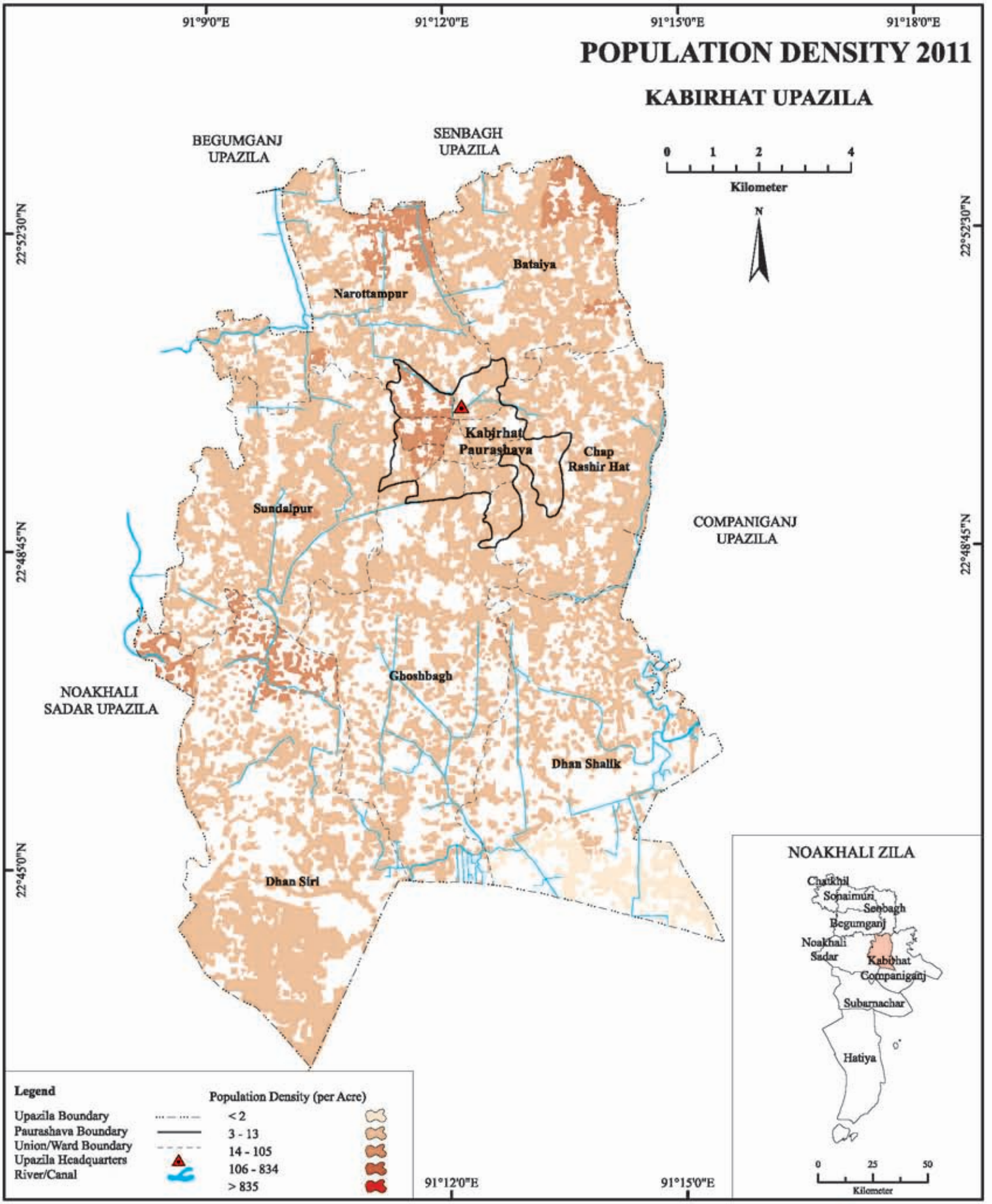

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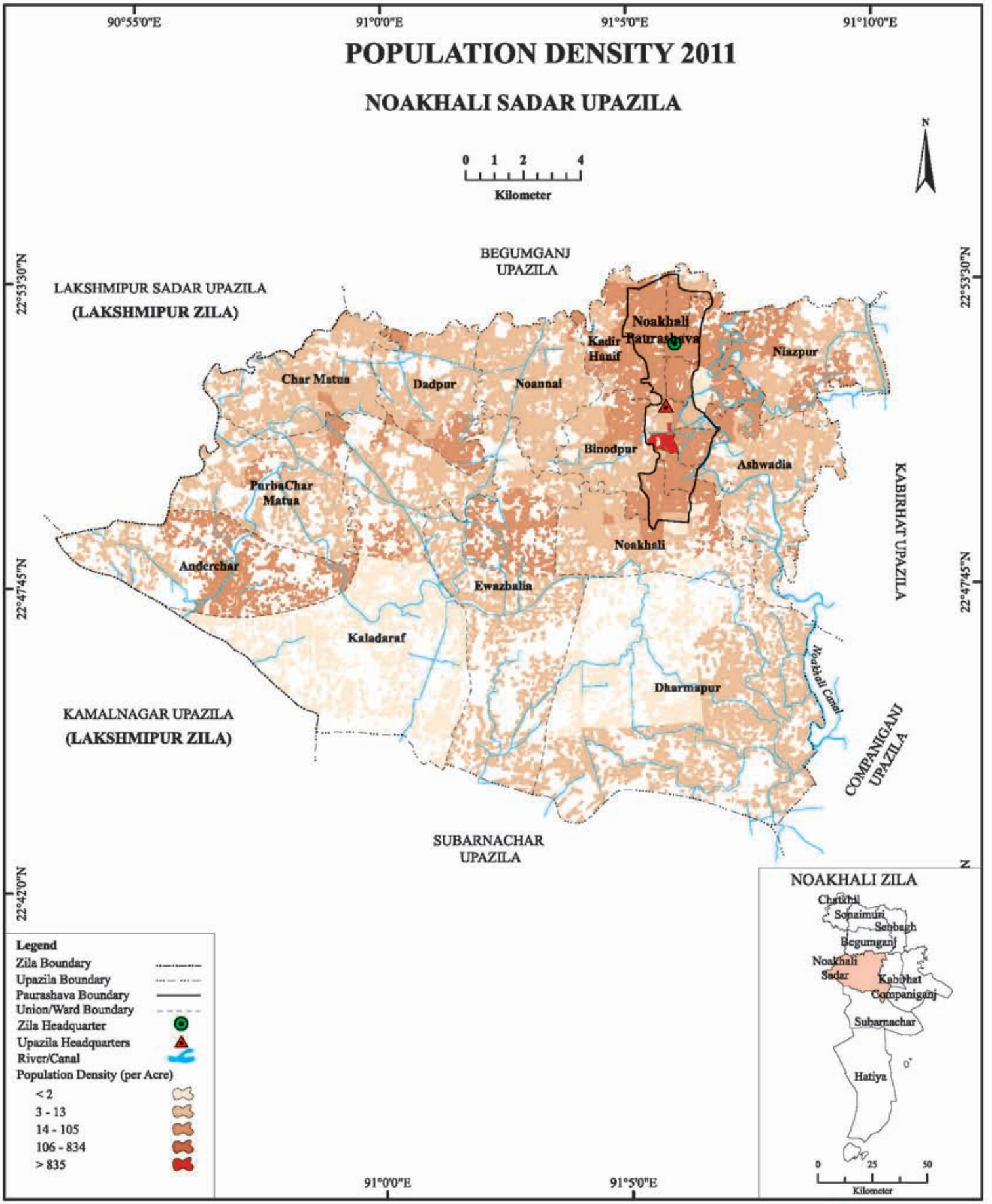

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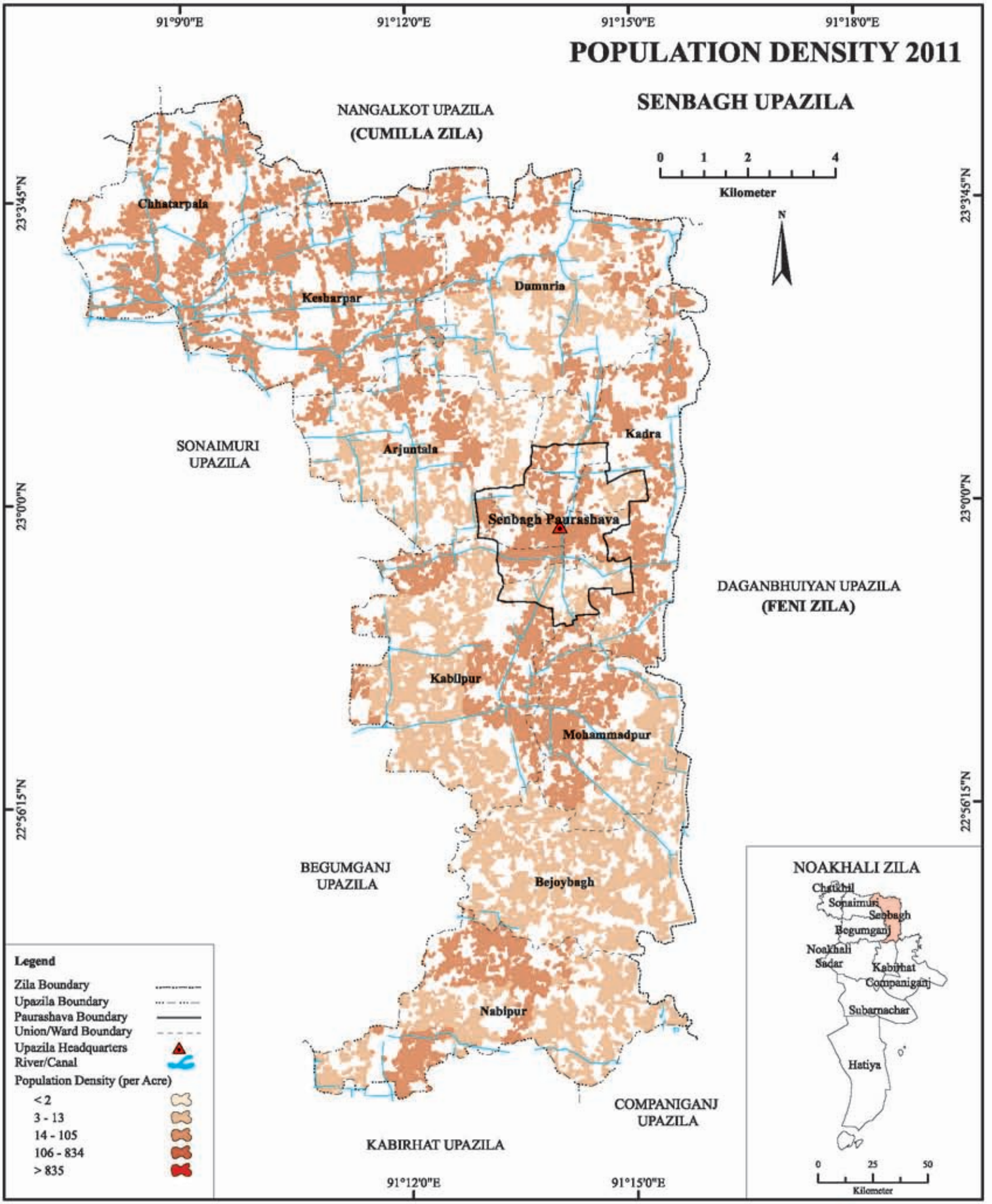

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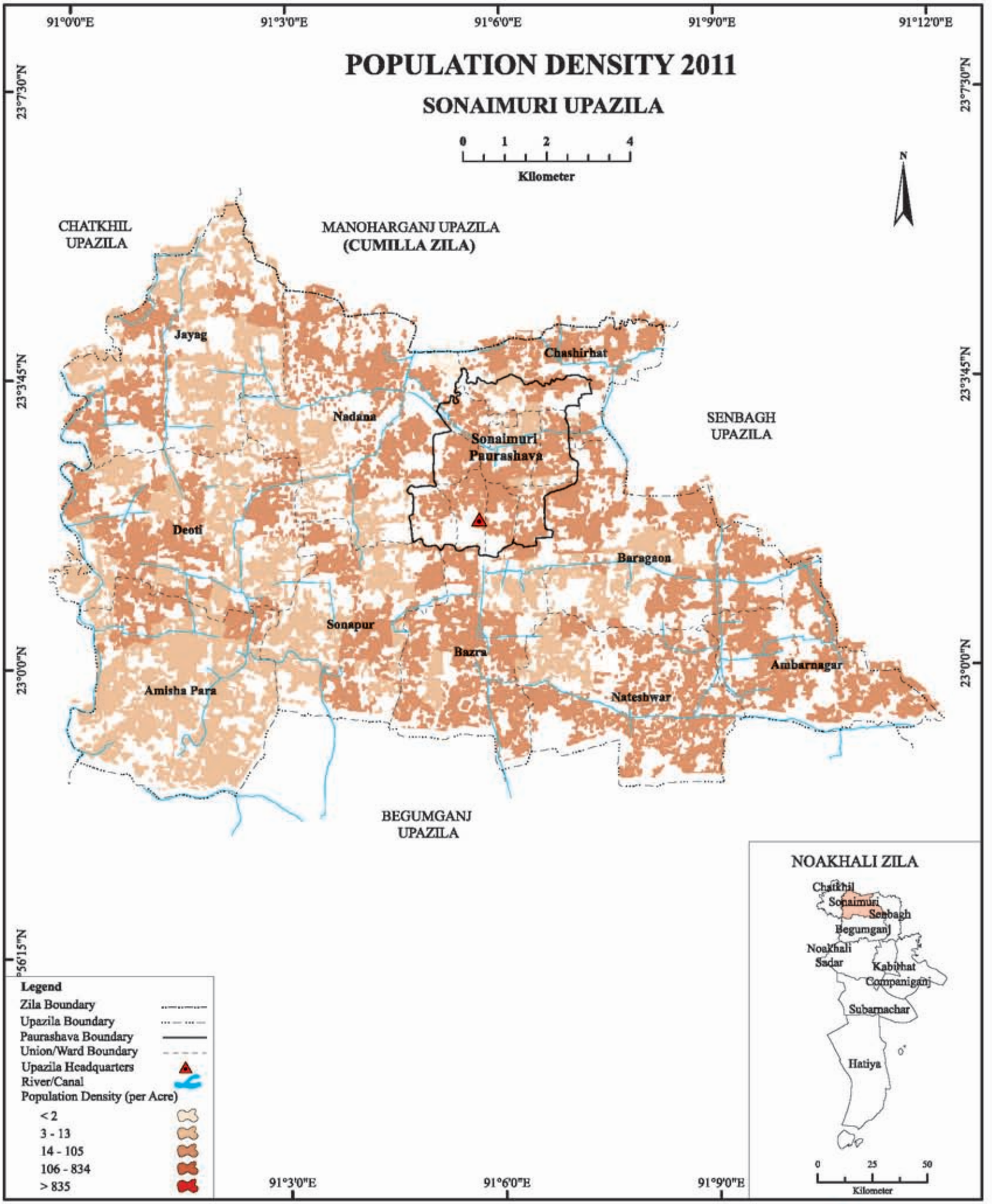

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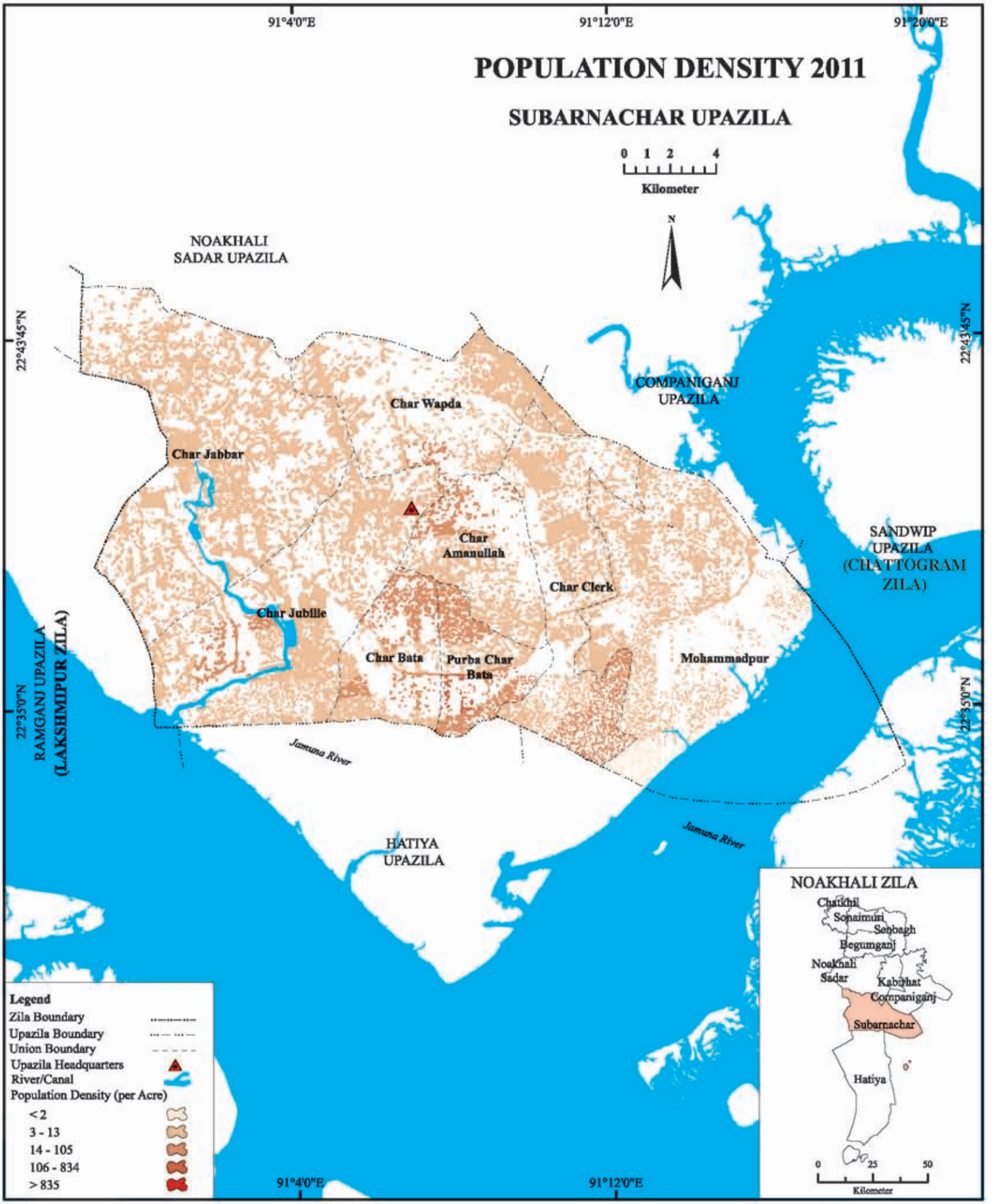

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3.3 Climate

The Noakhali lies at 9m above sea level. The climate is tropical in Noakhali. Noakhali has significant rainfall most months with a short dry season. This climate is considered to be Am according to the Köppen-Geiger climate classification. In Noakhali, the average annual temperature is 25.6 °C (78.0 °F). About 2980 mm (117.3) inches of precipitation falls annually. The precipitation varies 663 mm (26 inches) between the driest month and the wettest month. The variation in annual temperature is around 9.1 °C (48.4 °F).

Table 3.3 General Climatic characteristics of the Noakhali Zila.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	19.5	21.8	25.6	27.9	28.6	28	27.6	27.8	28.1	27.4	24	20.4
Min. Temperature (°C)	13.3	15.6	20.2	23.7	25	25.4	25.3	25.4	25.4	24.2	19.3	14.7
Max. Temperature (°C)	25.7	28	31.1	32.2	32.2	30.6	30	30.2	30.8	30.7	28.7	26.2
Avg. Temperature (°F)	67.1	71.2	78.1	82.2	83.5	82.4	81.7	82.0	82.6	81.3	75.2	68.7
Min. Temperature (°F)	55.9	60.1	68.4	74.7	77.0	77.7	77.5	77.7	77.7	75.6	66.7	58.5
Max. Temperature (°F)	78.3	82.4	88.0	90.0	90.0	87.1	86.0	86.4	87.4	87.3	83.7	79.2
Precipitation / Rainfall (mm)	8	18	53	115	282	592	671	593	374	209	52	13

Source: https://en.climate-data.org

3.4 Land cover

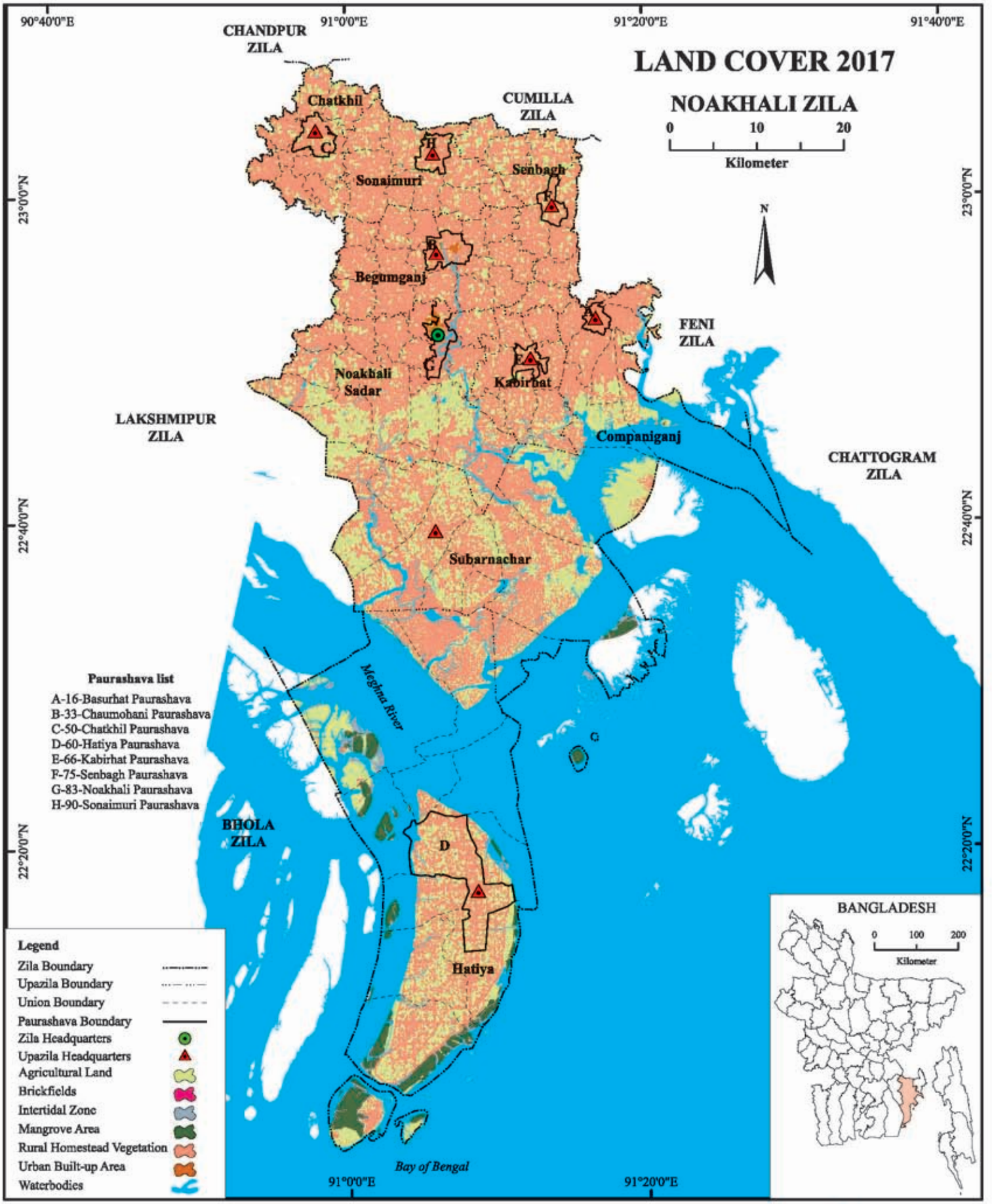
In Noakhali Zila, the largest Upazila is Hatiya with 40% of the total district area. On the other hand, the smallest Upazila is Chatkhil with 3.6% of the total area. In 2010, Noakhali had 37.8 ha of tree cover, extending over 15% of its land area. In 2017, it lost 9.69 ha of tree cover, equivalent to 1.19-kilo ton of CO_2 of emissions. (www.globalforestwatch.org). The distribution of land cover of the Noakhali district is given below.

Table 3.4: Land area distribution to different Upazilas of Noakhali Zila (in sq km)

Upazila	Land area	Reserve forest	River area	Total area
Begumganj	238.37			238.37
Chatkhil	133.89			133.89
Companiganj	355.62	3.33	22.0	380.95
Hatiya	872.96	298.39	336.0	1507.35
Kabirhat	185.25			185.25

Noakhali Sadar	336.06			336.06
Senbagh	159.36			159.36
Sonaimuri	169.14			169.14
Subarnachar	405.06	35.41	135.0	575.47
Total	**2855.74**	**337.13**	**493.0**	**3685.87**

Land Cover
Area Map



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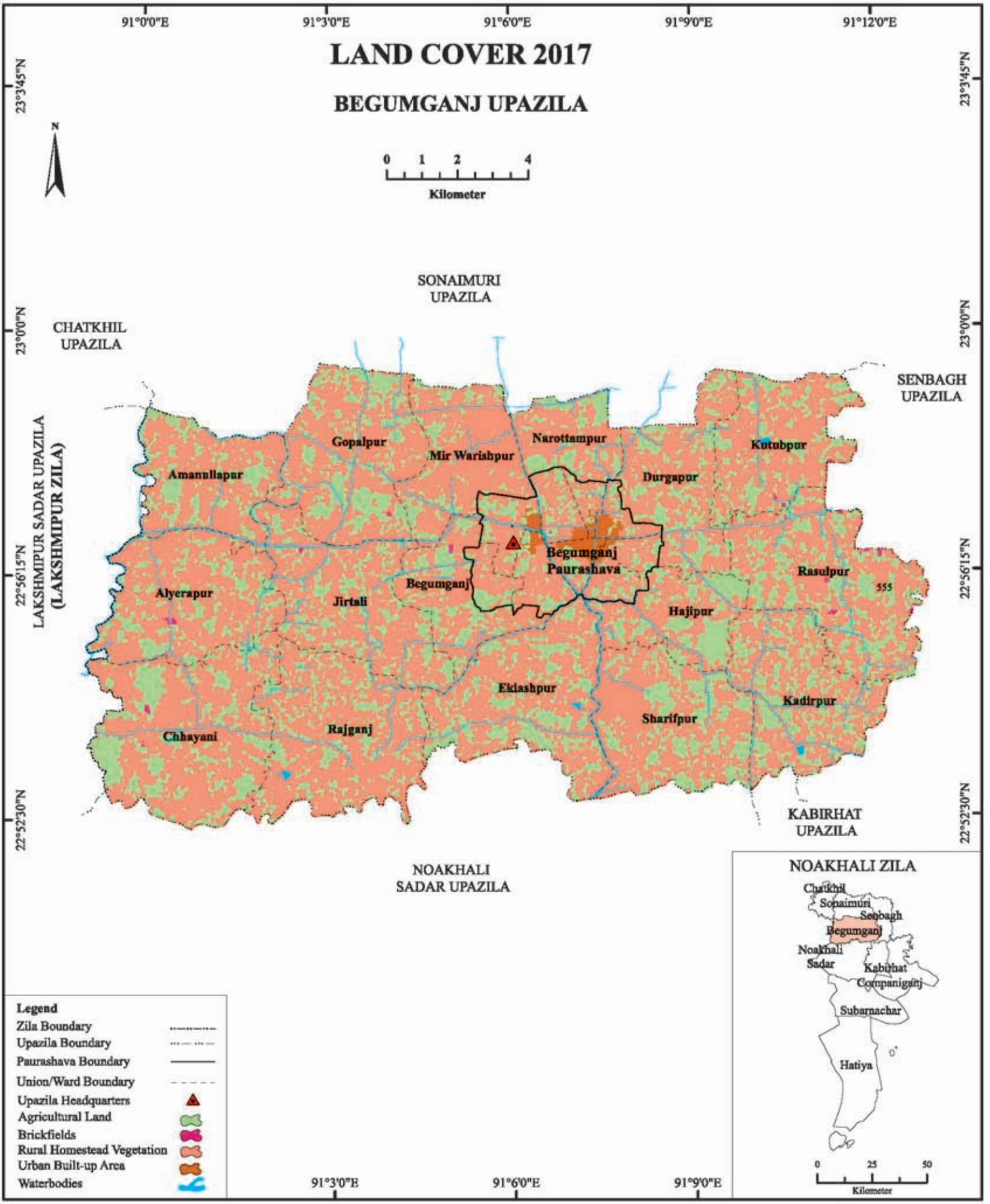

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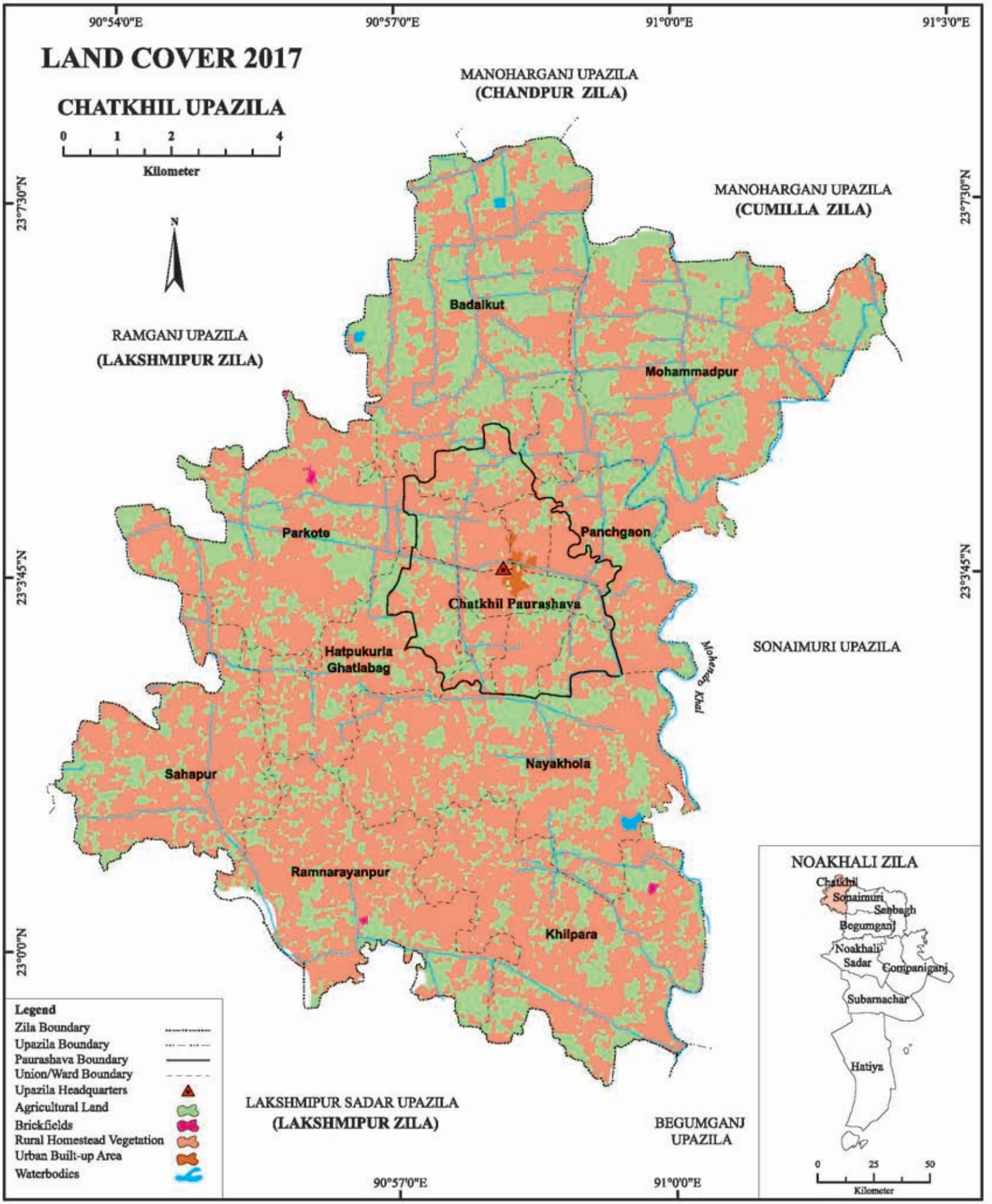

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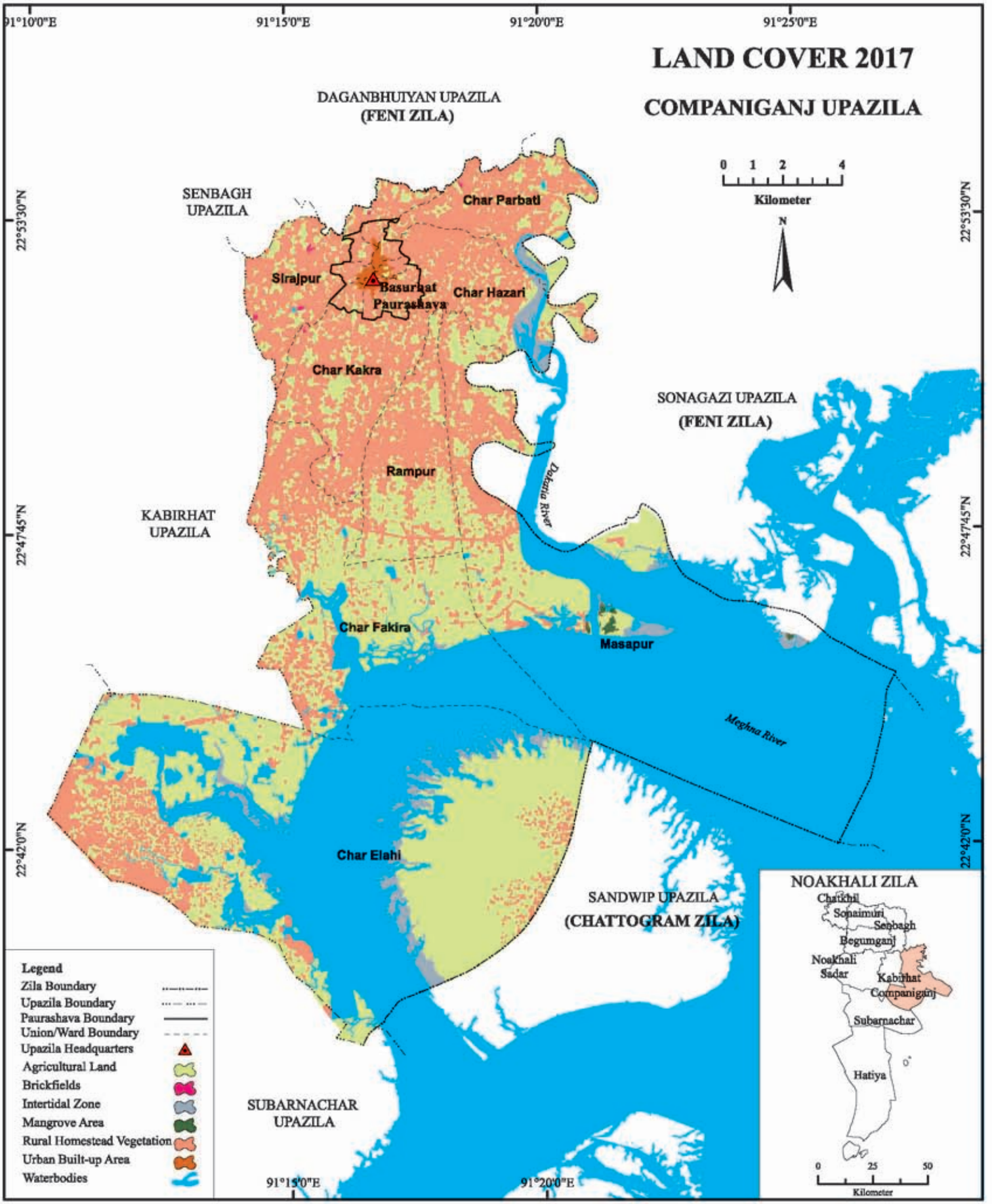

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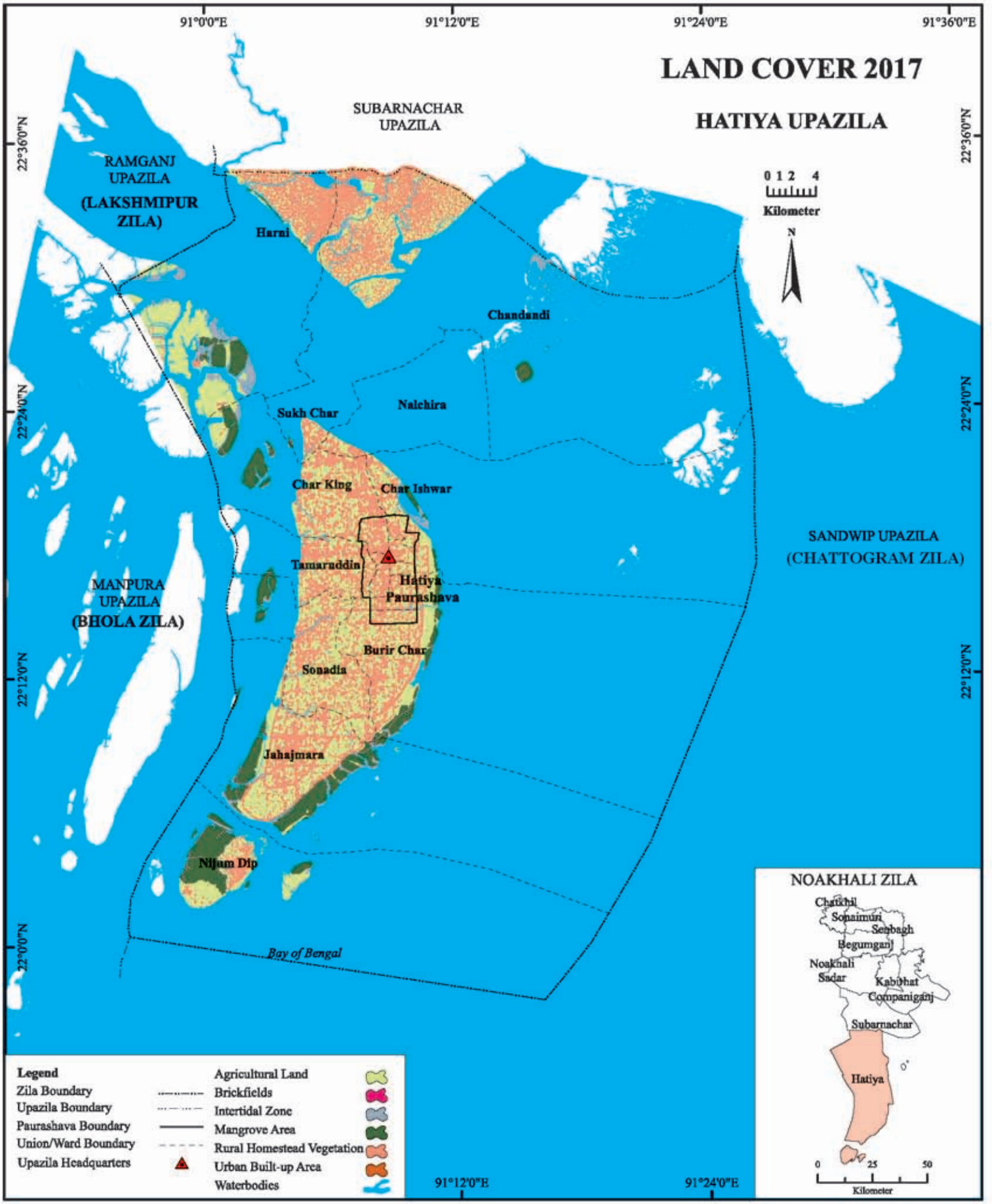

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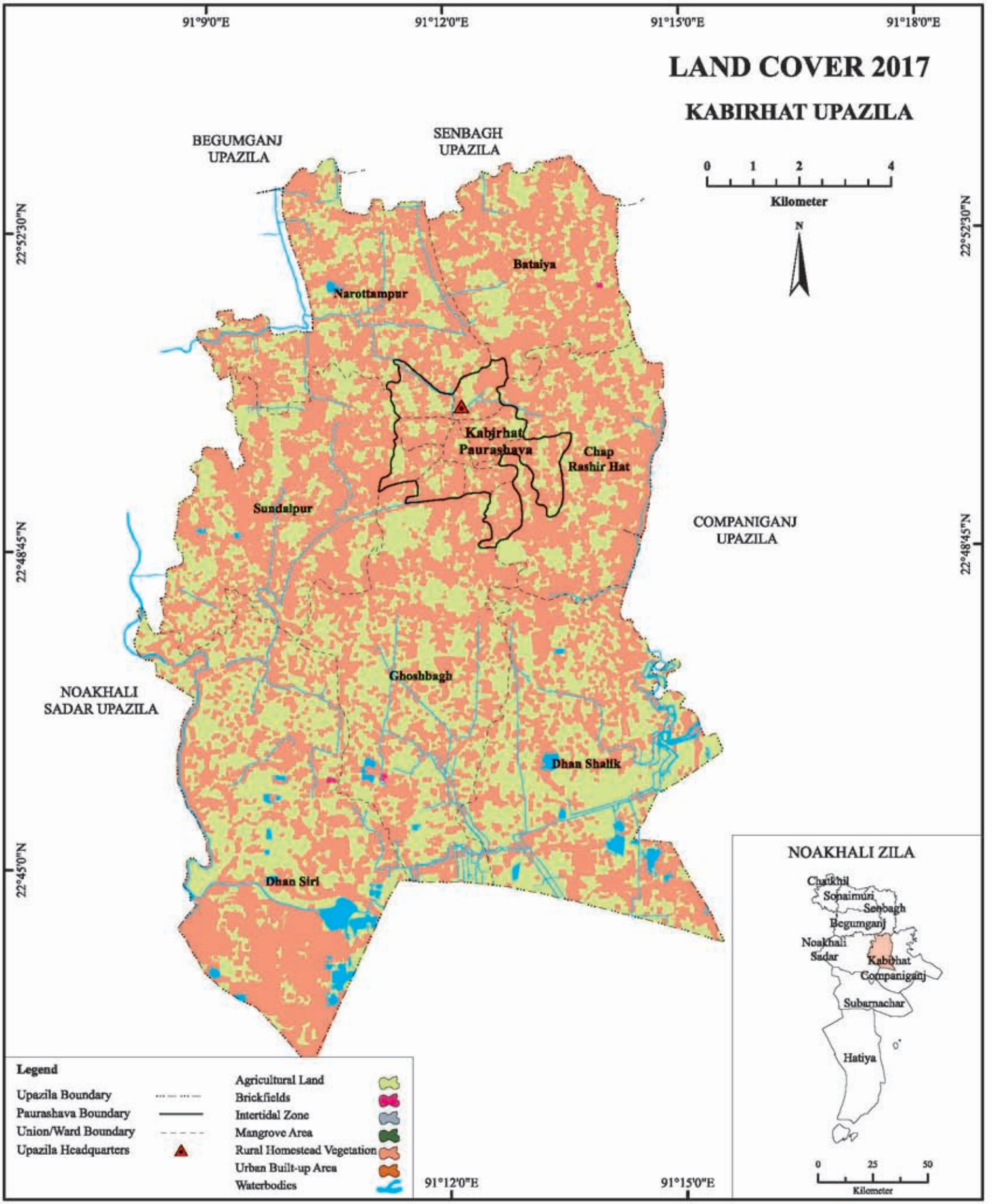

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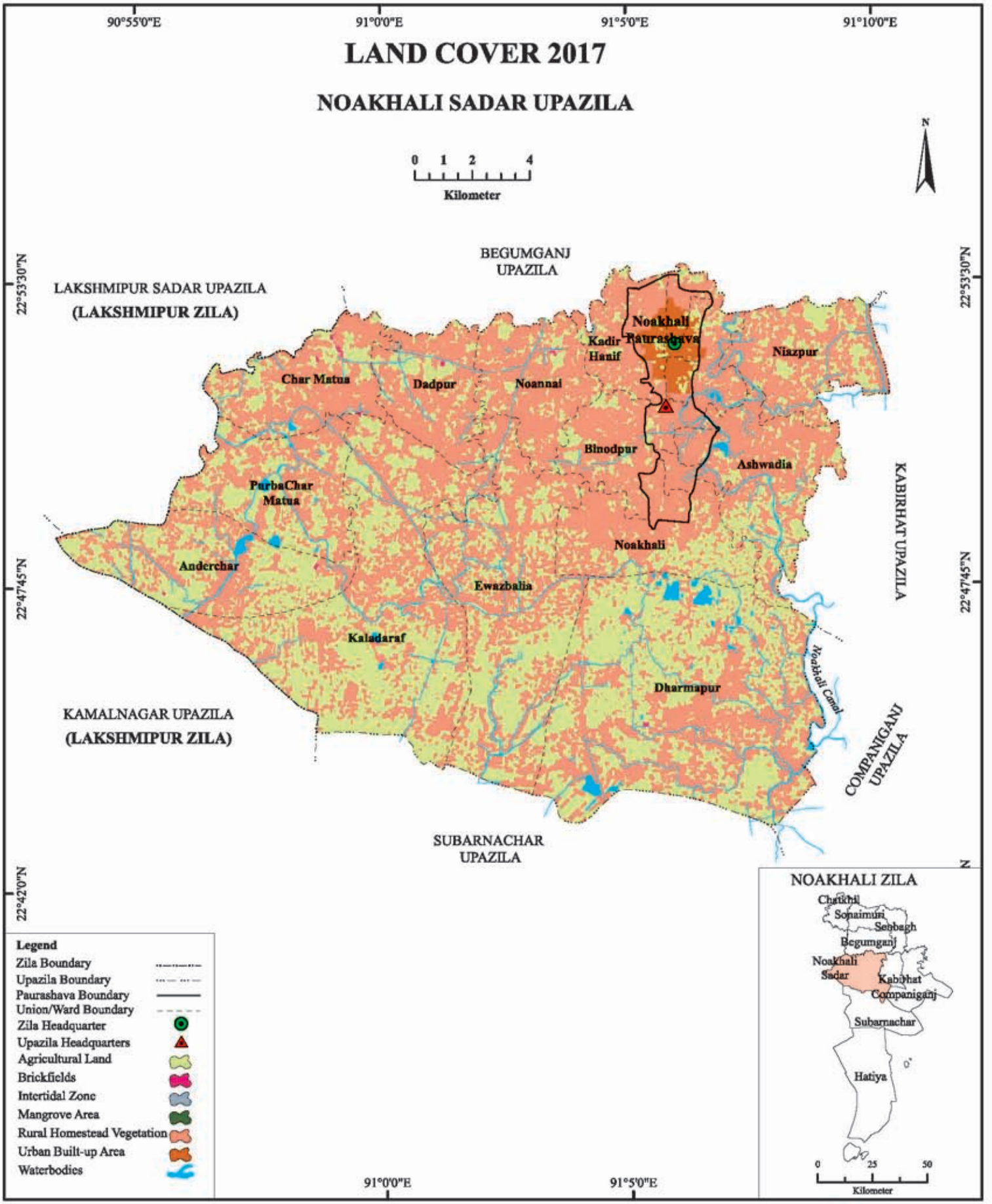

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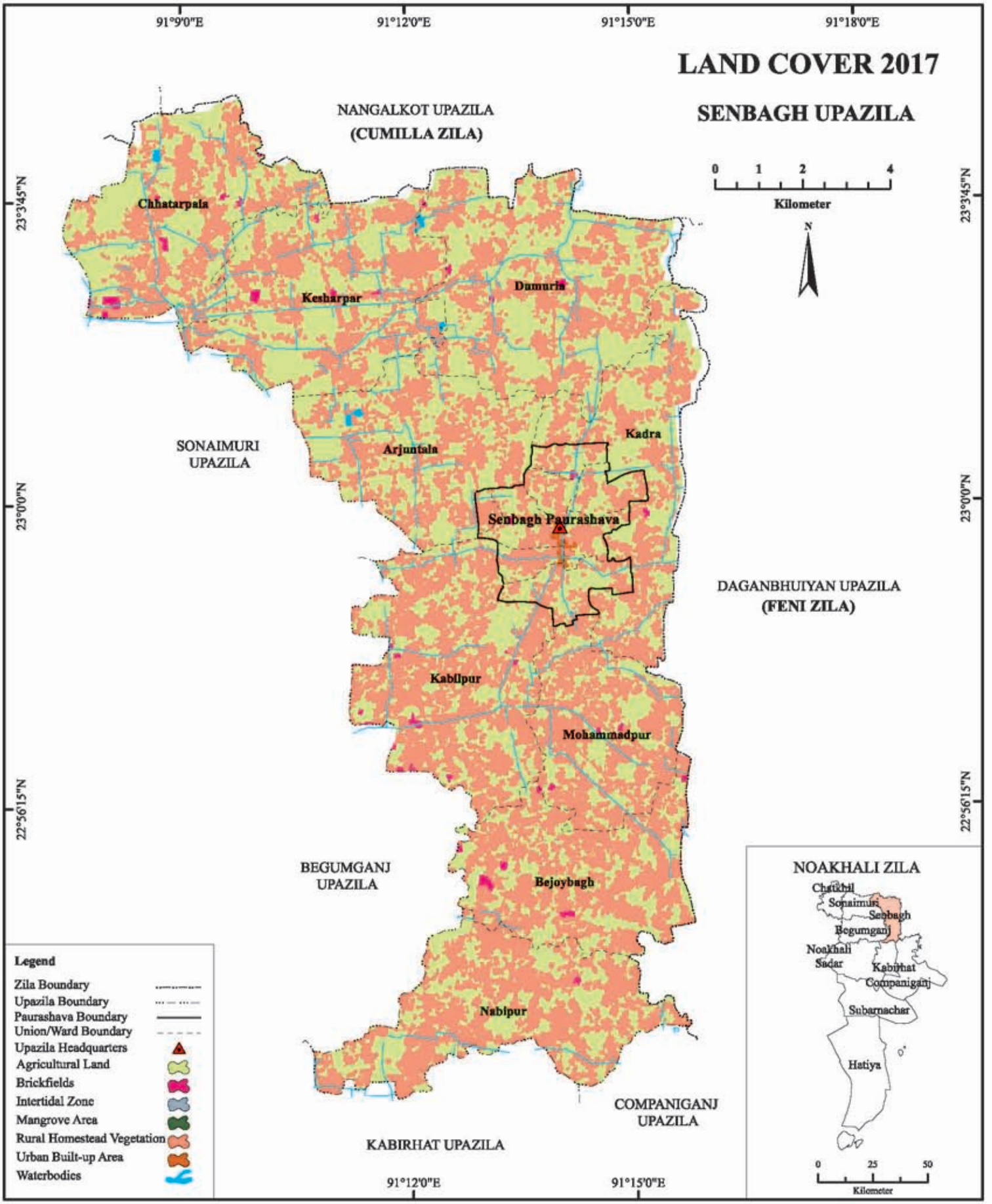

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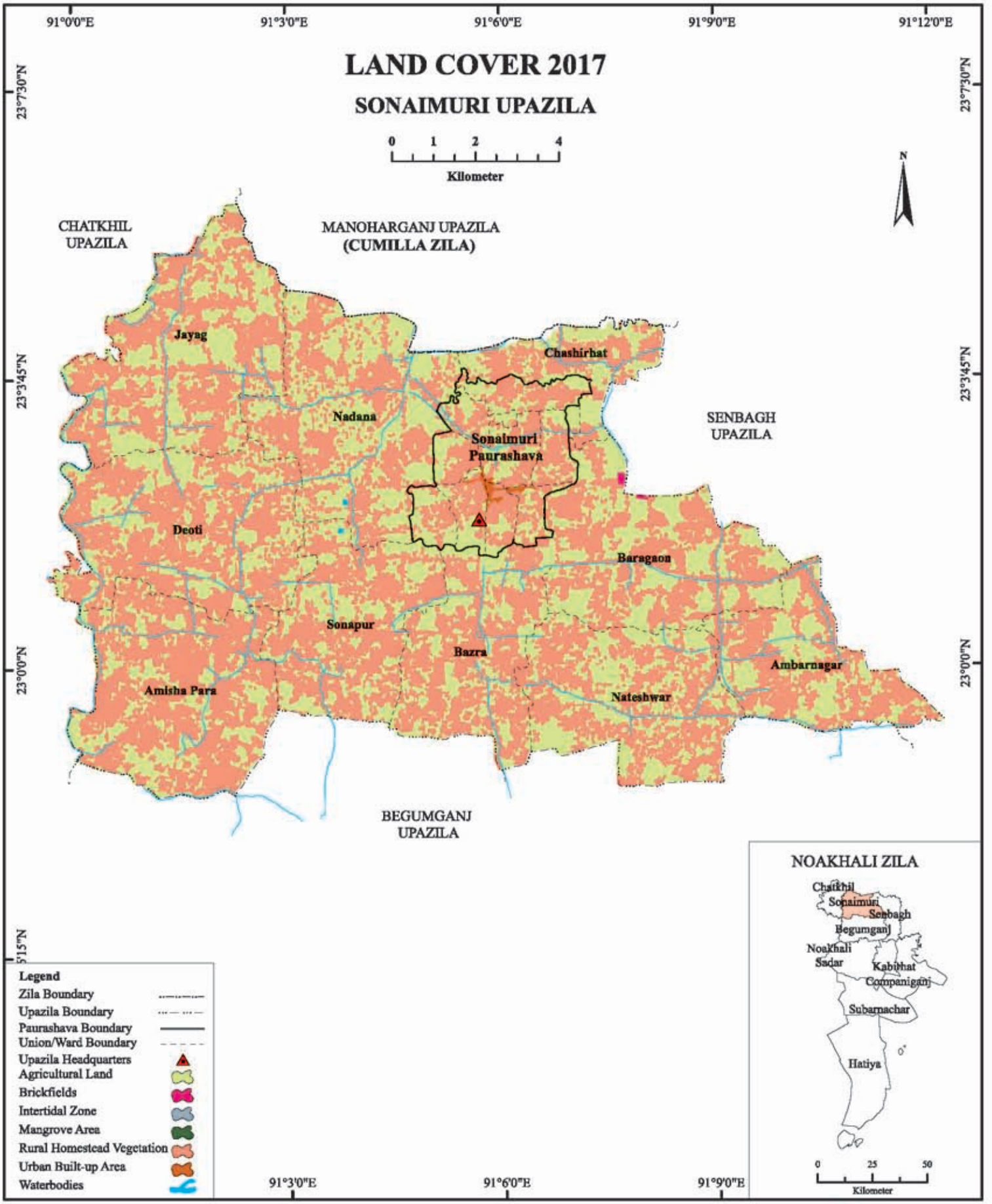

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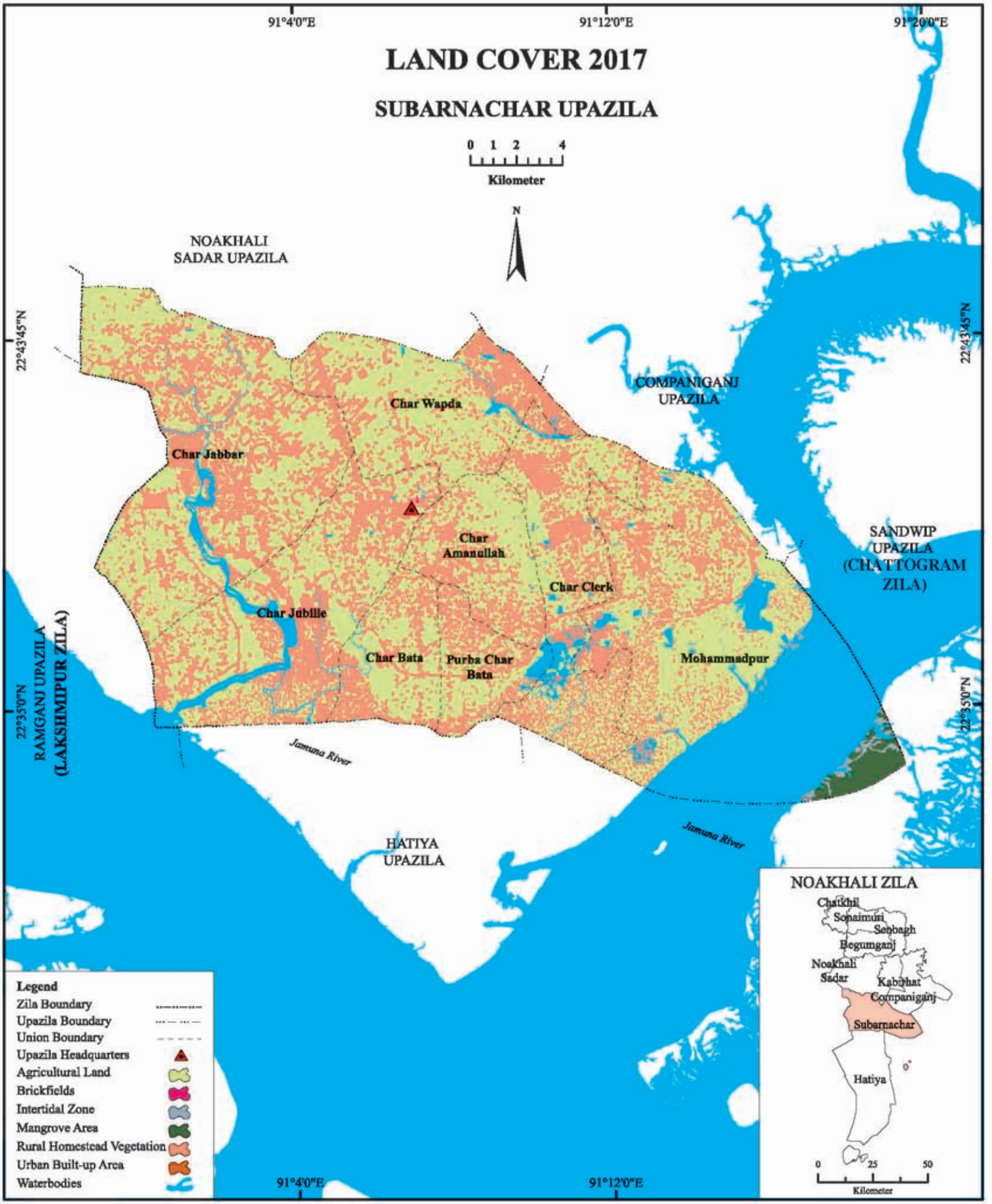

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3.5 Education

The literacy rate of the population 7 years and above is shown in Table 3.5. It is noticed that the literacy rates for both sex, male and female in urban areas have been increasing during the intercensal period 2001-2011, but it has decreased for both sex and male in the zila and rural areas during the same period. It has probably happened due to the migration of literate males from rural areas to urban areas for seeking jobs, education and better opportunities for urban life. In the urban area, the literacy rates have increased 3.57, 2.71 and 4.59 percentage points for both sex, male and female respectively during the decade 2001-2011 as against 8.62, 4.51 and 13.37 percentage points for both sex, male and female respectively during the decade 1991-2001.

Table 3.5: Literacy Rate of Population 7 Years and Above by Sex and Residence, 1991-2011

Years	Zila			Urban			Rural		
	Both Sex	Male	Female	Both Sex	Male	Female	Both Sex	Male	Female
2011	51.29	51.44	51.16	62.67	63.85	61.52	49.06	48.86	49.24
2001	51.67	53.51	49.90	59.10	61.14	56.93	50.44	52.17	48.80
1991	37.09	42.95	31.49	50.48	56.63	43.56	35.46	41.13	30.15

Table 3.6: Distribution of various educational establishments in Noakhali Zila.

Institute Types	Begumganj	Chatkhil	Companiganj	Hatiya	Kabirhat	Noakhali Sadar	Senbagh	Sonaimuri	Subarnachar	Total
Government primary School	156	98	57	105	52	111	79	97	21	**776**
Registered primary school	35	13	27	99	35	76	33	24	60	**402**
Non-govt. Primary school	0	0	6	0	6	2	2	0	24	**40**
Kindergarten school	64	64	28	5	24	37	57	101	7	**387**
NGO school	0	7	12	0	0	0	54	8	40	**121**
Government secondary school	2	2	2	2	0	2	2	0	0	**12**
Non-government secondary school	47	28	29	25	27	43	26	45	18	**288**
School & college	1	0	1	0	0	0	1	0	1	**4**

Government college	1	1	1	1	1	2	1	0	0	**8**
Non-government college	2	3	2	3	1	6	2	4	3	**26**
Madrasah	37	19	16	17	7	28	20	19	19	**182**
Kawmi madrasah	55	24	2	6	2	51	3	12	0	**155**
Ebtedayee madrasah	4	19	9	8	11	4	3	9	13	**80**
Technical and vocational institution	2	0	1	0	0	4	1	2	2	**8**
Medical college	1	0	0	0	0	0	0	0	0	**1**

Source: BBS, 2011

3.6 Health facilities

There is no medical college hospital in Noakhali Zila. The mass population mainly depends on community clinics. Besides this, there are few union health & family welfare centers and private clinic facilities. The following table shows the health facility types and their number in the Zila.

Table 3.7: Number of health facilities in Noakhali Zila.

Institute Types	Begumganj	Chatkhil	Companiganj	Hatiya	Kabirhat	Noakhali Sadar	Sabbagh	Sonaimuri	Subarnachar	**Total**
Government health complex	1	1	1	1	1	1	1	1	1	**9**
private hospital/clinic	13	9	7	0	2	24	3	4	0	**62**
diagnostic centre	12	5	6	4	1	8	5	5	2	**48**
missionary hospital	0	1	0	0	0	1	0	0	0	**2**
health centre	12	8	8	8	4	7	6	14	1	**68**

Source: BBS, 2013

3.7 Transport

The total road length of the Noakhali Zila is 8326.23 km, where 21.6 % is the metalled road, semi-metalled is only 2.6% and the rest of 75.5% road is the un-metalled road. A very few waterways are available with 268.92 km which increased up to 598.37 km around the year.

Table 3.8: Distribution of road types (km) of different Upazilas of Noakhali Zila.

Upazila	Metalled road	Semi metalled road	Unmetalled (Katcha) road	Total	Waterway in Monsoon (River + Canal)	Waterway round the Year (River + Canal)
Begumganj	396.00	36.00	1278.00	1722.00	193.50	
Chatkhil	284.30	6.22	527.00	817.52		
Companiganj	106.00	7.00	370.00	483.00		
Hatiya	129.85	59.60	687.19	876.74	307.87	205.92
Kabirhat	152.24	0.98	680.43	833.65		
Noakhali Sadar	200.66	45.23	814.36	1060.25	10	
Senbagh	188.01	5.06	457.41	650.48	87	63
Sonaimuri	222.35	7.75	1293.31	1523.41		
Subarnachar	119.28	55.21	184.70	359.18		
Total	**1798.69**	**223.05**	**6292.4**	**8326.23**	**598.37**	**268.92**

Source: Upazila Statistical Office, BBS, 2013

3.8 Cyclone Shelters

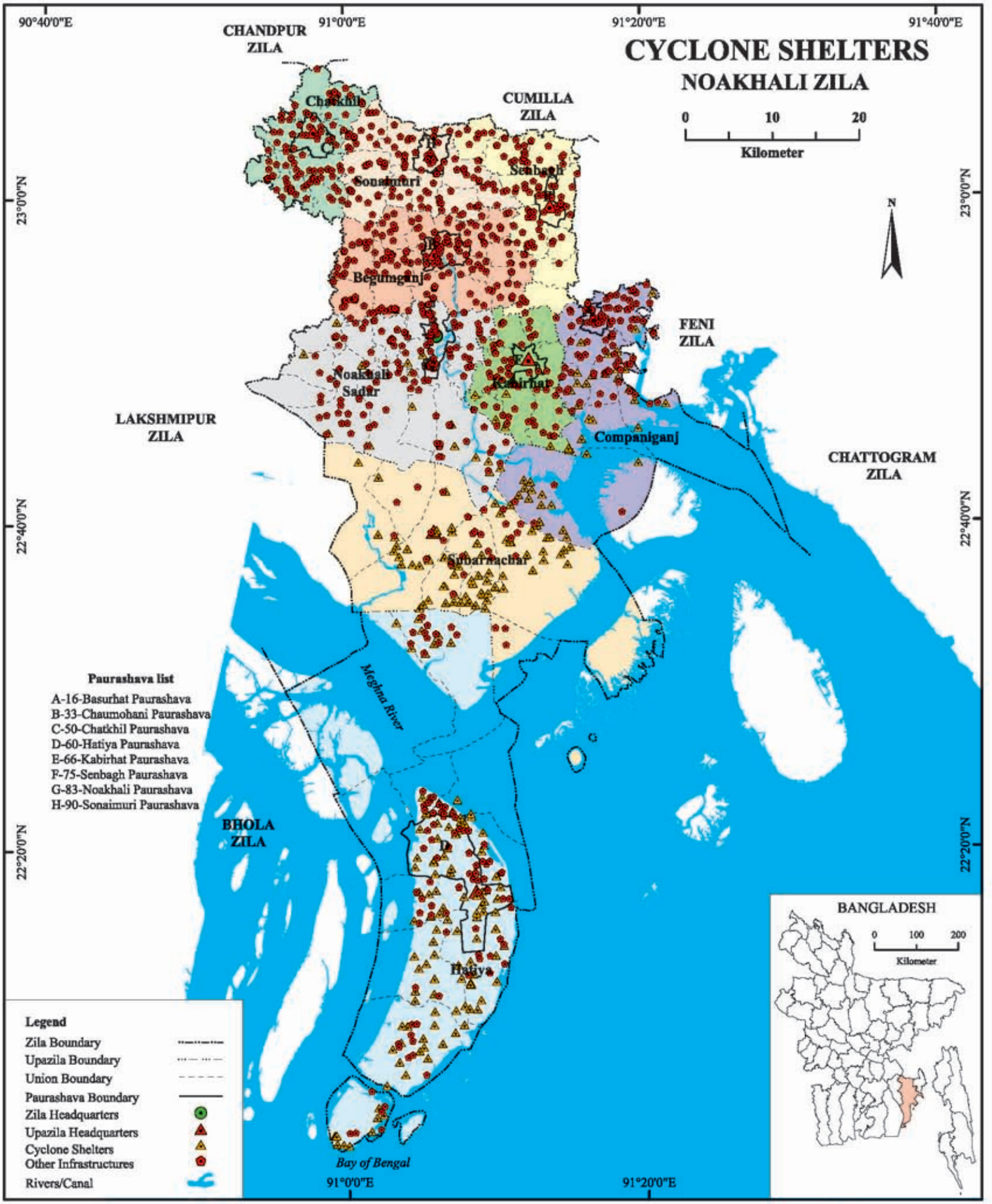
There are only 361 cyclone shelters available constructed by Governmental and 957 infrastructures by different non-governmental agencies with the capacity of 7,90,663 people. Whereas, the total population of the Zila is 31,27,393 and only 25 % of the total population may have the disaster shelter.

Table 3.9: Upazila specific distribution of cyclone shelters and population.

Upazila	Number of Cyclone Shelter	Number of Other Infrastructure as Cyclone Shelter	Other Infrastructure as Cyclone Shelter capacity	Population
Begumganj		202	139500	549308
Chatkhil		107	59000	233253
Companiganj	106	42	103160	250579
Hatiya	132	98	54000	452463
Kabirhat	9	74	48700	196944
Noakhali Sadar	15	163	125500	525934
Senbagh		99	52250	282894
Sonaimuri		139	77000	327194
Subarnachar	99	33	131553	289514
Total	**361**	**957**	**7,90,663**	**31,27,393**

Source: BMD, BBS field survey 2019

Cyclone Shelters
Area Map



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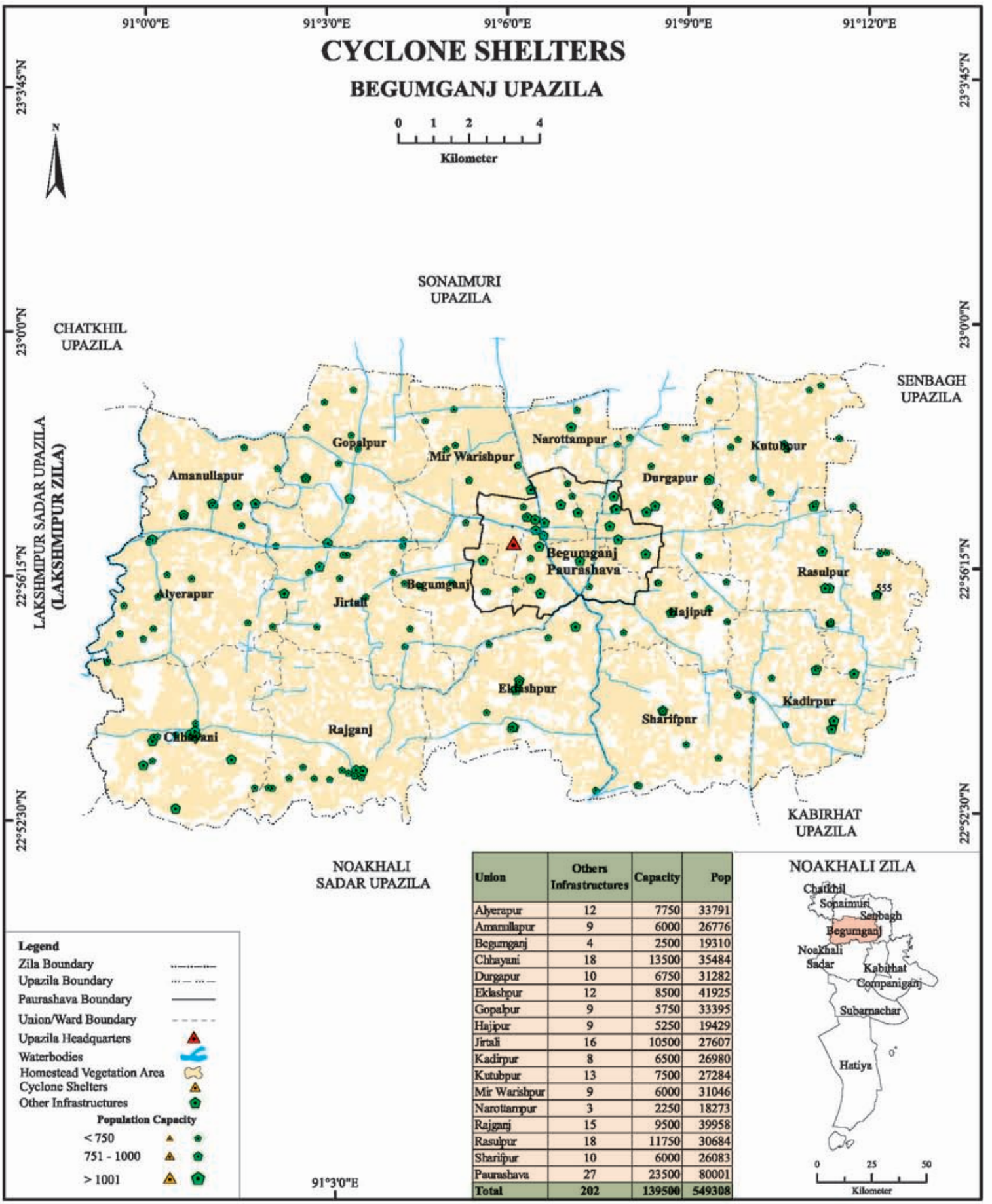
CYCLONE SHELTERS

BEGUMGANJ UPAZILA



Legend

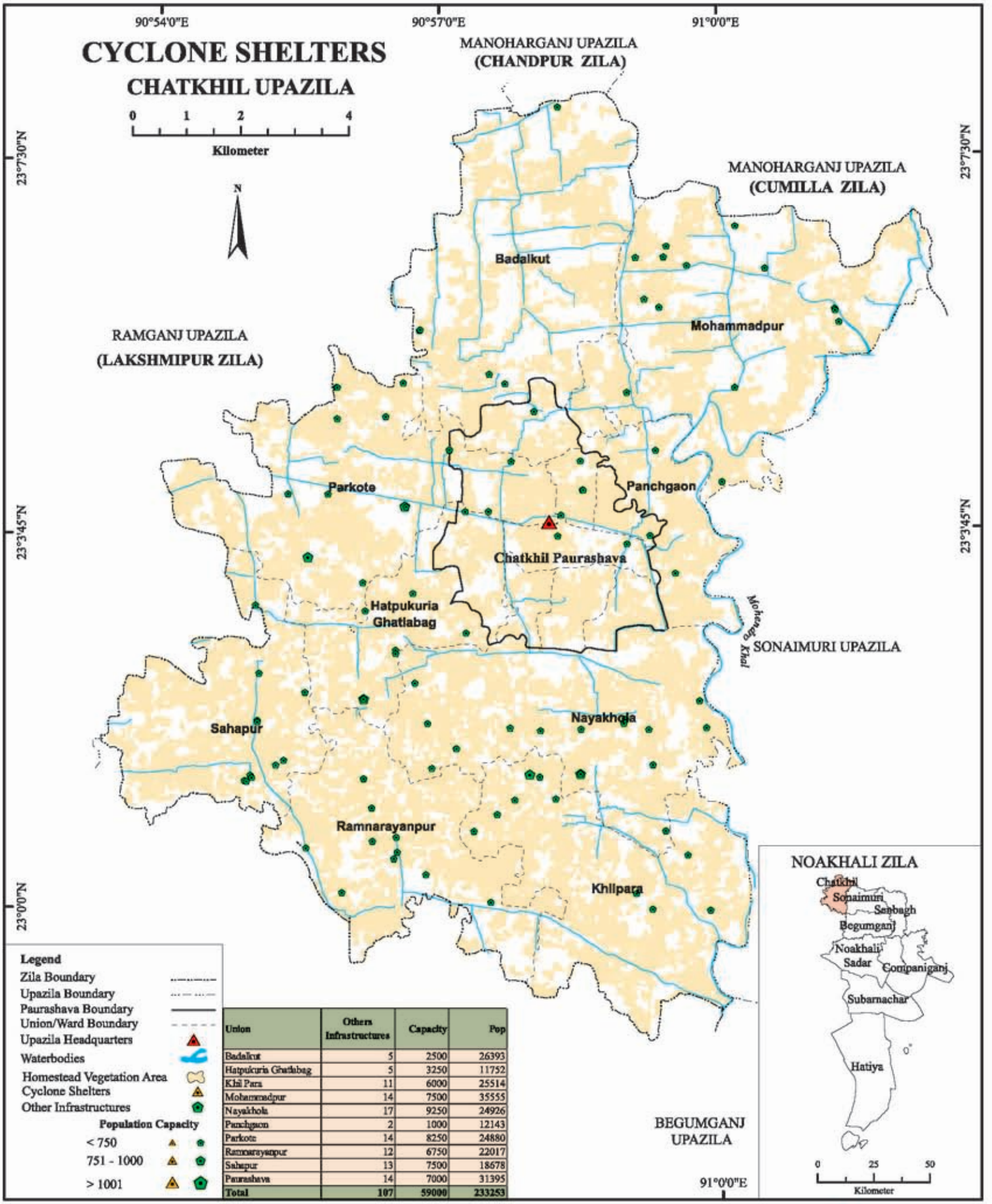
- Zila Boundary
- Upazila Boundary
- Paurashava Boundary
- Union/Ward Boundary
- Upazila Headquarters
- Waterbodies
- Homestead Vegetation Area
- Cyclone Shelters
- Other Infrastructures

Population Capacity

- < 750
- 751 - 1000
- > 1001

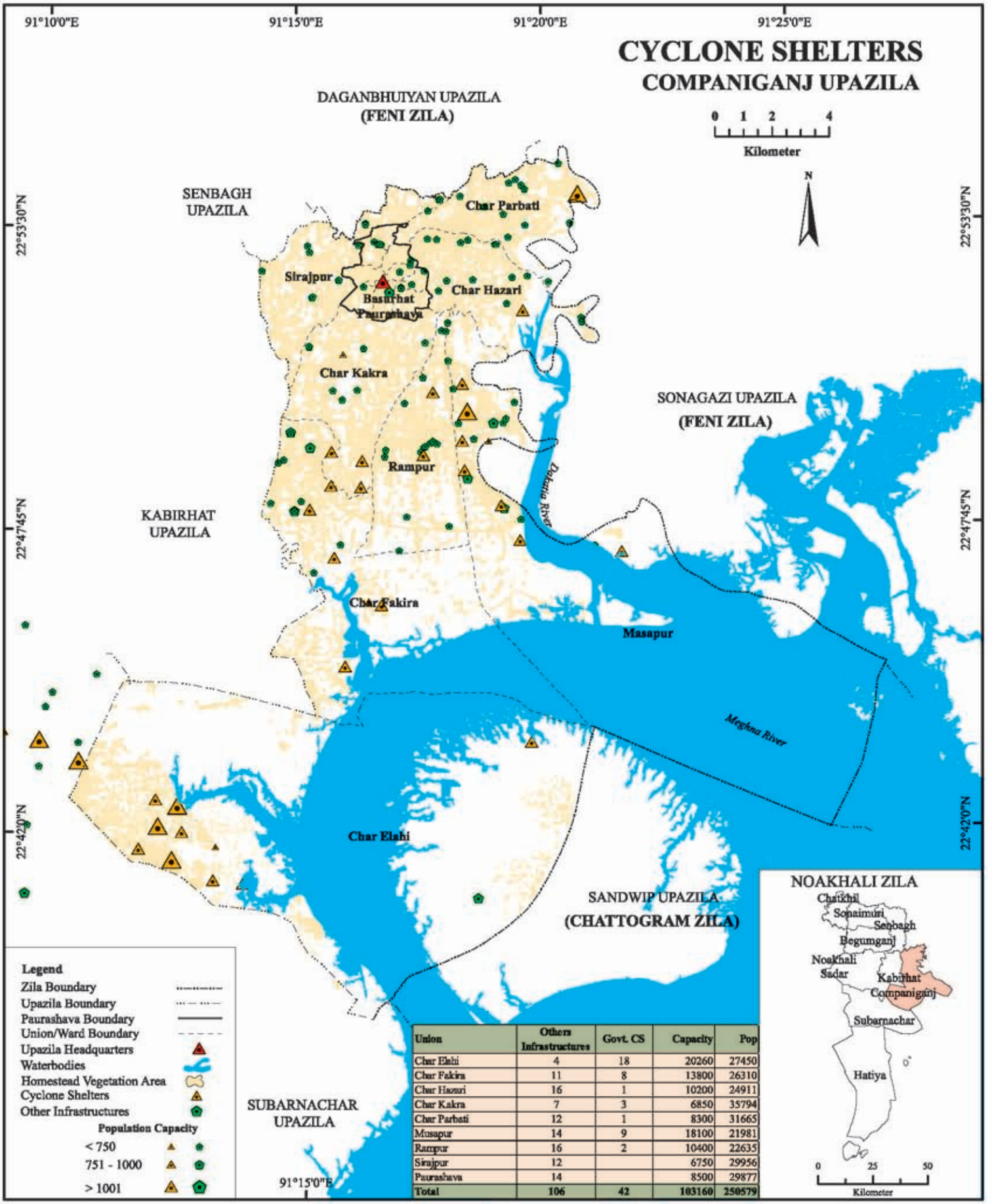
Union	Others Infrastructures	Capacity	Pop
Alyerapur	12	7750	33791
Amanullapur	9	6000	26776
Begumganj	4	2500	19310
Chhayani	18	13500	35484
Durgapur	10	6750	31282
Eklashpur	12	8500	41925
Gopalpur	9	5750	33395
Hajipur	9	5250	19429
Jirtali	16	10500	27607
Kadirpur	8	6500	26980
Kutubpur	13	7500	27284
Mir Warishpur	9	6000	31046
Narottampur	3	2250	18273
Rajganj	15	9500	39958
Rasulpur	18	11750	30684
Sharifpur	10	6000	26083
Paurashava	27	23500	80001
Total	**202**	**139500**	**549308**

Stat4Dev Project, 2020



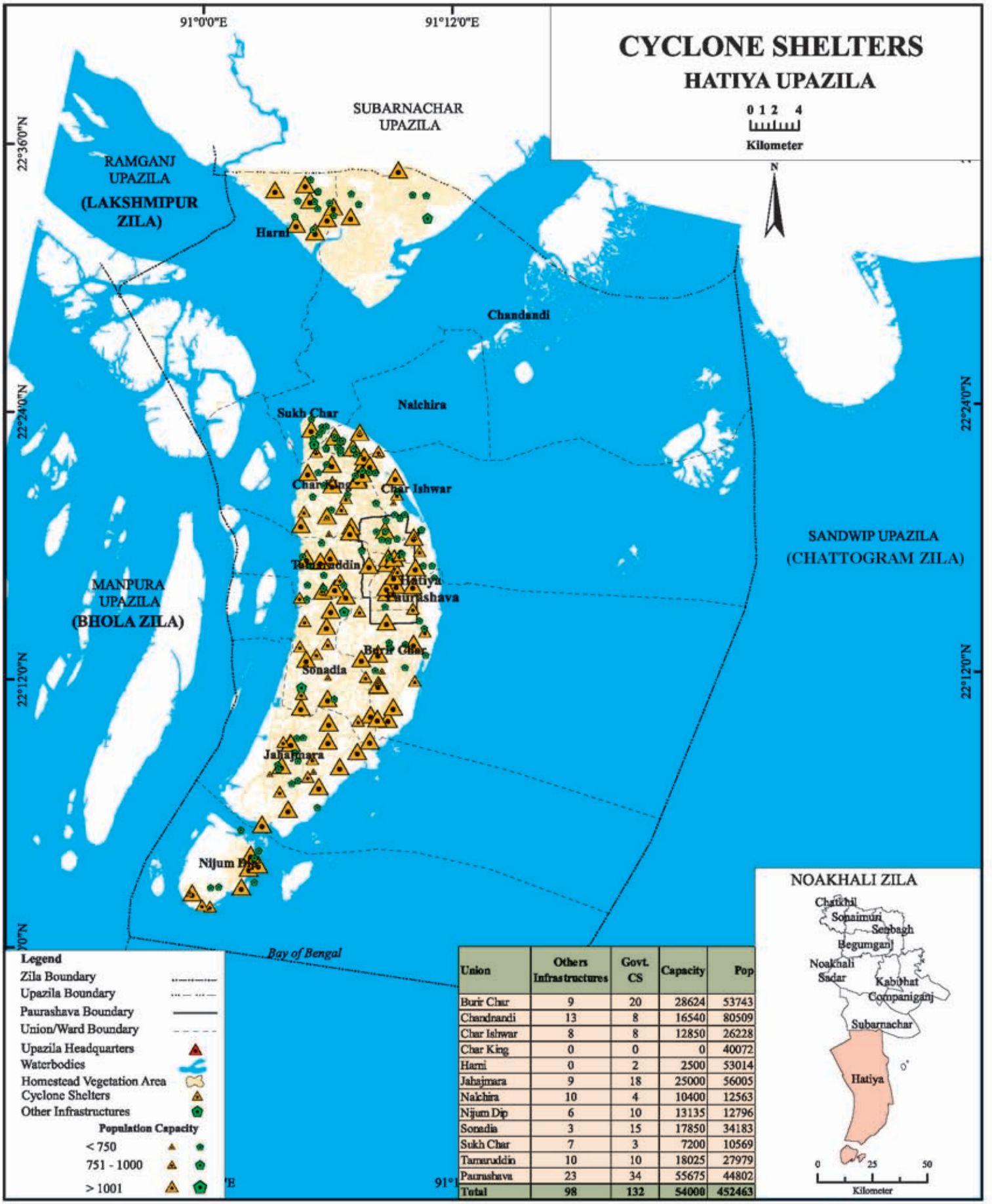
Union	Others Infrastructures	Capacity	Pop
Badalkut	5	2500	26393
Hatpukuria Ghatlabag	5	3250	11752
Khil Para	11	6000	25514
Mohammadpur	14	7500	35555
Nayakhola	17	9250	24926
Panchgaon	2	1000	12143
Parkote	14	8250	24880
Ramnarayanpur	12	6750	22017
Sahapur	13	7500	18678
Paurashava	14	7000	31395
Total	**107**	**59000**	**233253**

Stat4Dev Project, 2020



Union	Others Infrastructures	Govt. CS	Capacity	Pop
Char Elahi	4	18	20260	27450
Char Fakira	11	8	13800	26310
Char Hazari	16	1	10200	24911
Char Kakra	7	3	6850	35794
Char Parbati	12	1	8300	31665
Masapur	14	9	18100	21981
Rampur	16	2	10400	22635
Sirajpur	12		6750	29956
Paurashava	14		8500	29877
Total	**106**	**42**	**103160**	**250579**

Stat4Dev Project, 2020



Union	Others Infrastructures	Govt. CS	Capacity	Pop
Burir Char	9	20	28624	53743
Chandnandi	13	8	16540	80509
Char Ishwar	8	8	12850	26228
Char King	0	0	0	40072
Harni	0	2	2500	53014
Jahajmara	9	18	25000	56005
Nalchira	10	4	10400	12563
Nijum Dip	6	10	13135	12796
Sonadia	3	15	17850	34183
Sukh Char	7	3	7200	10569
Tamaruddin	10	10	18025	27979
Paurashava	23	34	55675	44802
Total	98	132	54000	452463

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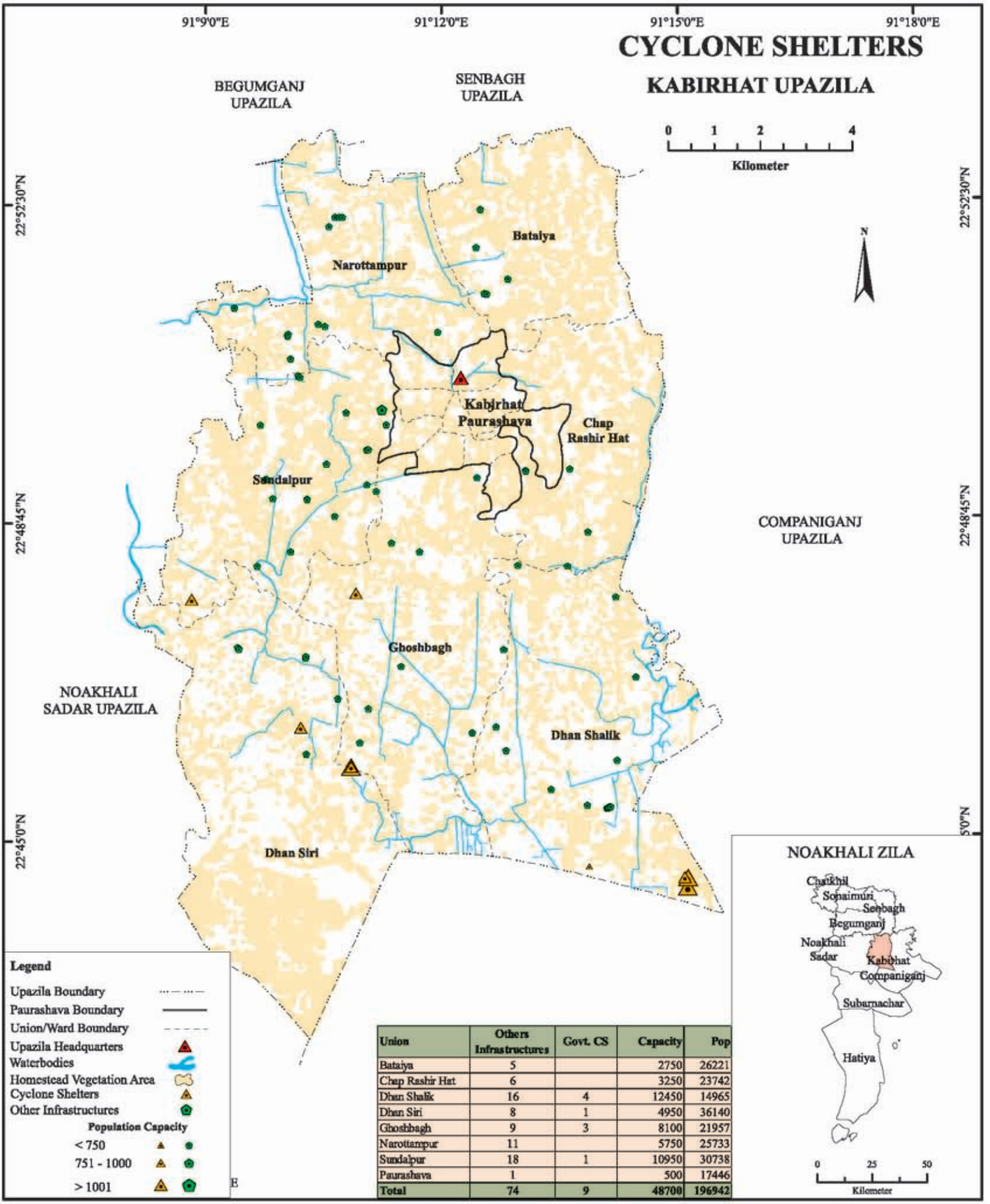

Union	Others Infrastructures	Govt. CS	Capacity	Pop
Bataiya	5		2750	26221
Chap Rashir Hat	6		3250	23742
Dhan Shalik	16	4	12450	14965
Dhan Siri	8	1	4950	36140
Ghoshbagh	9	3	8100	21957
Narottampur	11		5750	25733
Sundalpur	18	1	10950	30738
Paurashava	1		500	17446
Total	**74**	**9**	**48700**	**196942**

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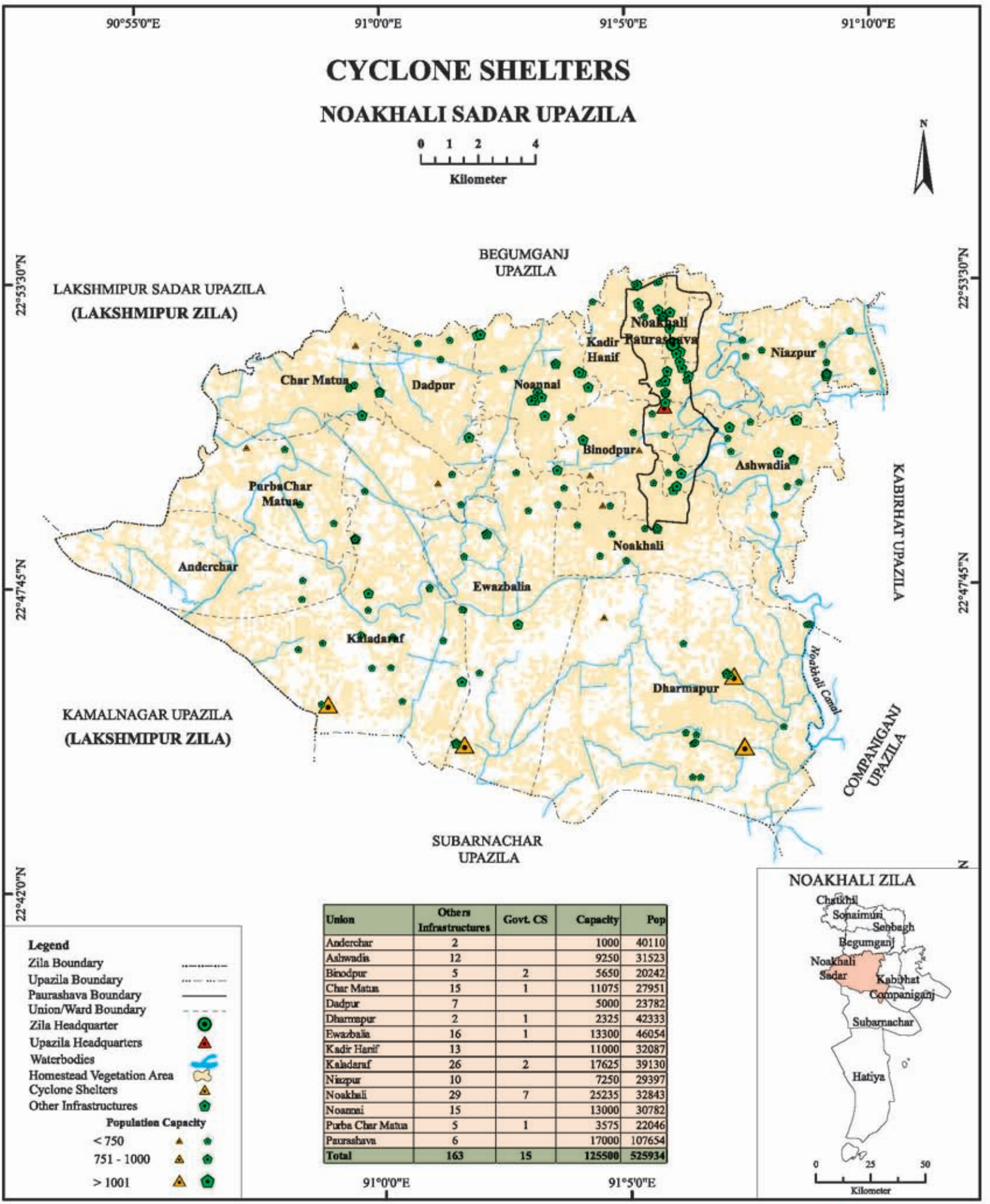
CYCLONE SHELTERS

NOAKHALI SADAR UPAZILA



Union	Others Infrastructures	Govt. CS	Capacity	Pop
Anderchar	2		1000	40110
Ashwadia	12		9250	31523
Binodpur	5	2	5650	20242
Char Matua	15	1	11075	27951
Dadpur	7		5000	23782
Dharmapur	2	1	2325	42333
Ewazbalia	16	1	13300	46054
Kadir Hanif	13		11000	32087
Kaladaraf	26	2	17625	39130
Niazpur	10		7250	29397
Noakhali	29	7	25235	32843
Noannai	15		13000	30782
Purba Char Matua	5	1	3575	22046
Paurashava	6		17000	107654
Total	**163**	**15**	**125500**	**525934**

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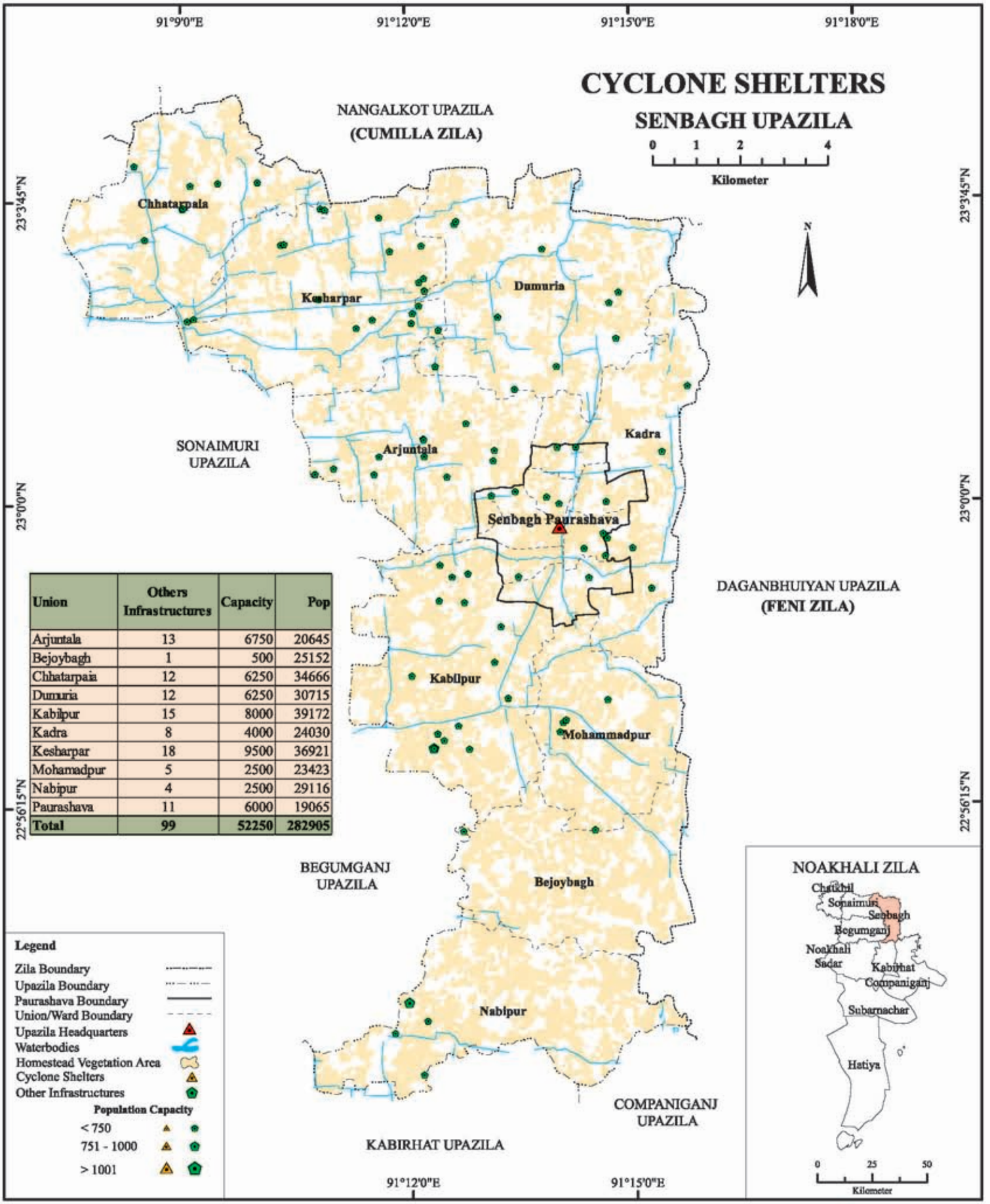

Union	Others Infrastructures	Capacity	Pop
Arjuntala	13	6750	20645
Bejoybagh	1	500	25152
Chhatarpaia	12	6250	34666
Dumuria	12	6250	30715
Kabilpur	15	8000	39172
Kadra	8	4000	24030
Kesharpar	18	9500	36921
Mohamadpur	5	2500	23423
Nabipur	4	2500	29116
Paurashava	11	6000	19065
Total	**99**	**52250**	**282905**

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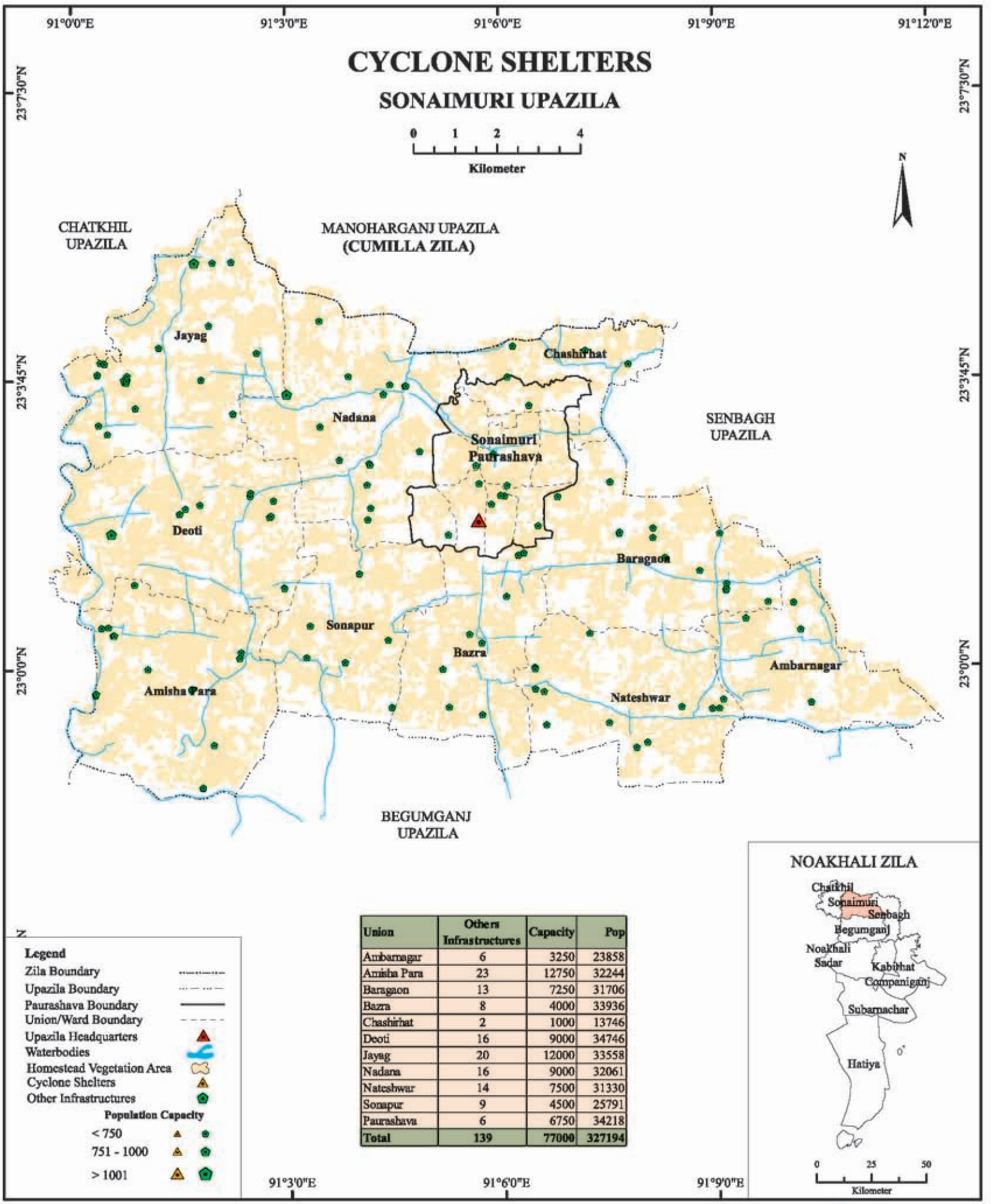
CYCLONE SHELTERS

SONAIMURI UPAZILA



Union	Others Infrastructures	Capacity	Pop
Ambarnagar	6	3250	23858
Amisha Para	23	12750	32244
Baragaon	13	7250	31706
Bazra	8	4000	33936
Chashirhat	2	1000	13746
Deoti	16	9000	34746
Jayag	20	12000	33558
Nadana	16	9000	32061
Nateshwar	14	7500	31330
Sonapur	9	4500	25791
Paurashava	6	6750	34218
Total	**139**	**77000**	**327194**

Legend

- Zila Boundary
- Upazila Boundary
- Paurashava Boundary
- Union/Ward Boundary
- Upazila Headquarters
- Waterbodies
- Homestead Vegetation Area
- Cyclone Shelters
- Other Infrastructures

Population Capacity

- < 750
- 751 - 1000
- > 1001

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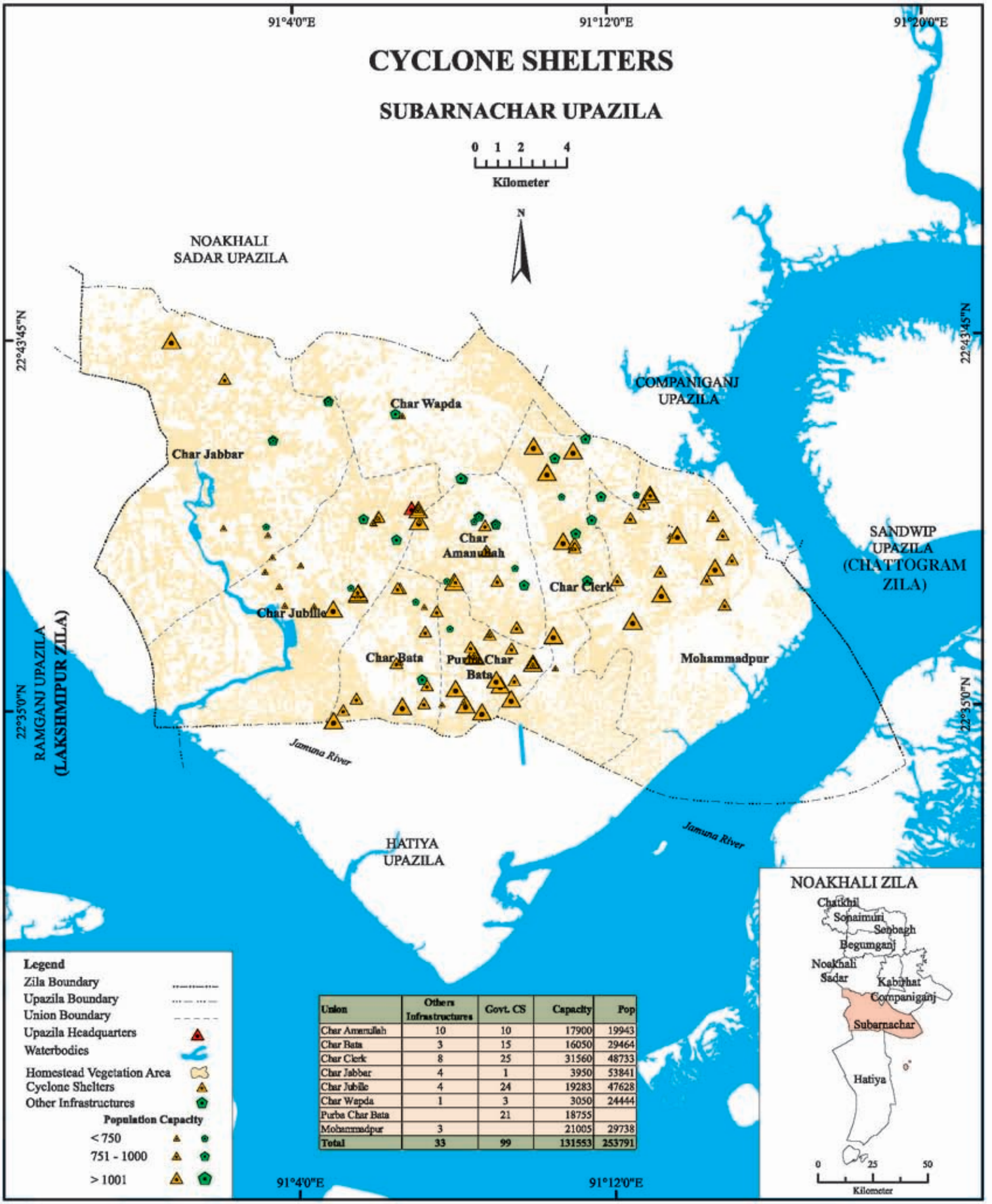

Union	Others Infrastructures	Govt. CS	Capacity	Pop
Char Amanullah	10	10	17900	19943
Char Bata	3	15	16050	29464
Char Clerk	8	25	31560	48733
Char Jabbar	4	1	3950	53841
Char Jubilee	4	24	19283	47628
Char Wapda	1	3	3050	24444
Purba Char Bata		21	18755	
Mohammadpur	3		21005	29738
Total	33	99	131553	253791

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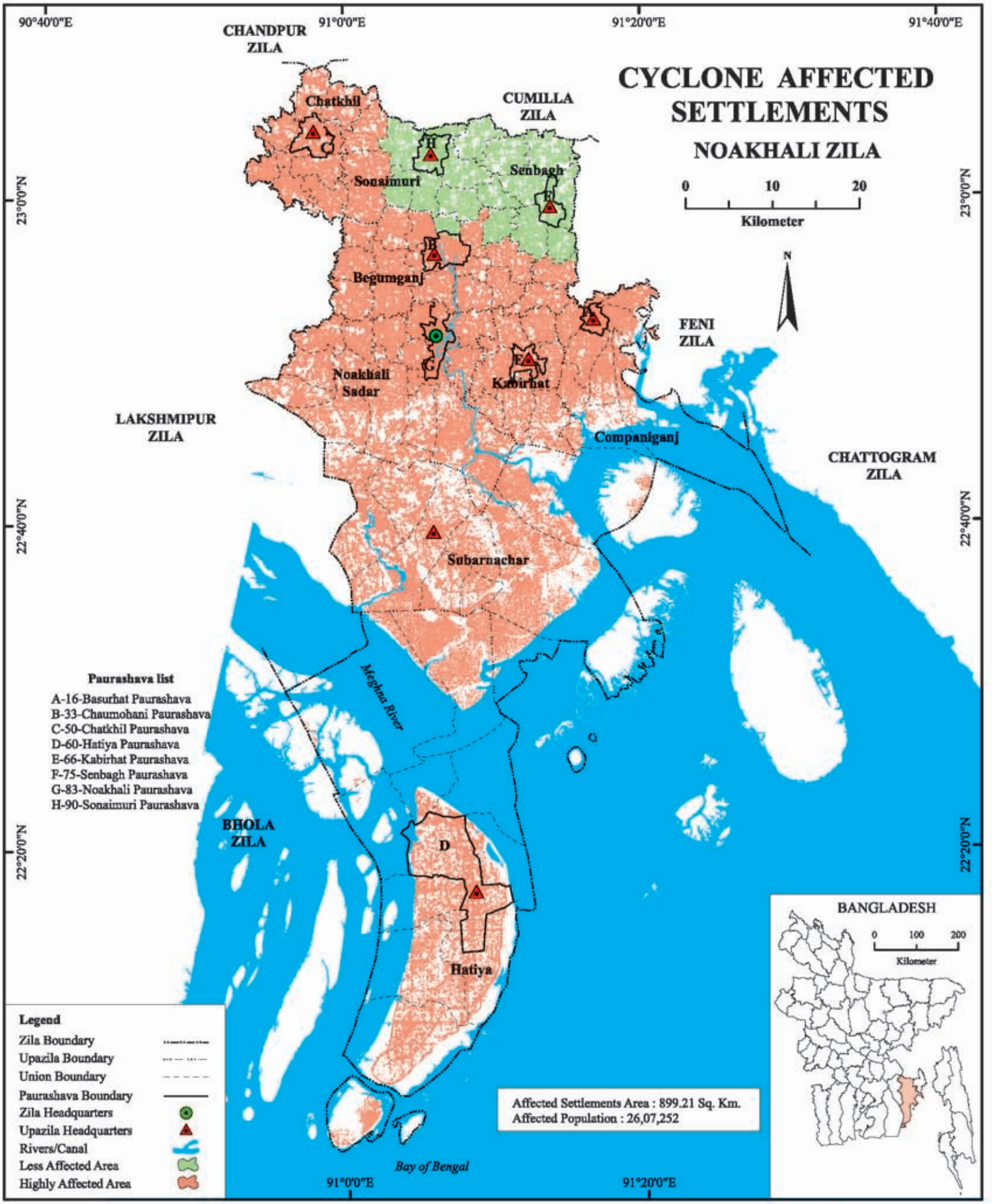
Chapter 4

Hazard Assessment and Mapping

Cyclone Affected Area Map



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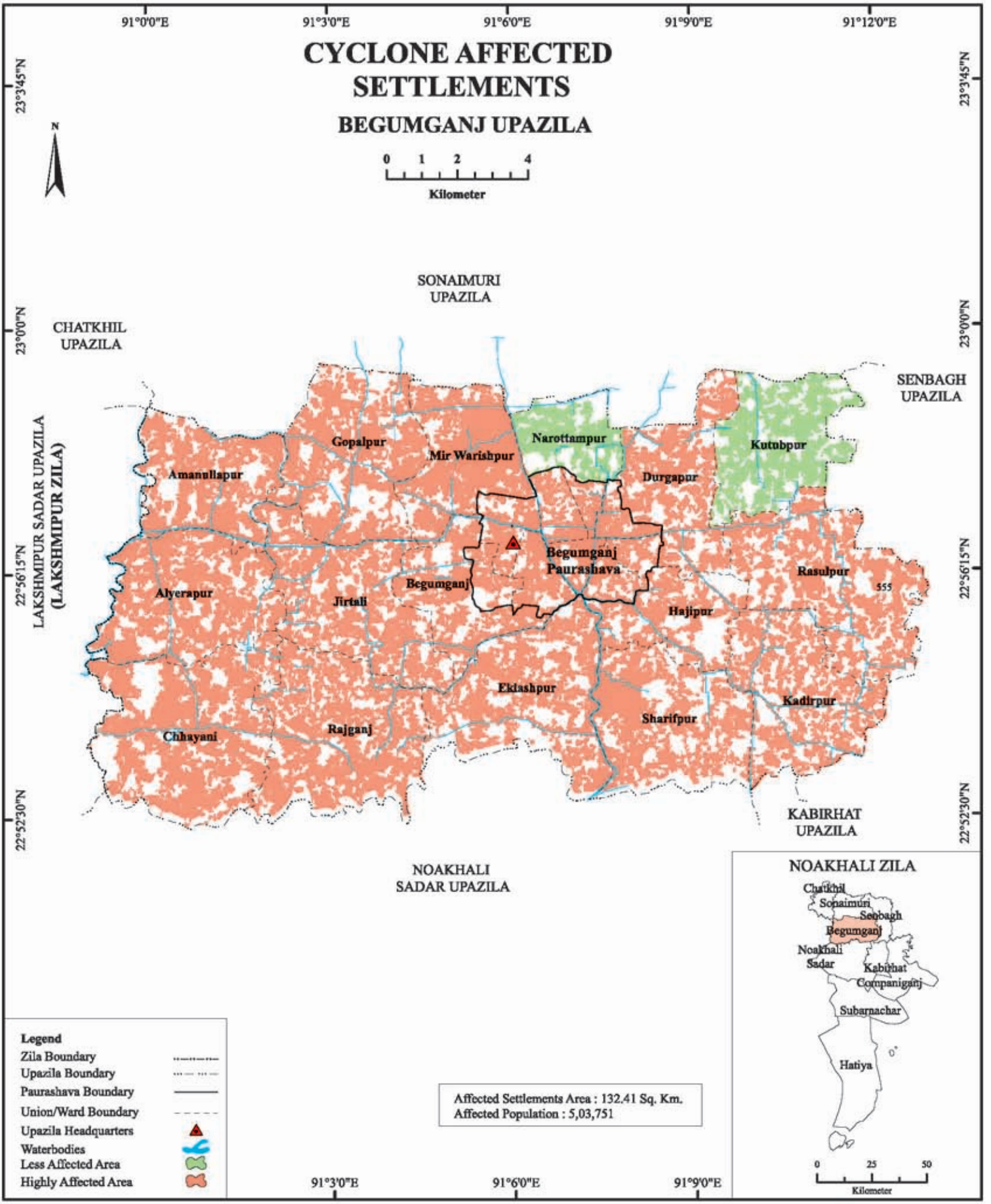

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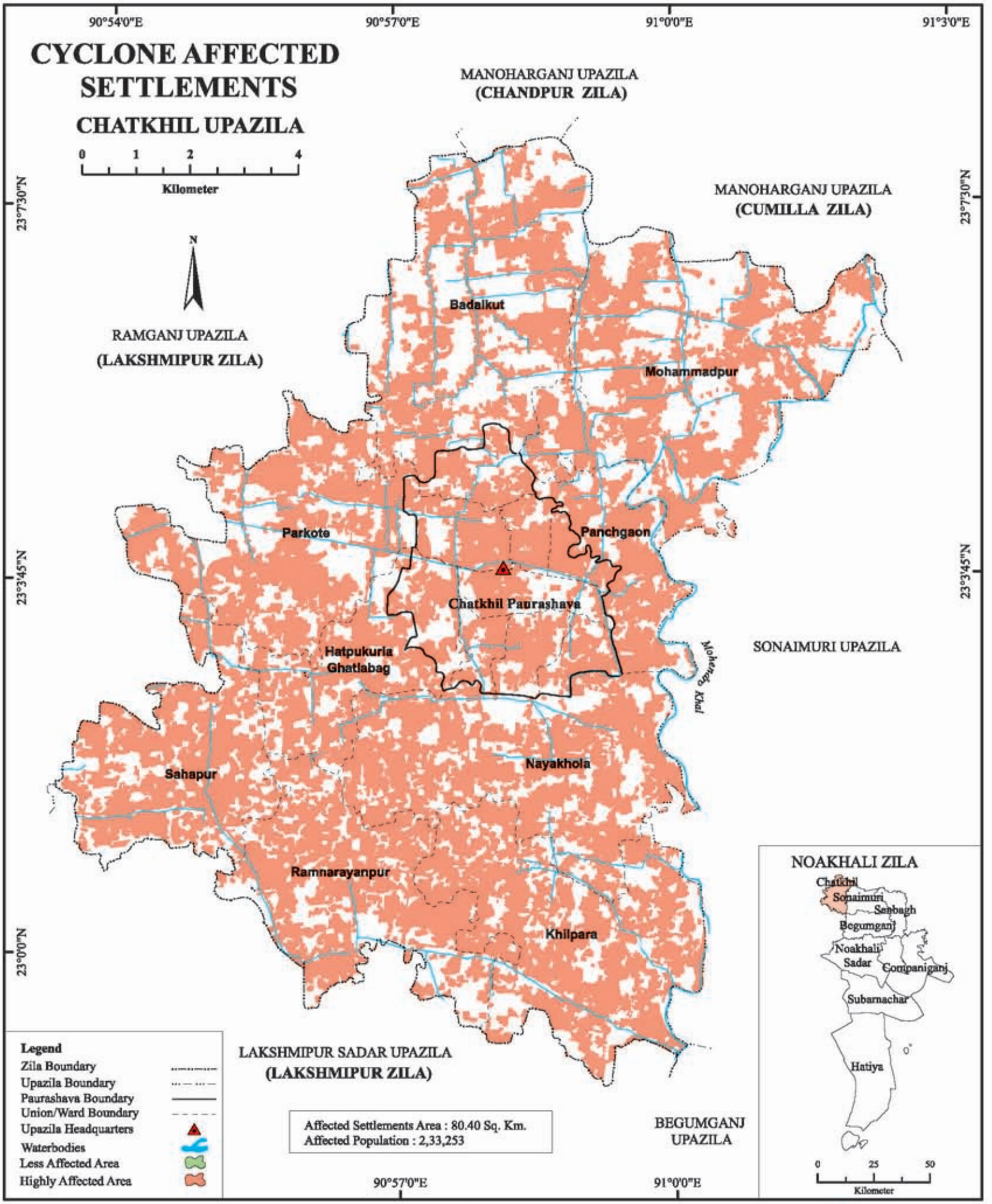

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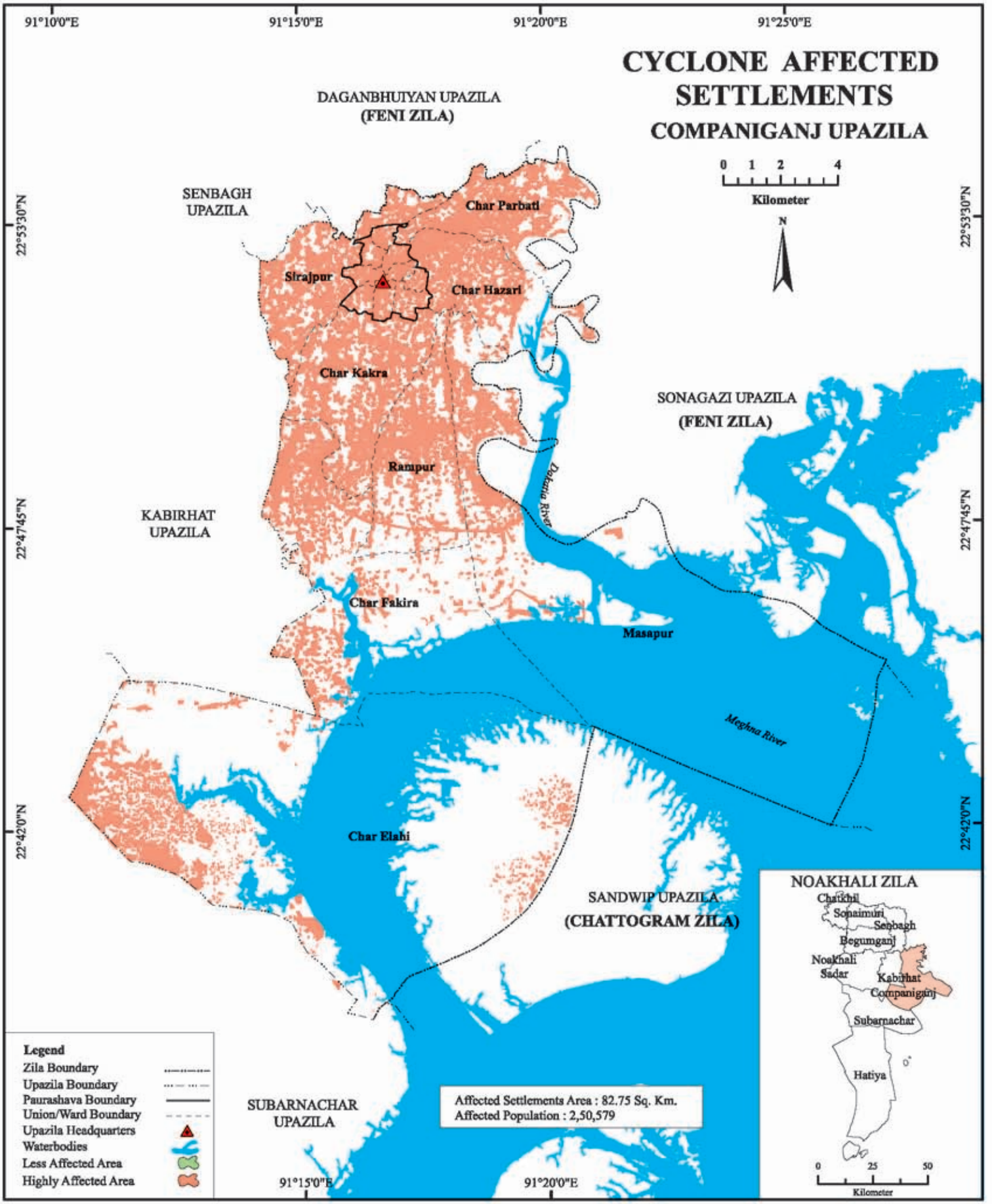

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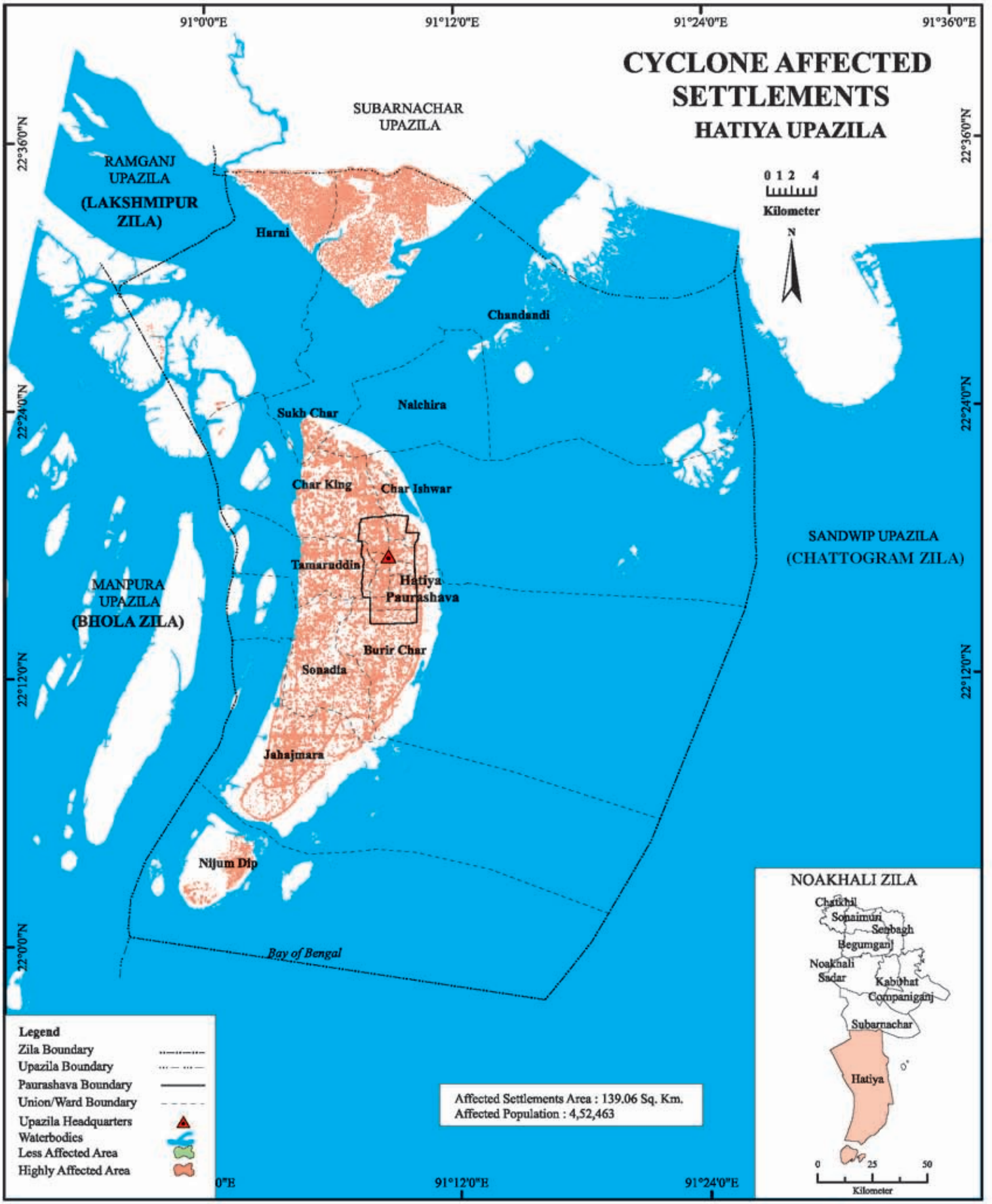

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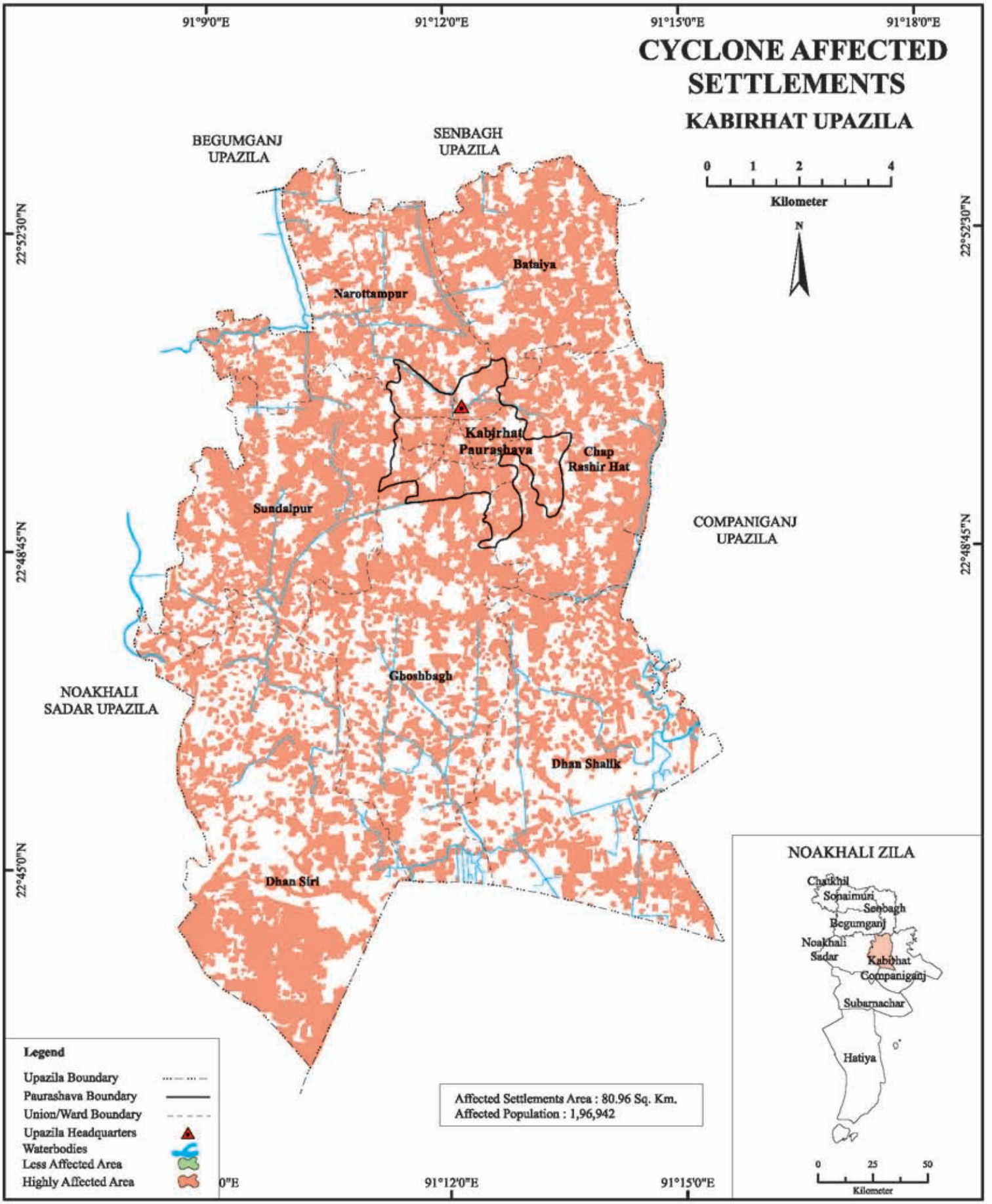

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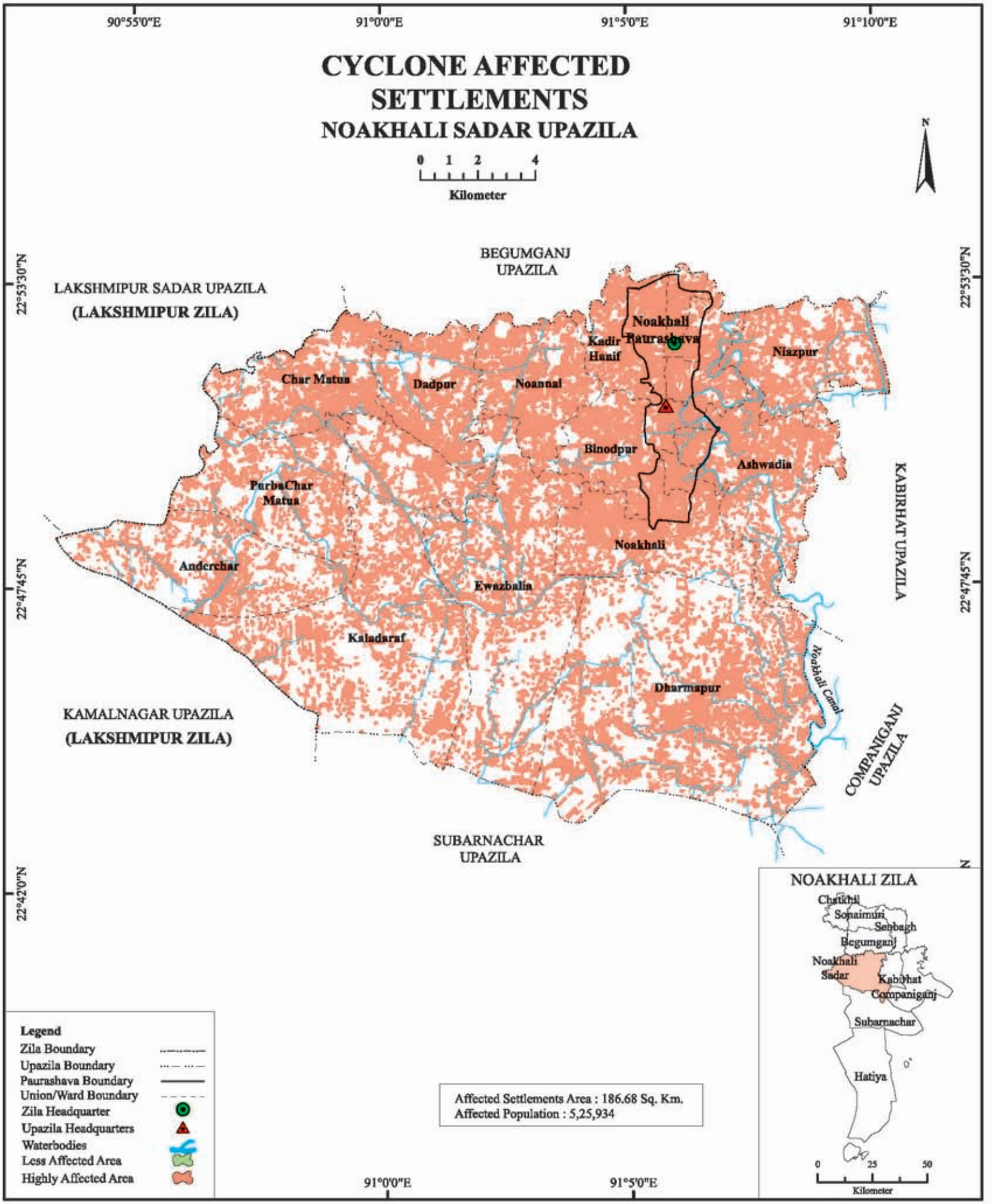

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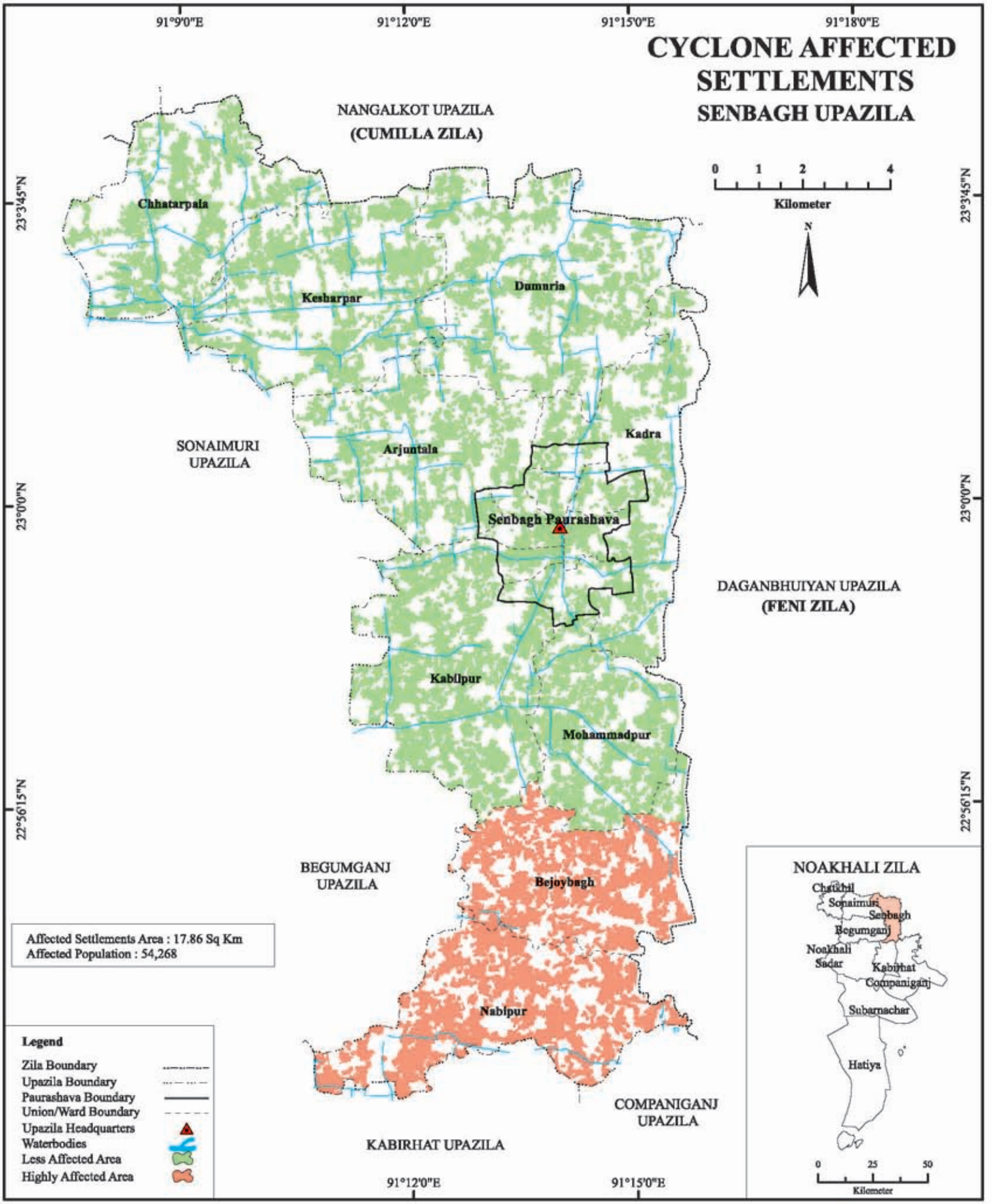

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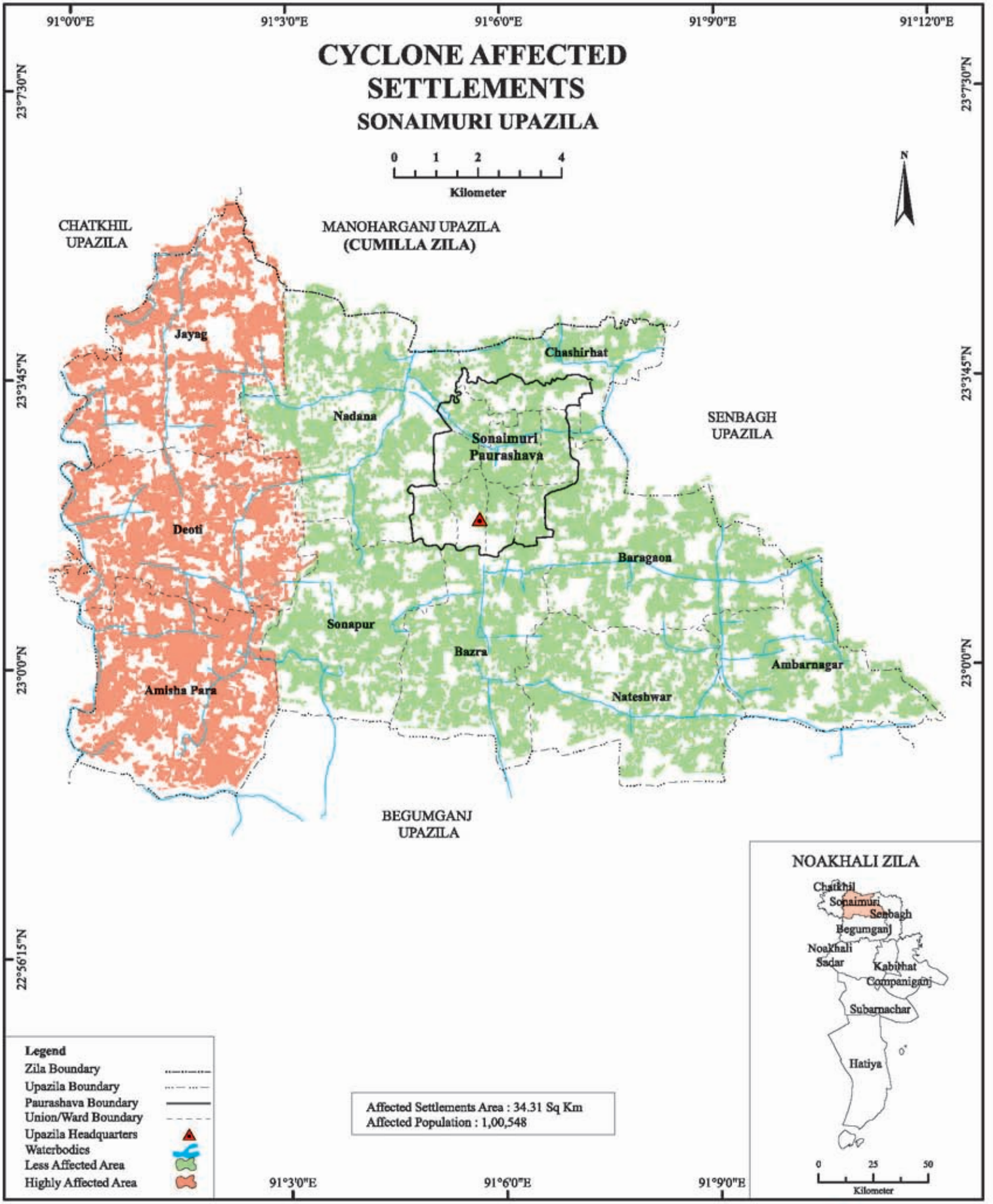

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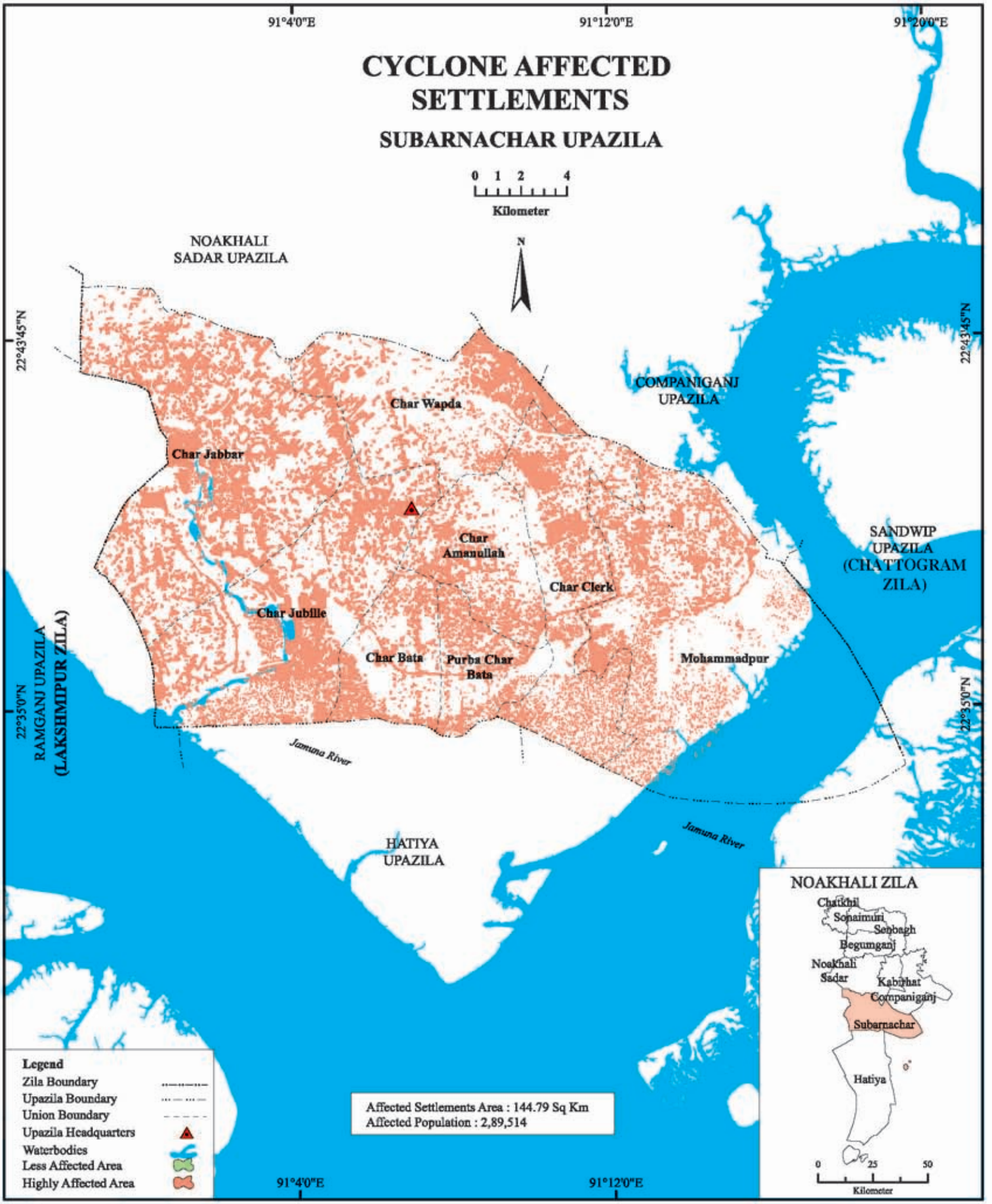

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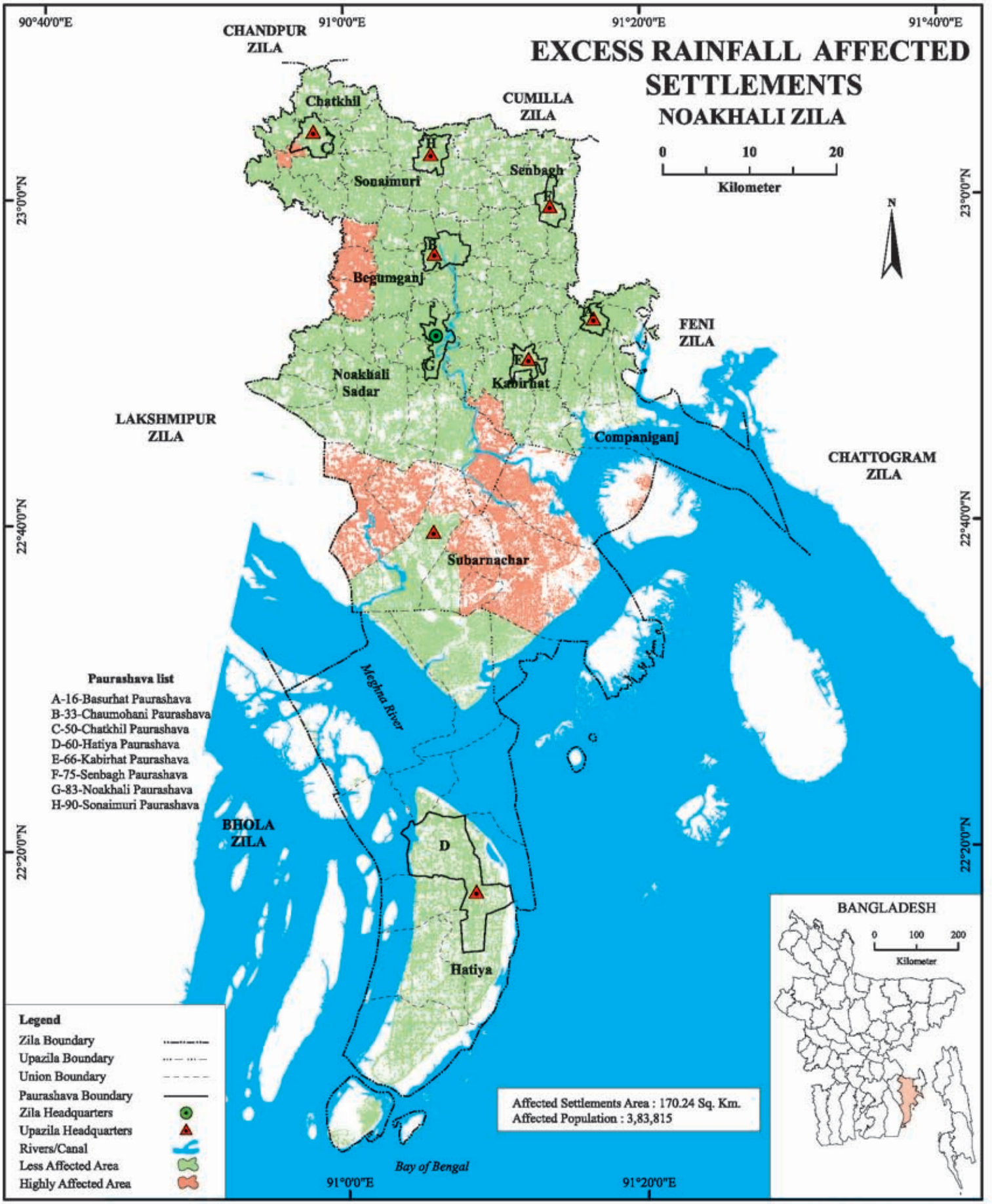
Excess Rainfall Affected Area Map



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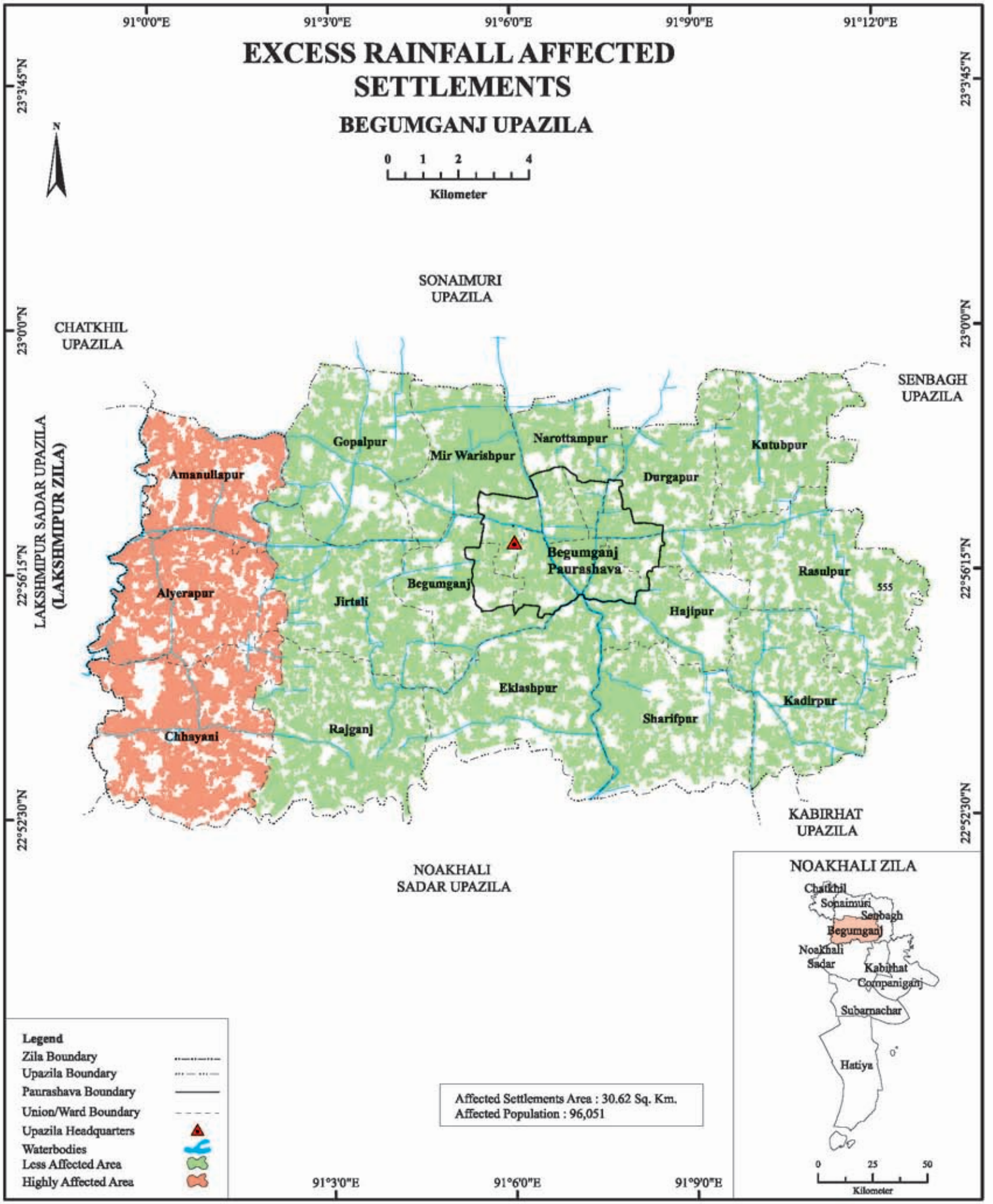

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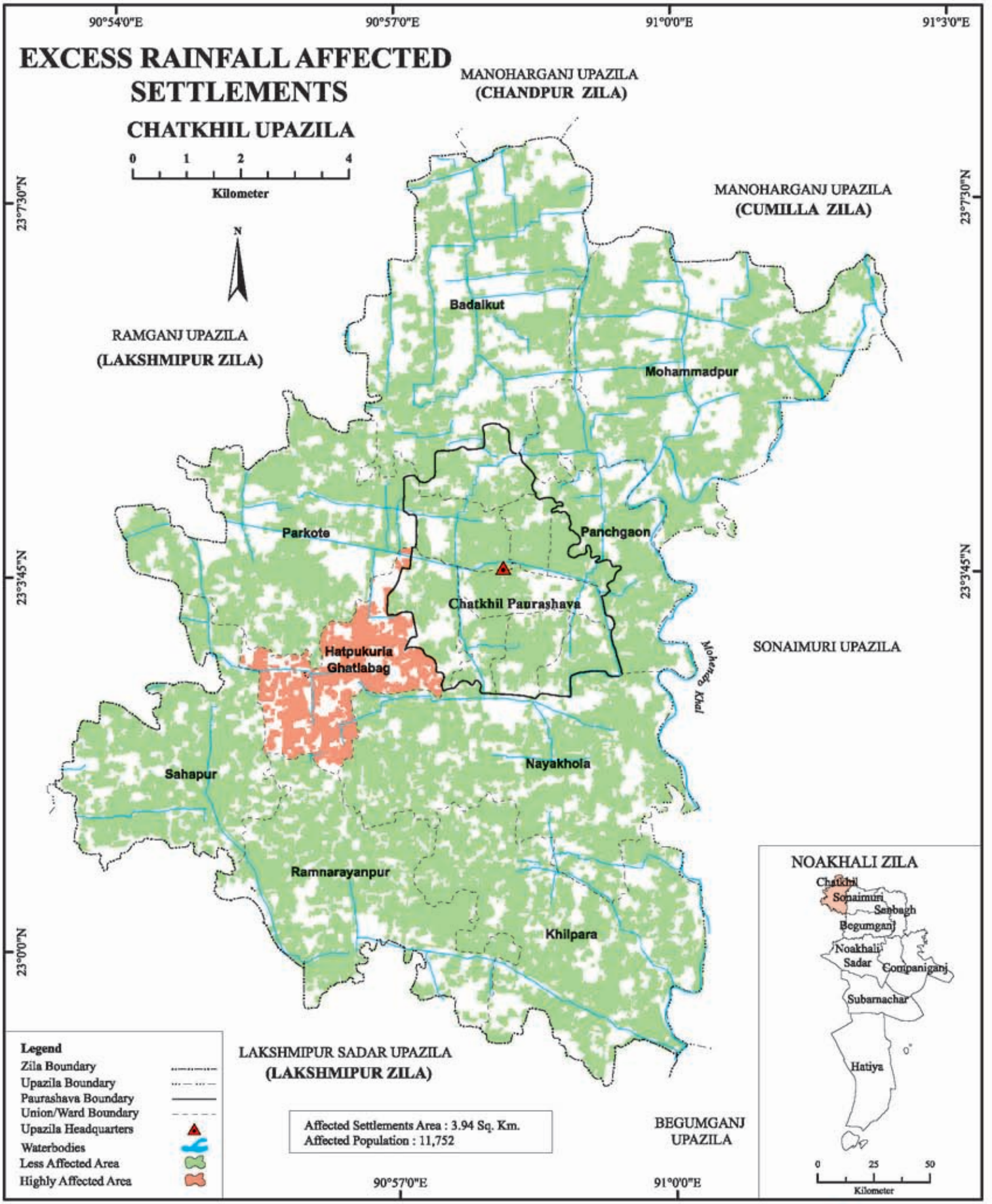

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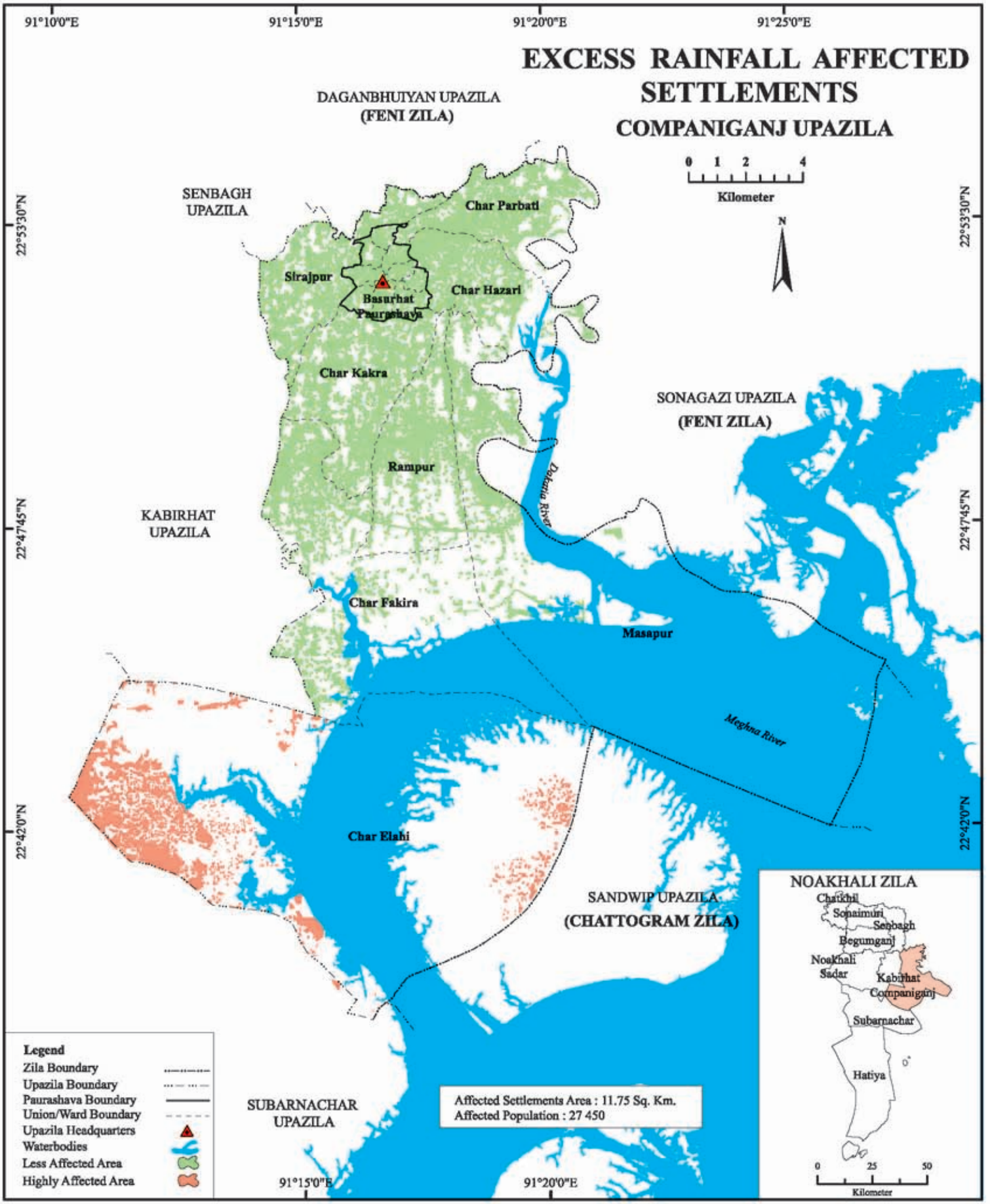

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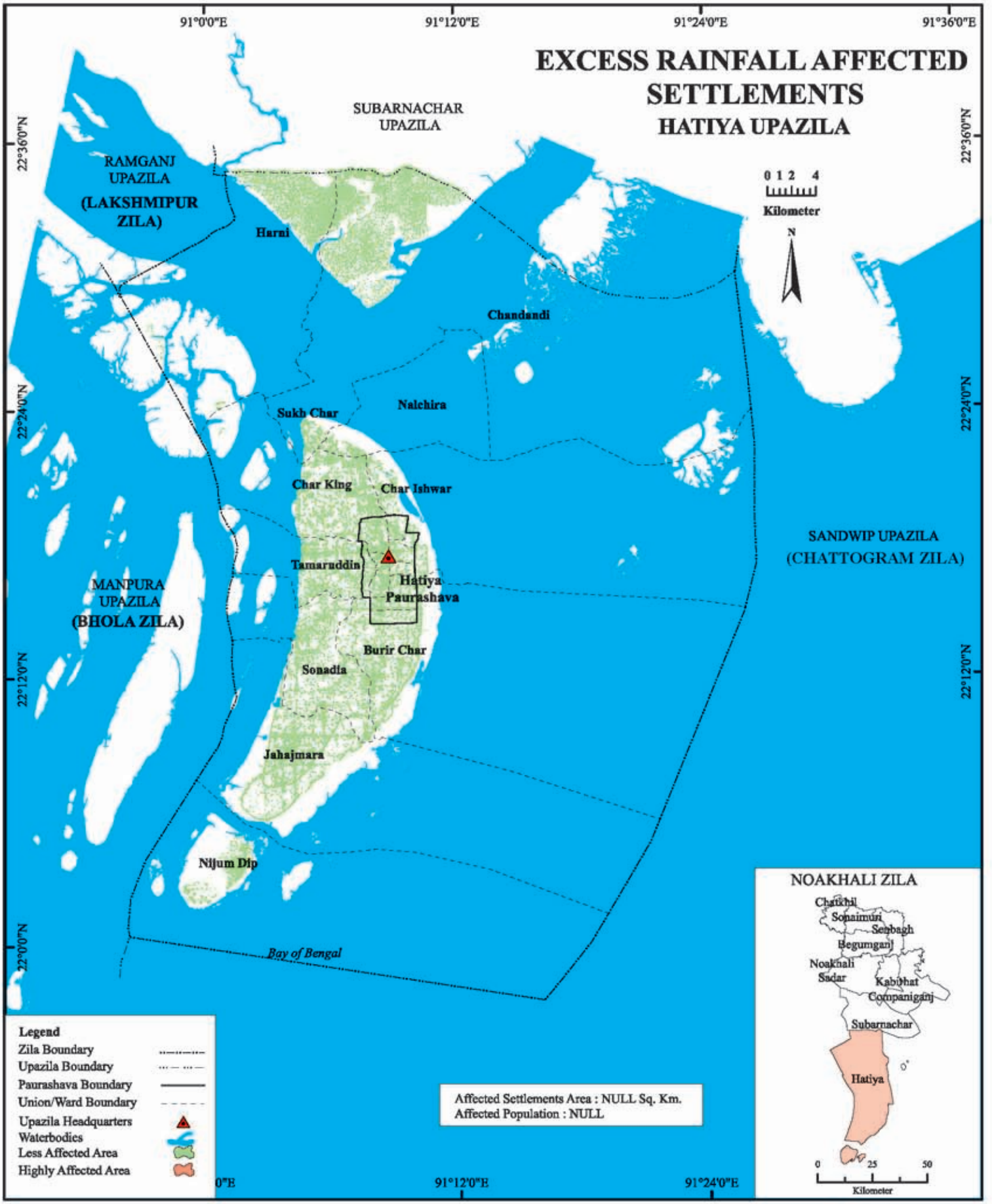

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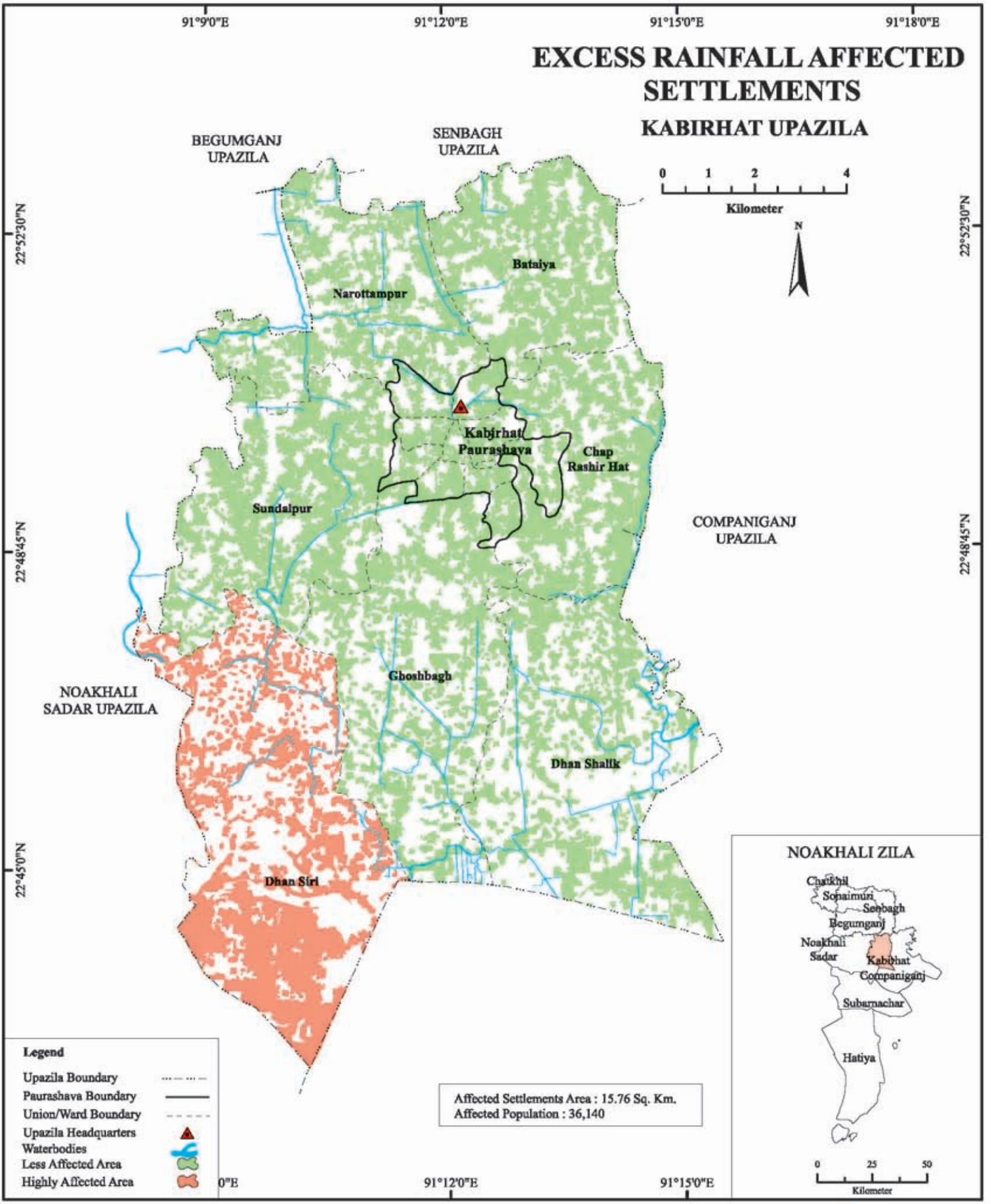

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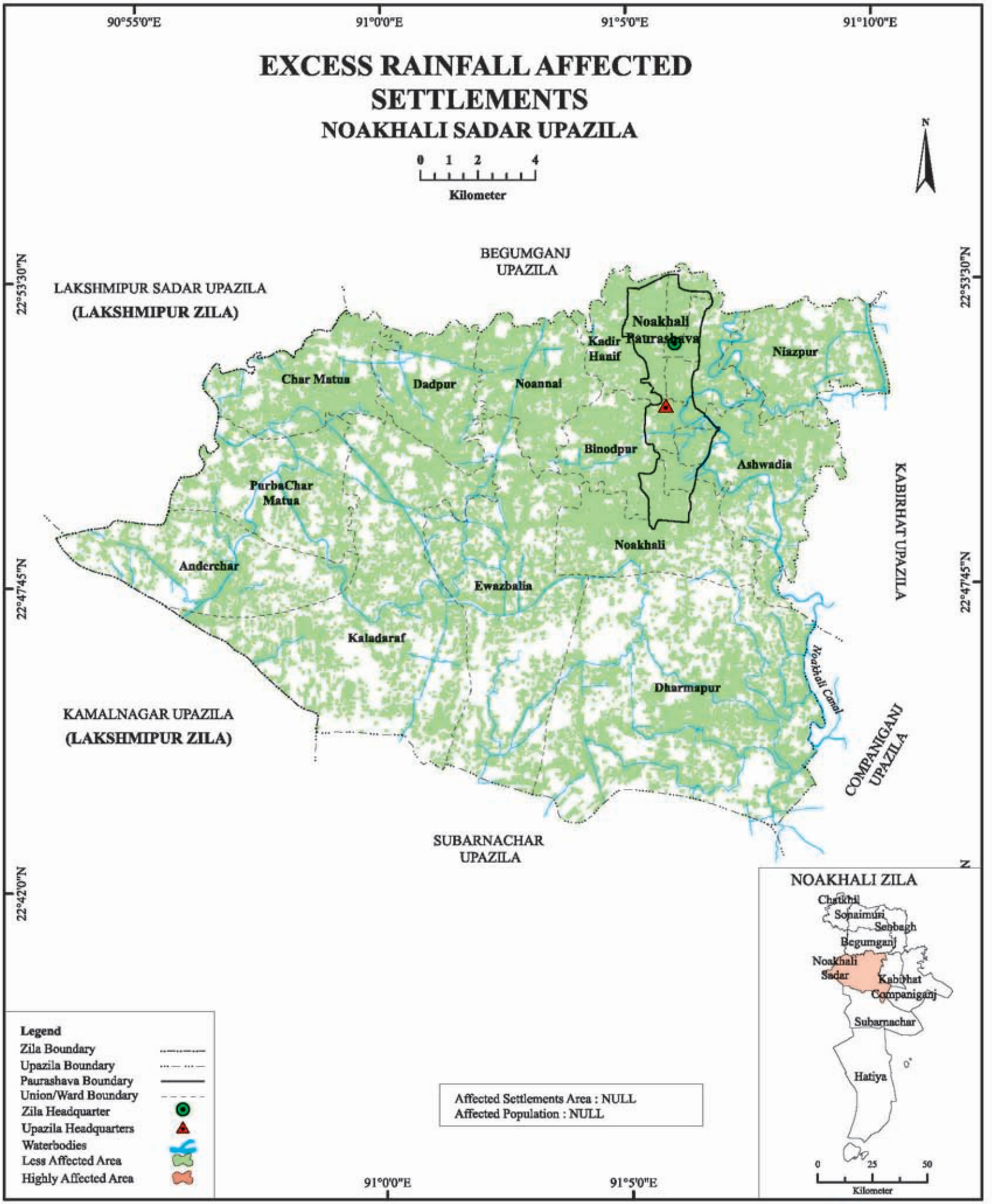

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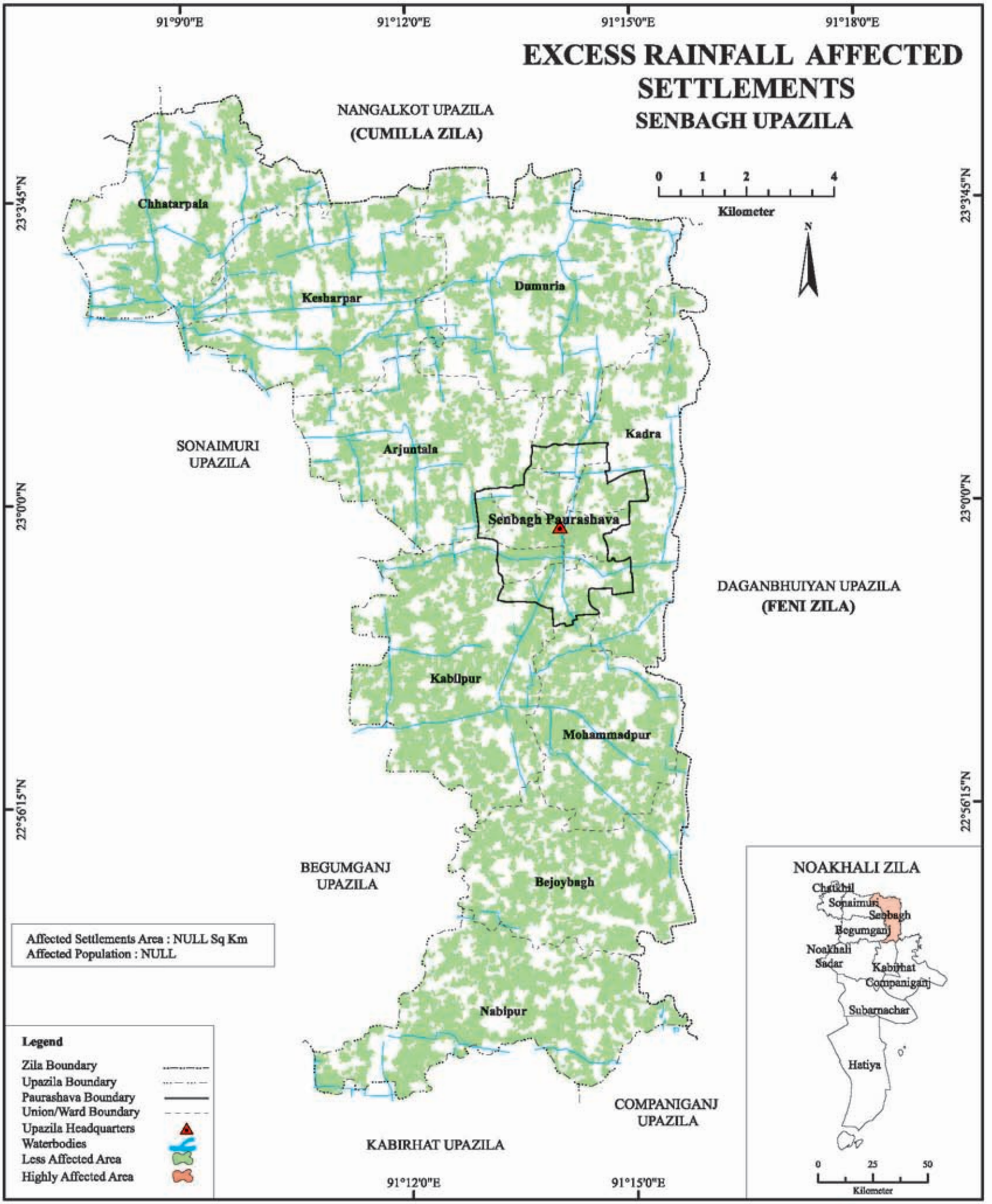

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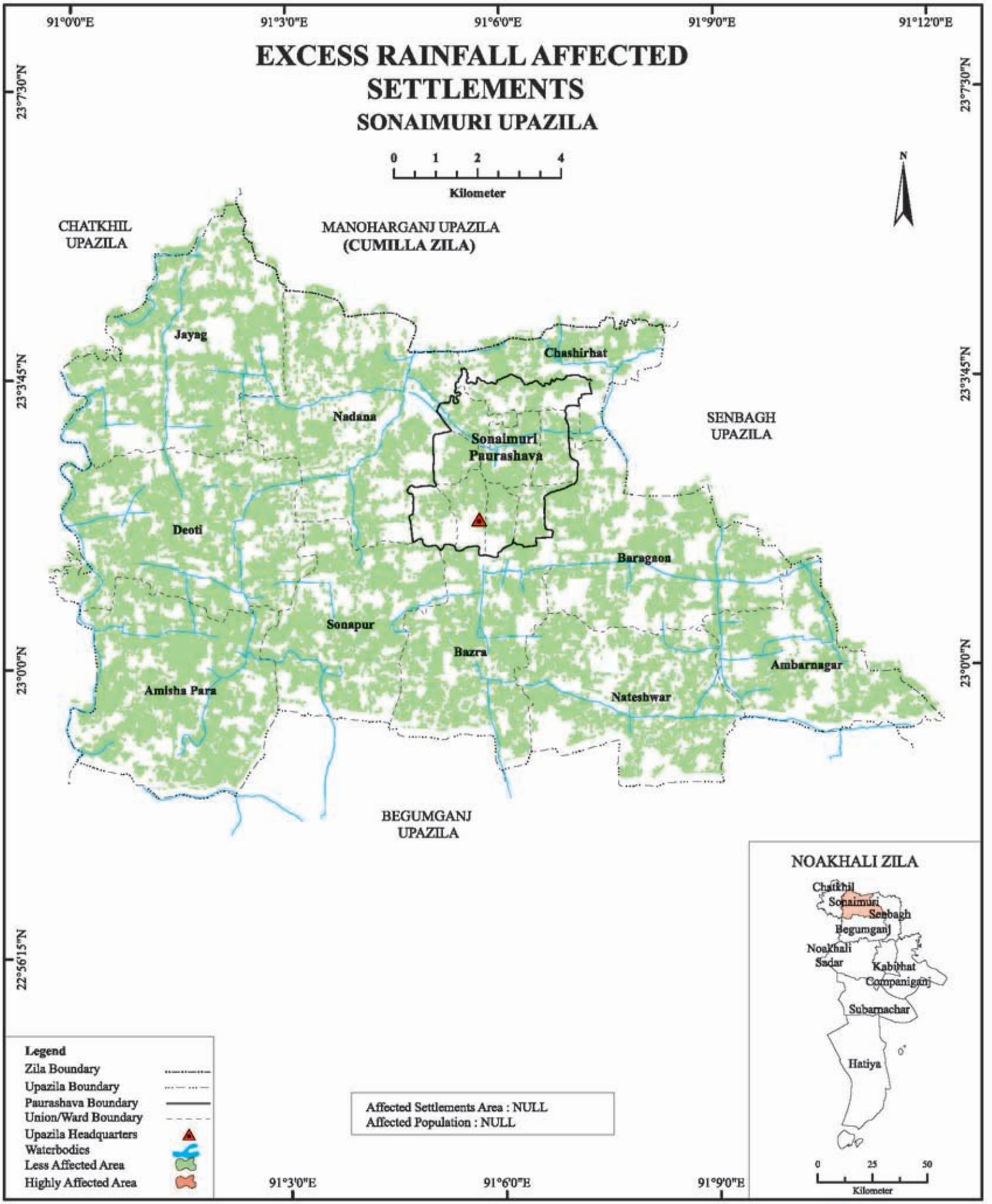

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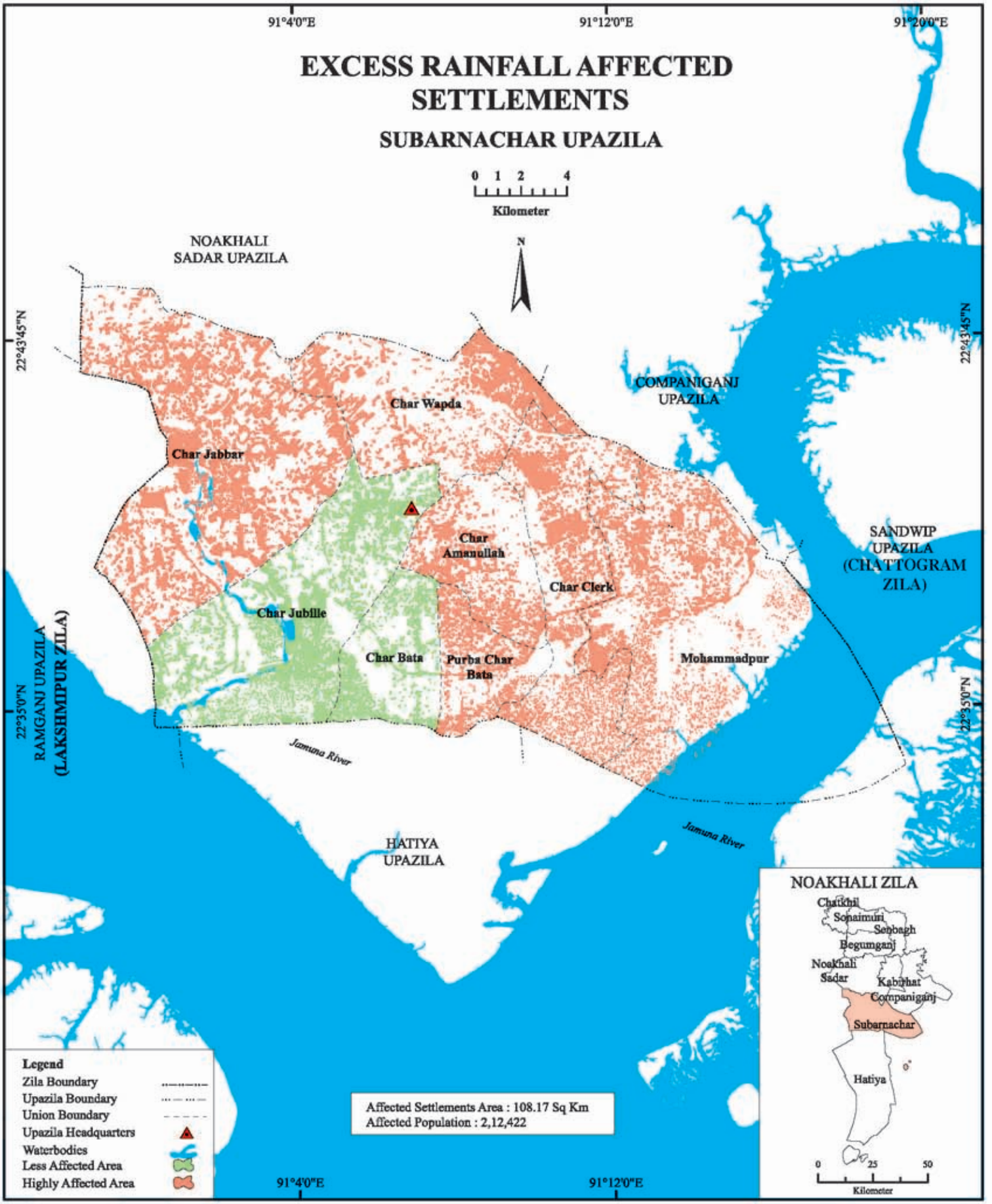
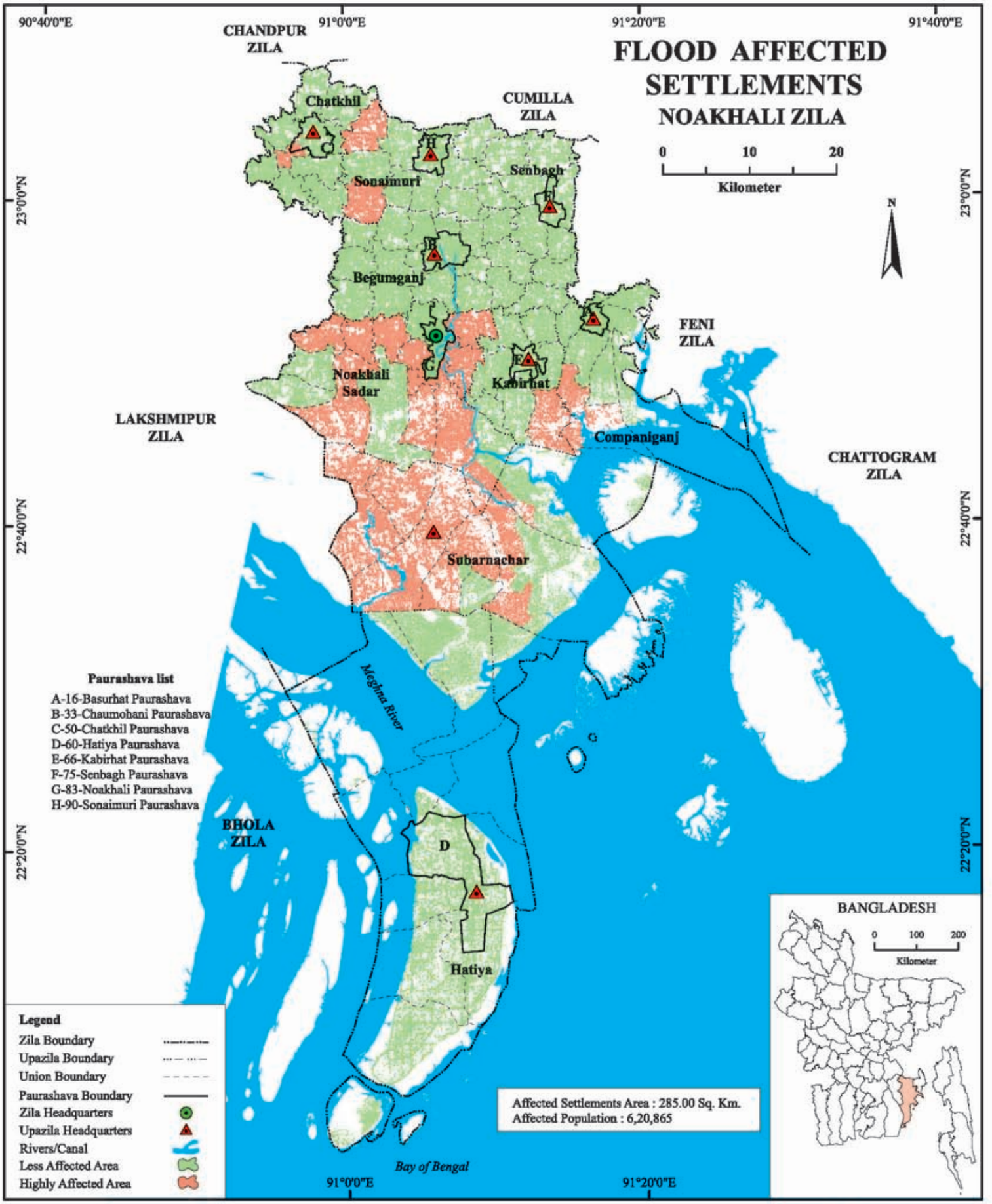


Stat4Dev Project, 2020

Flood Affected Area Map



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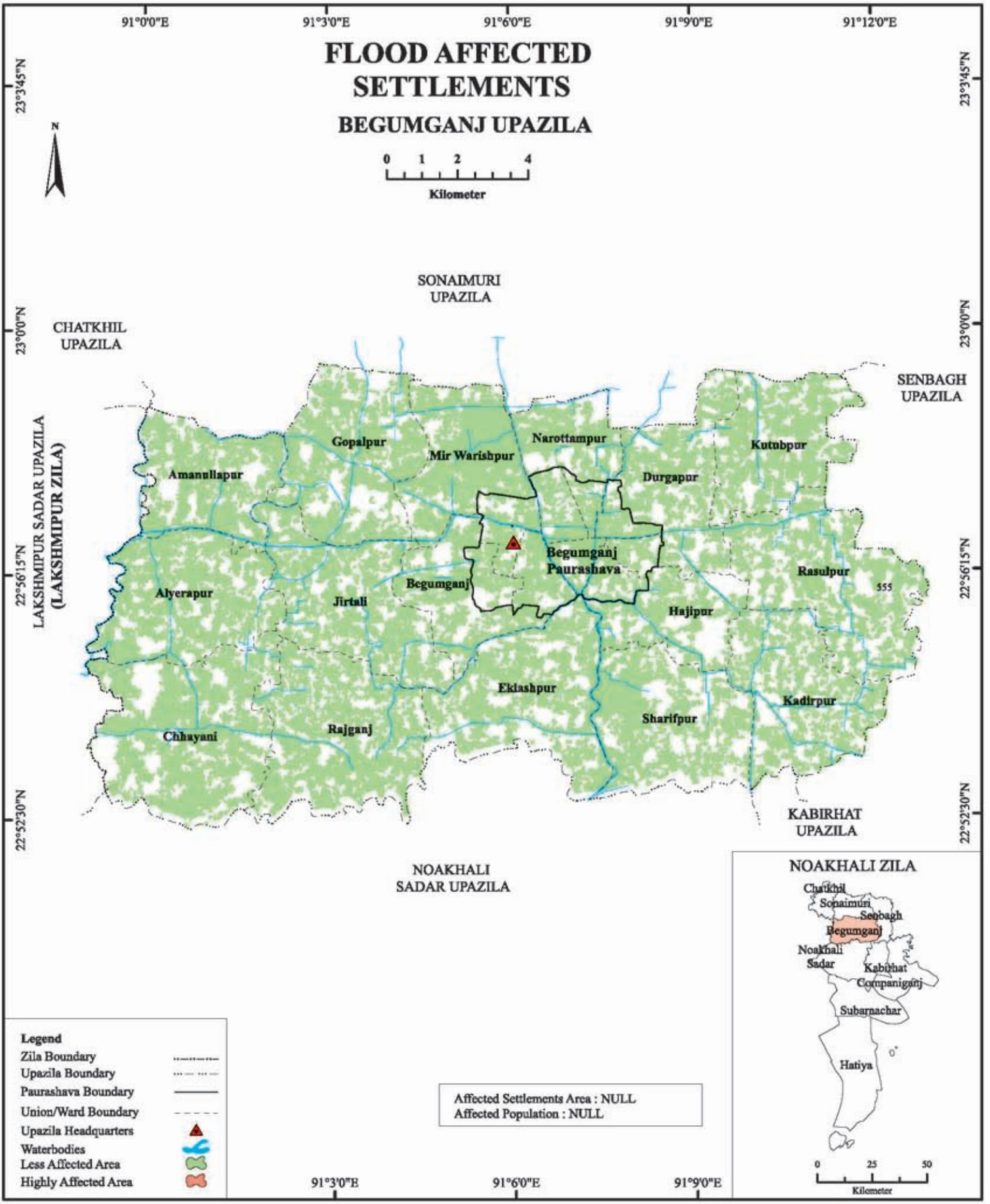

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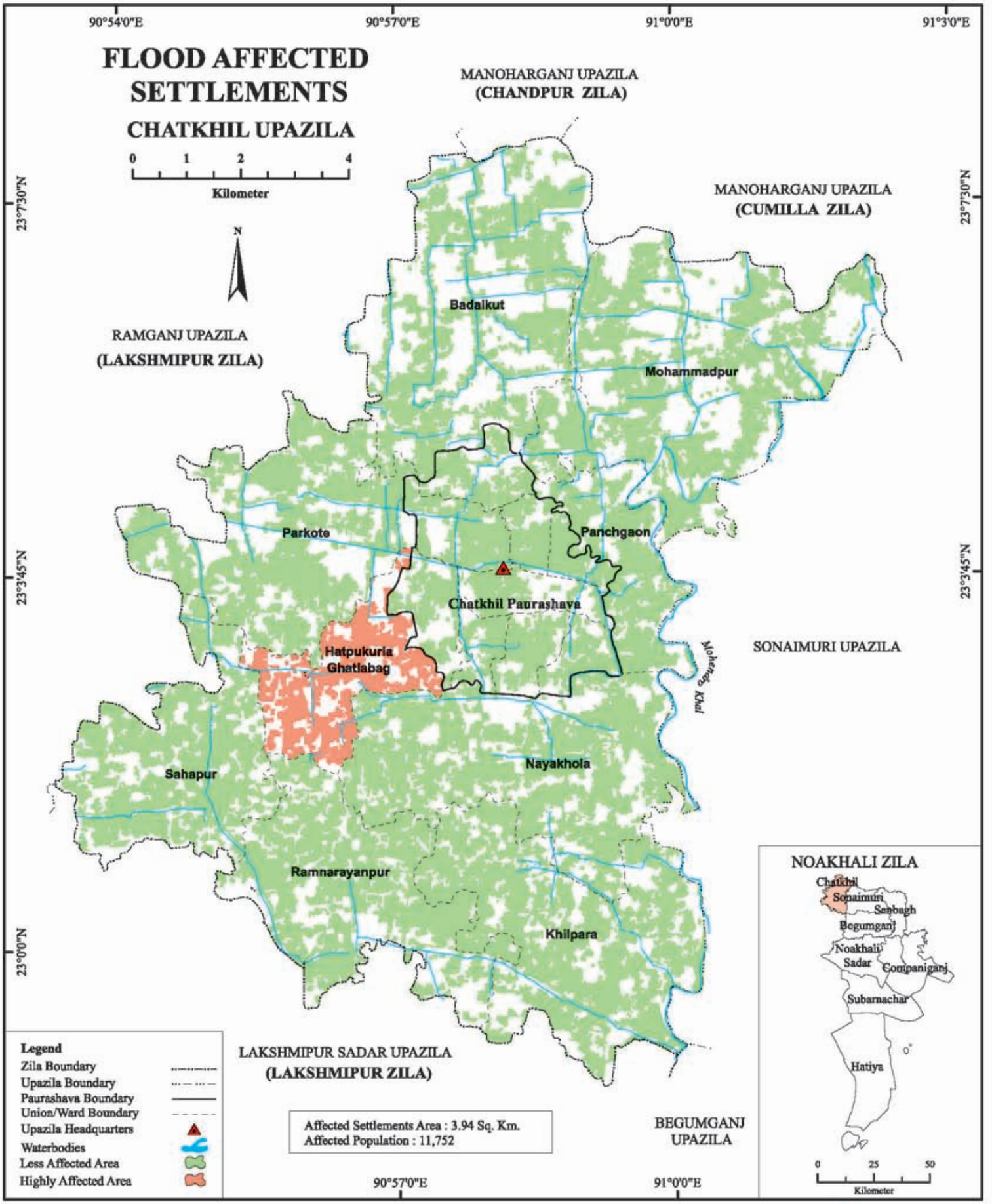

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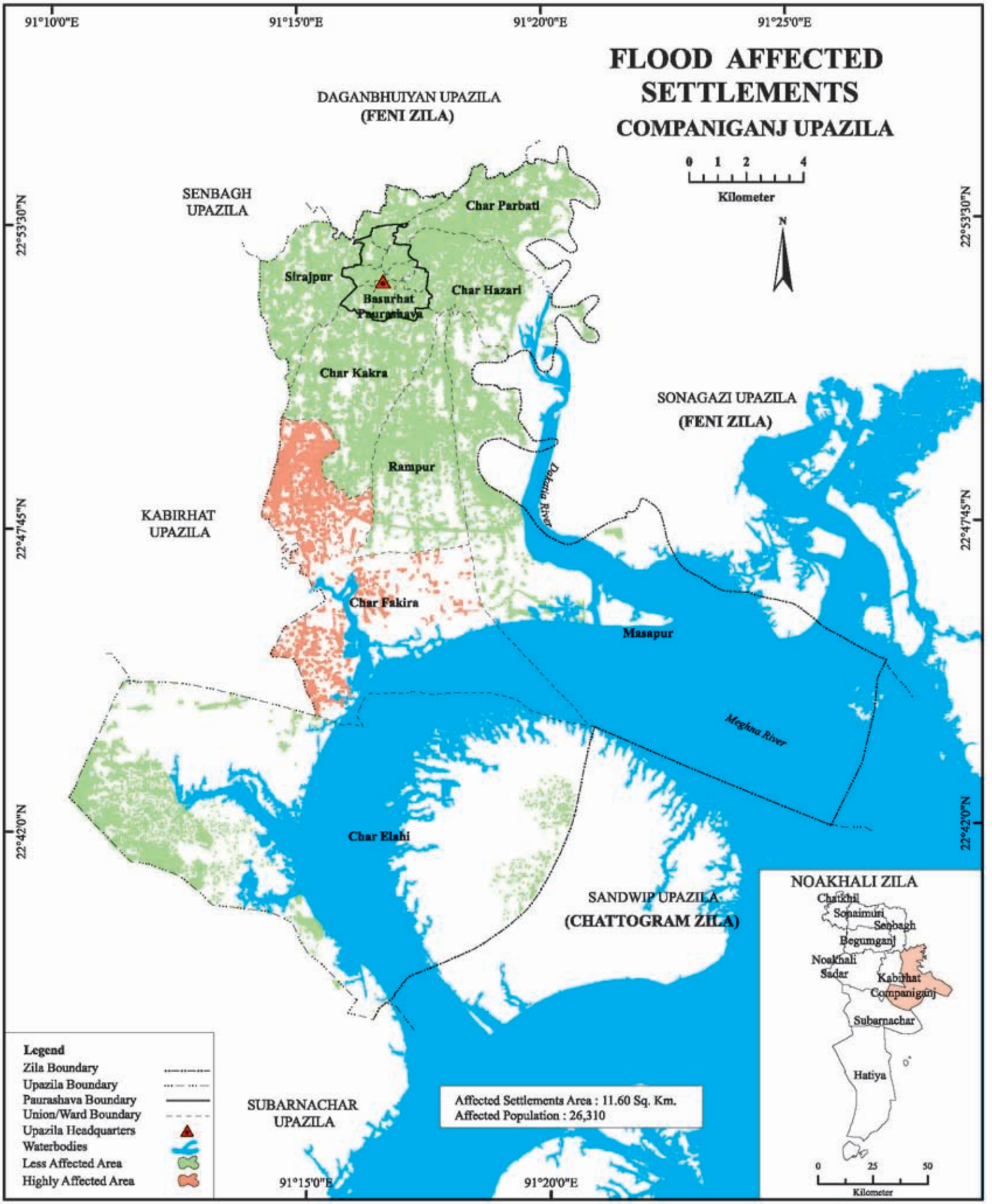

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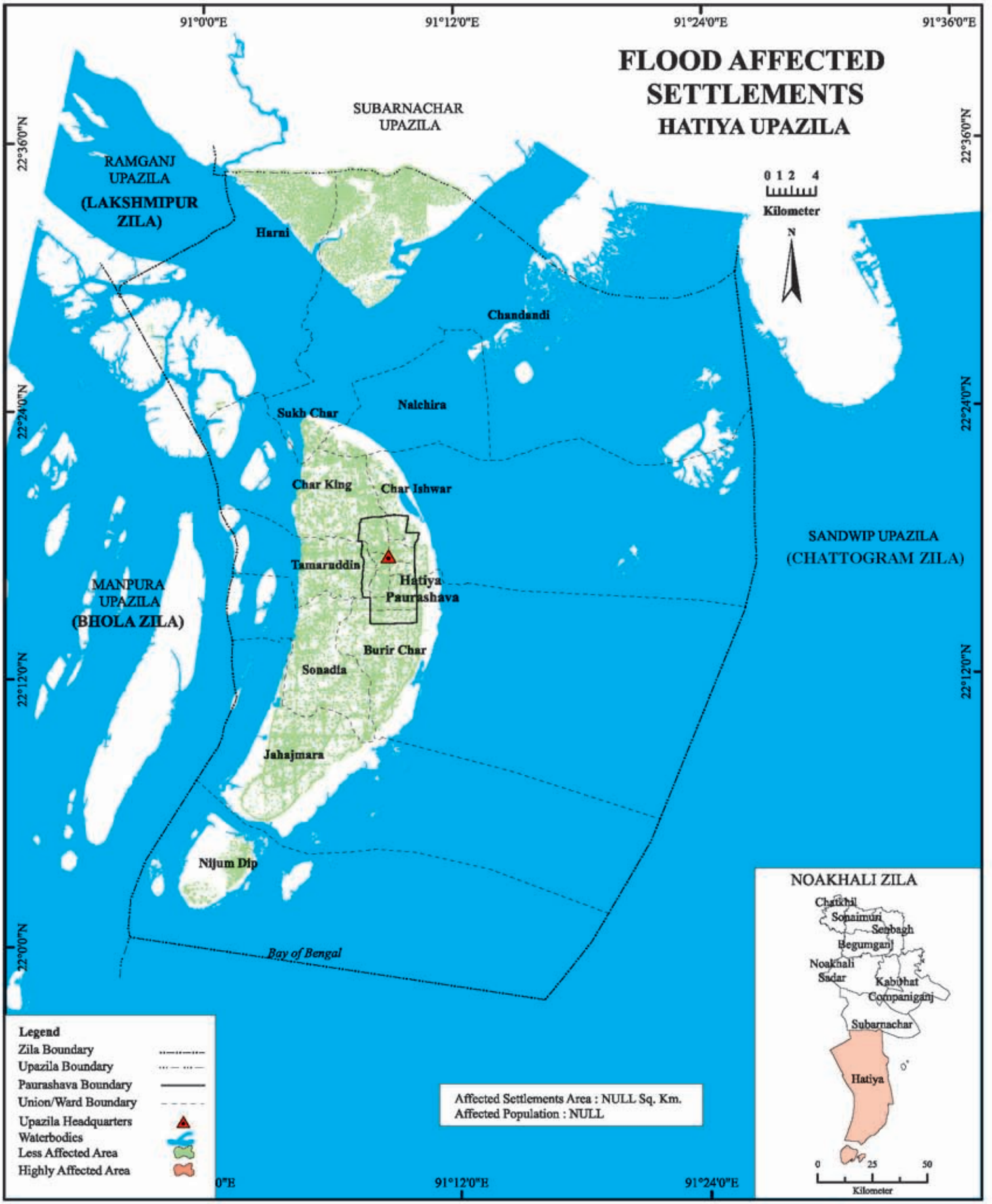

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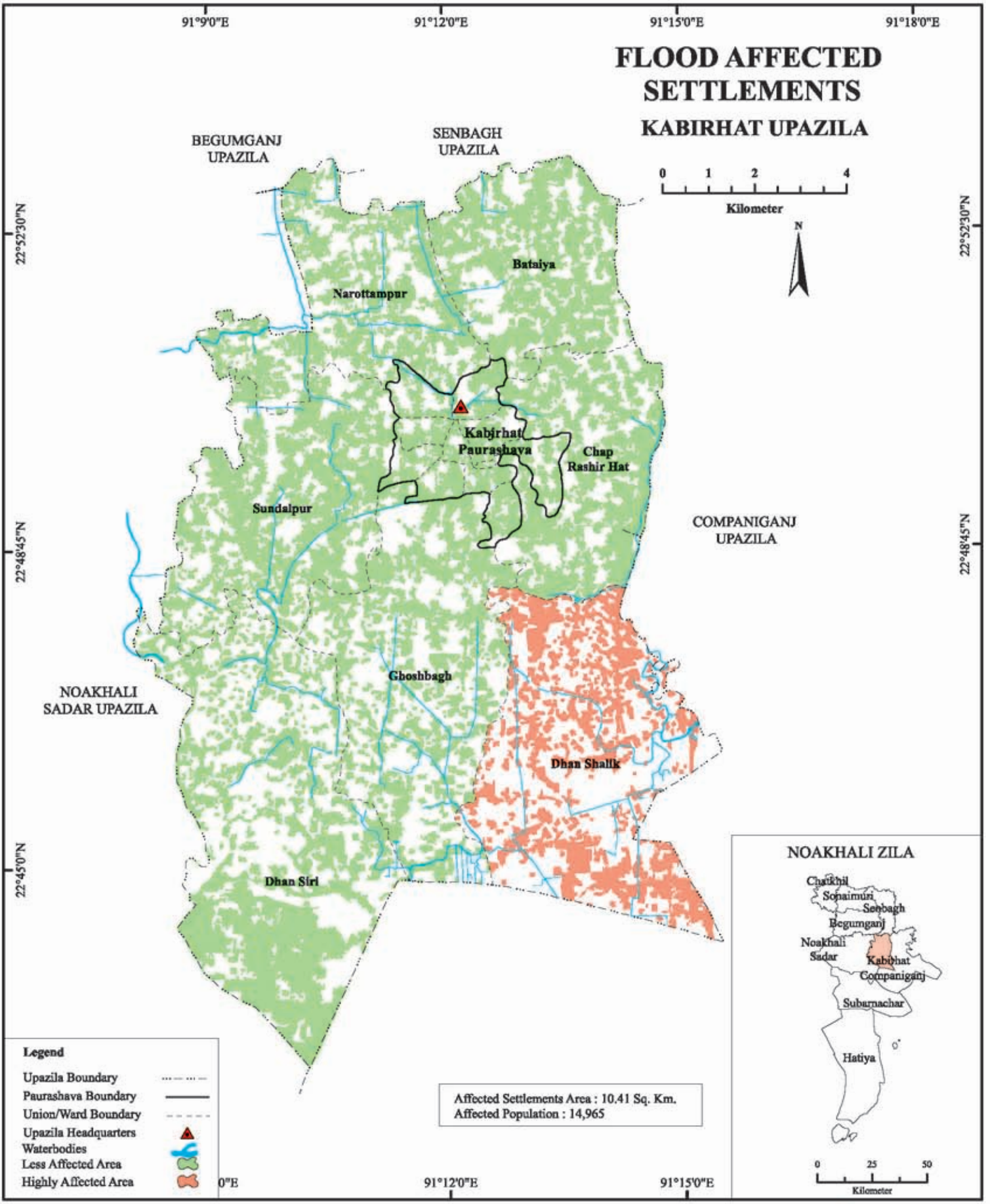

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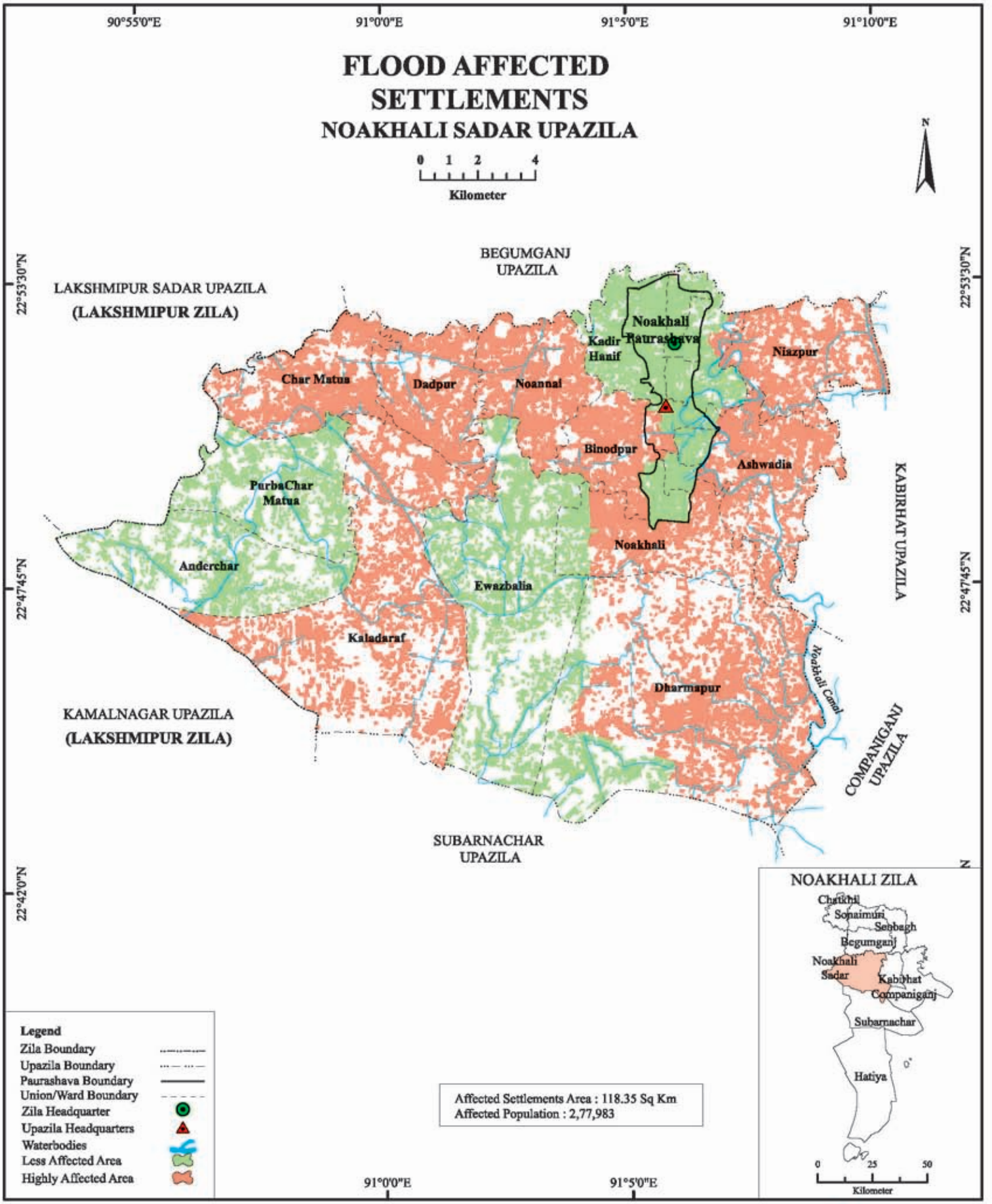

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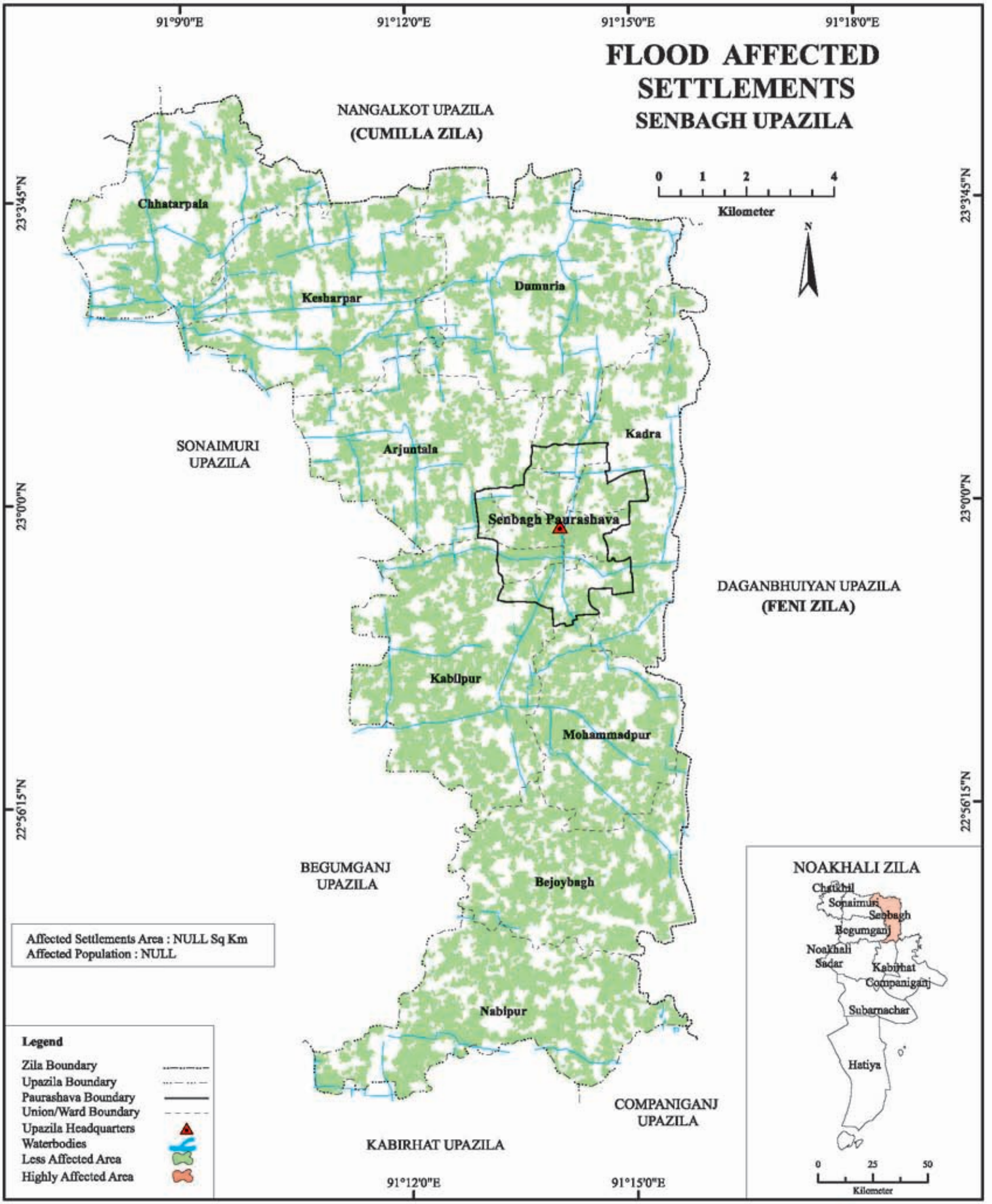

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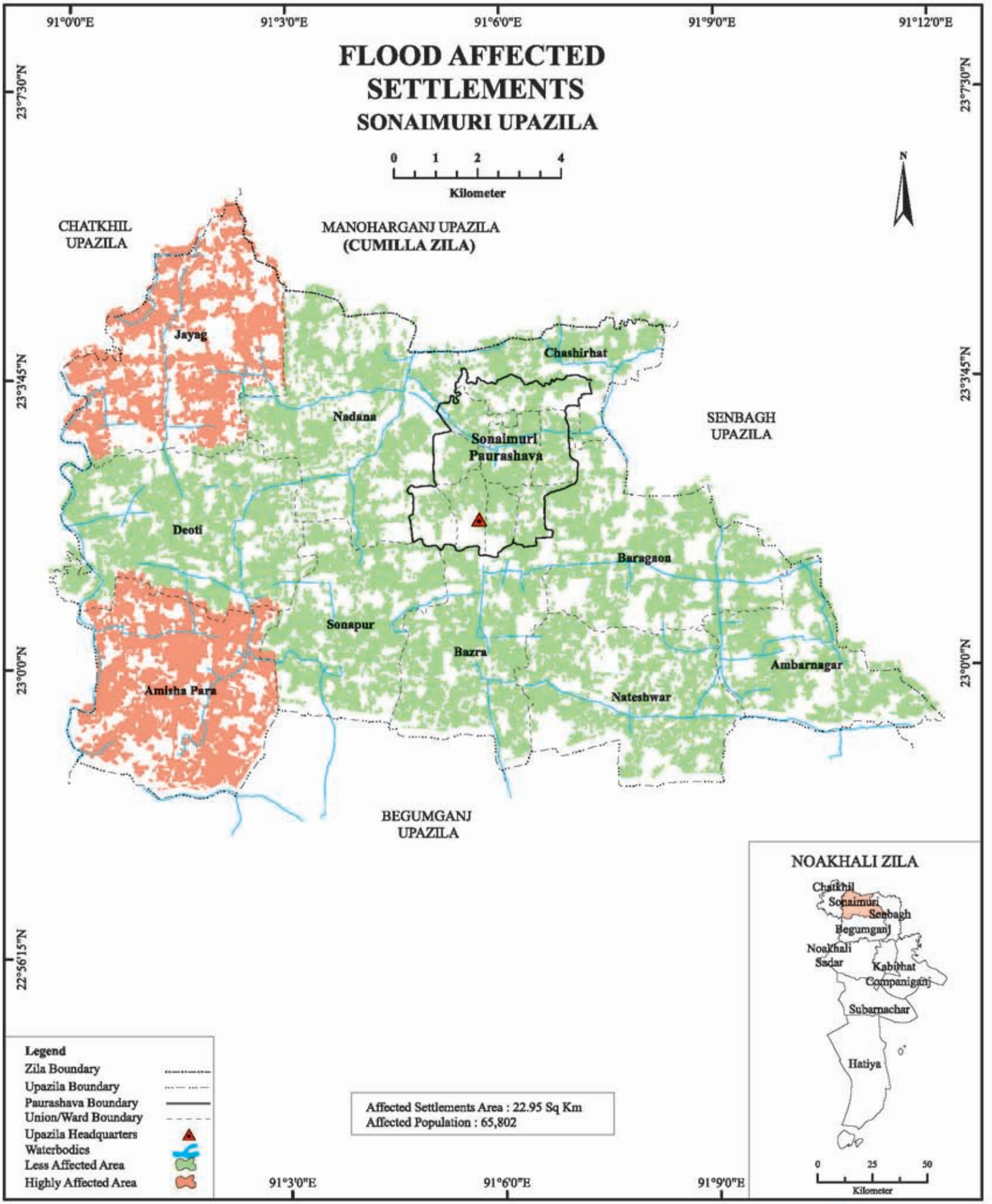

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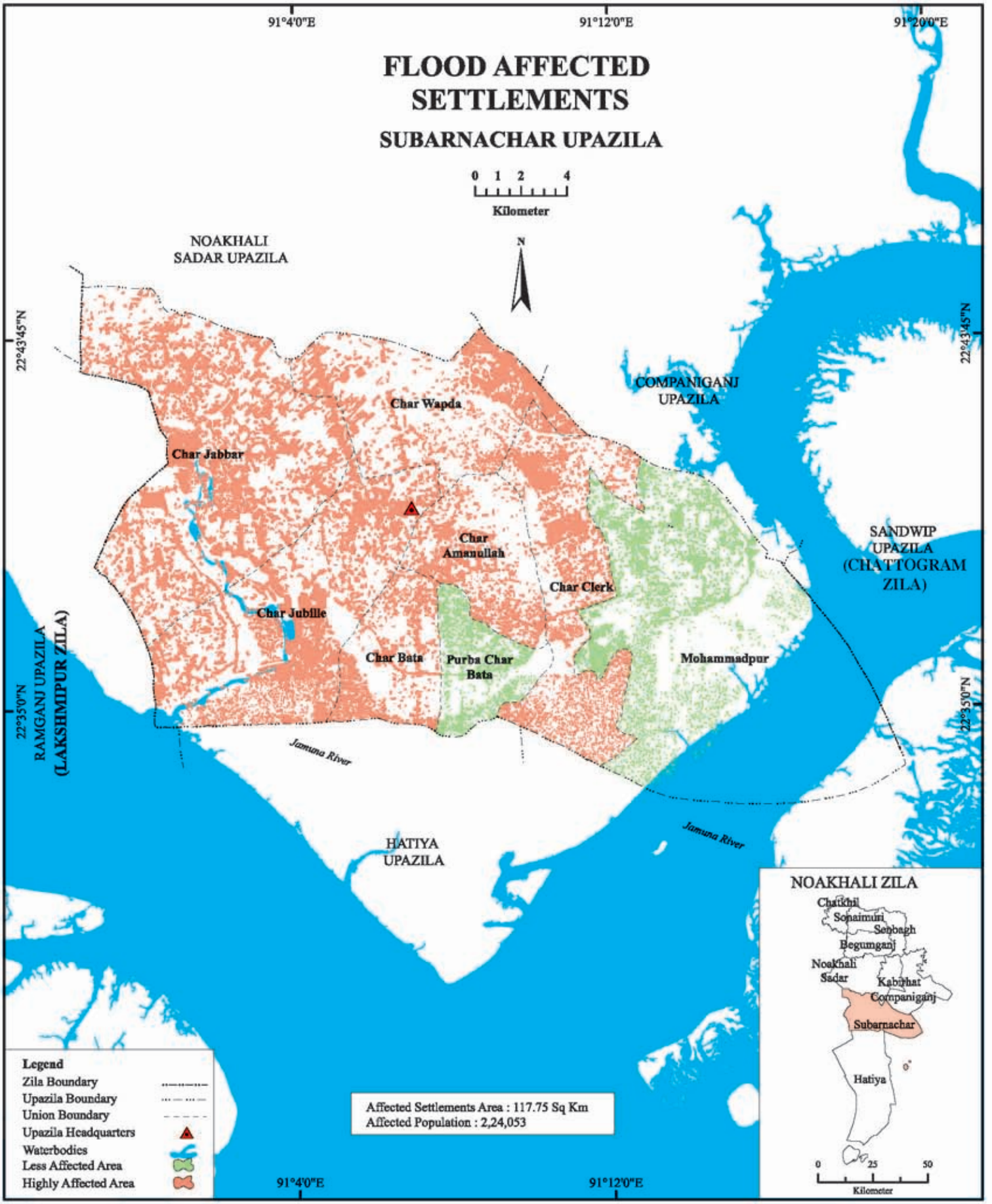
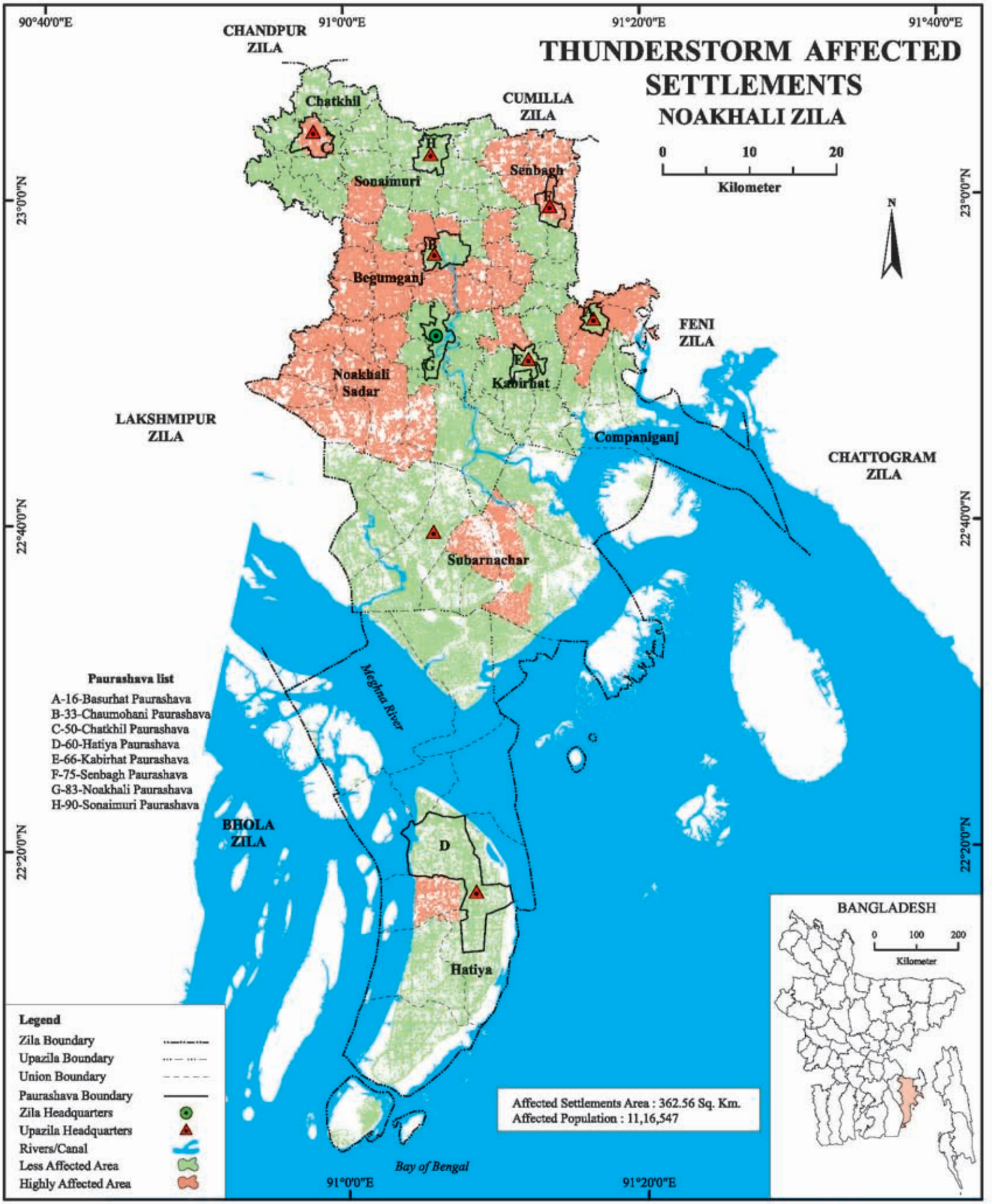


Stat4Dev Project, 2020

Thunderstorm Affected Area Map



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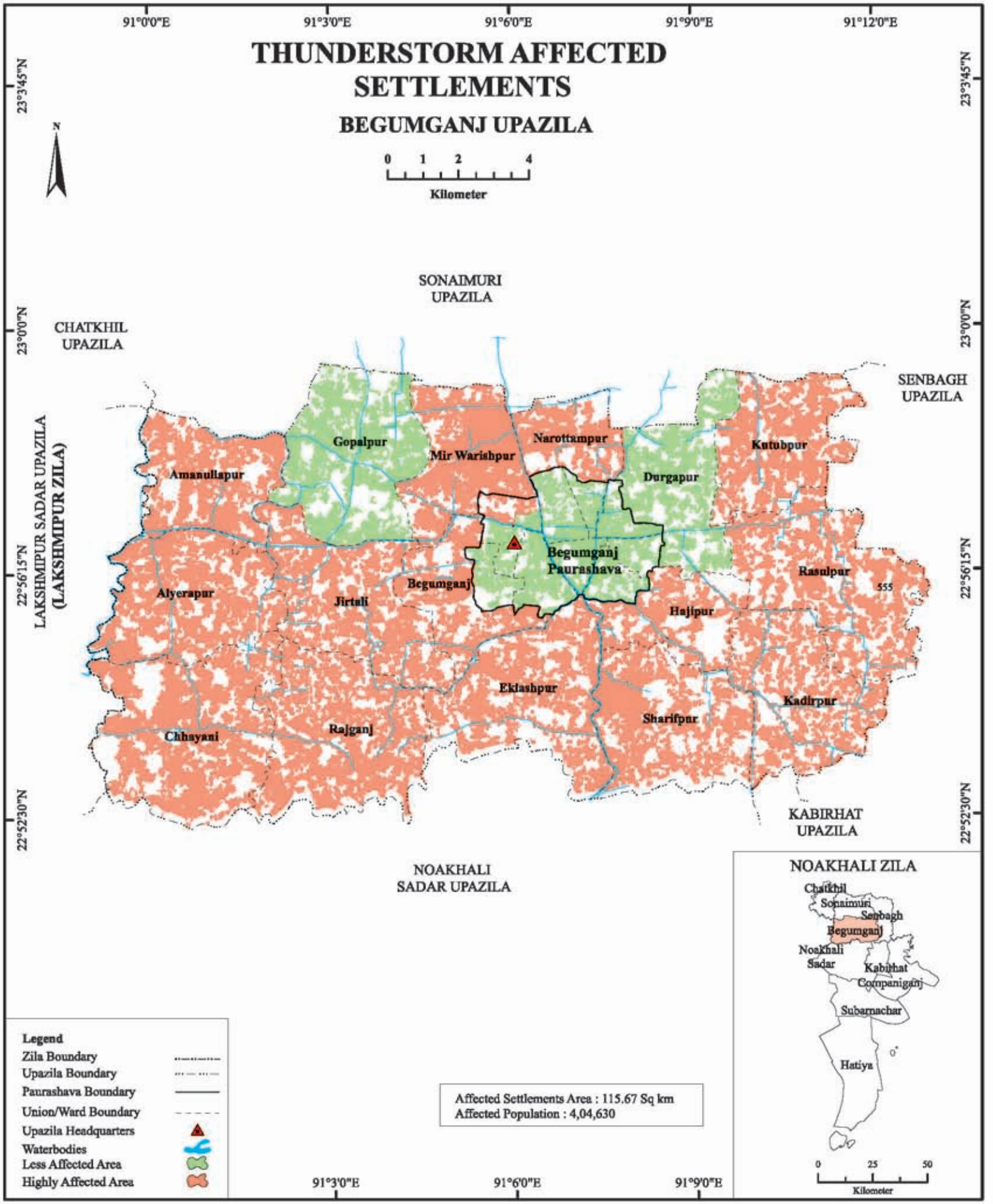

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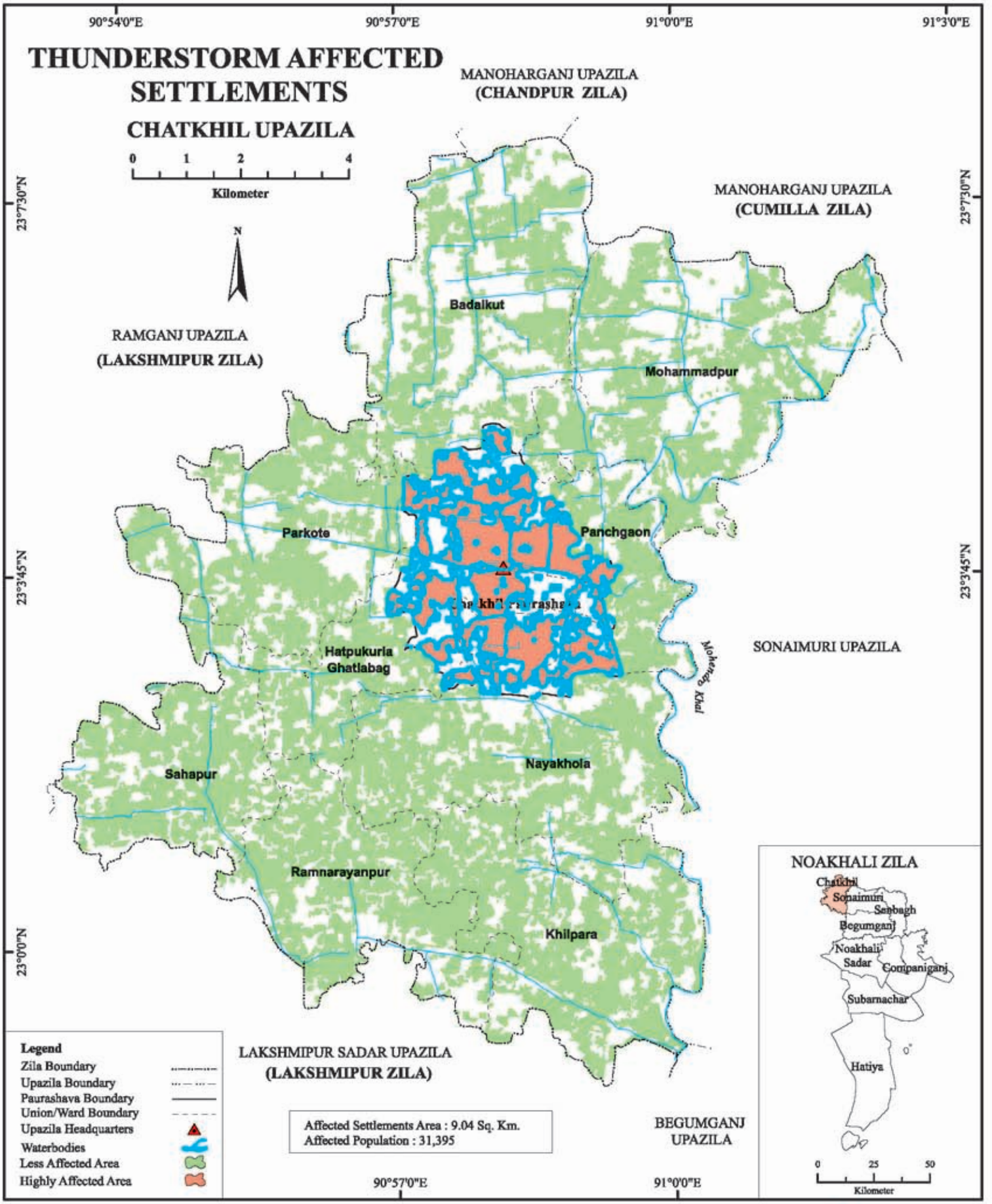

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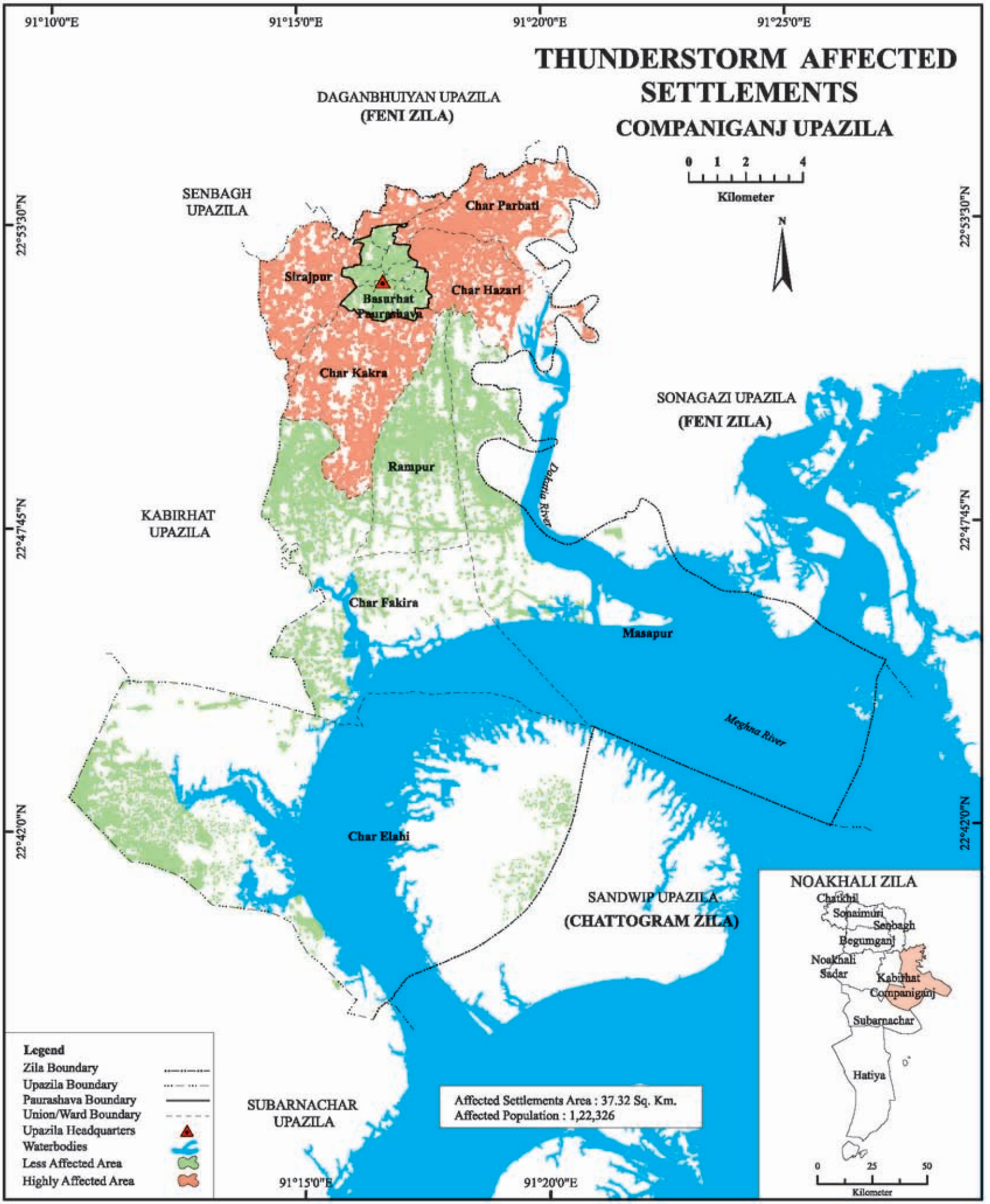

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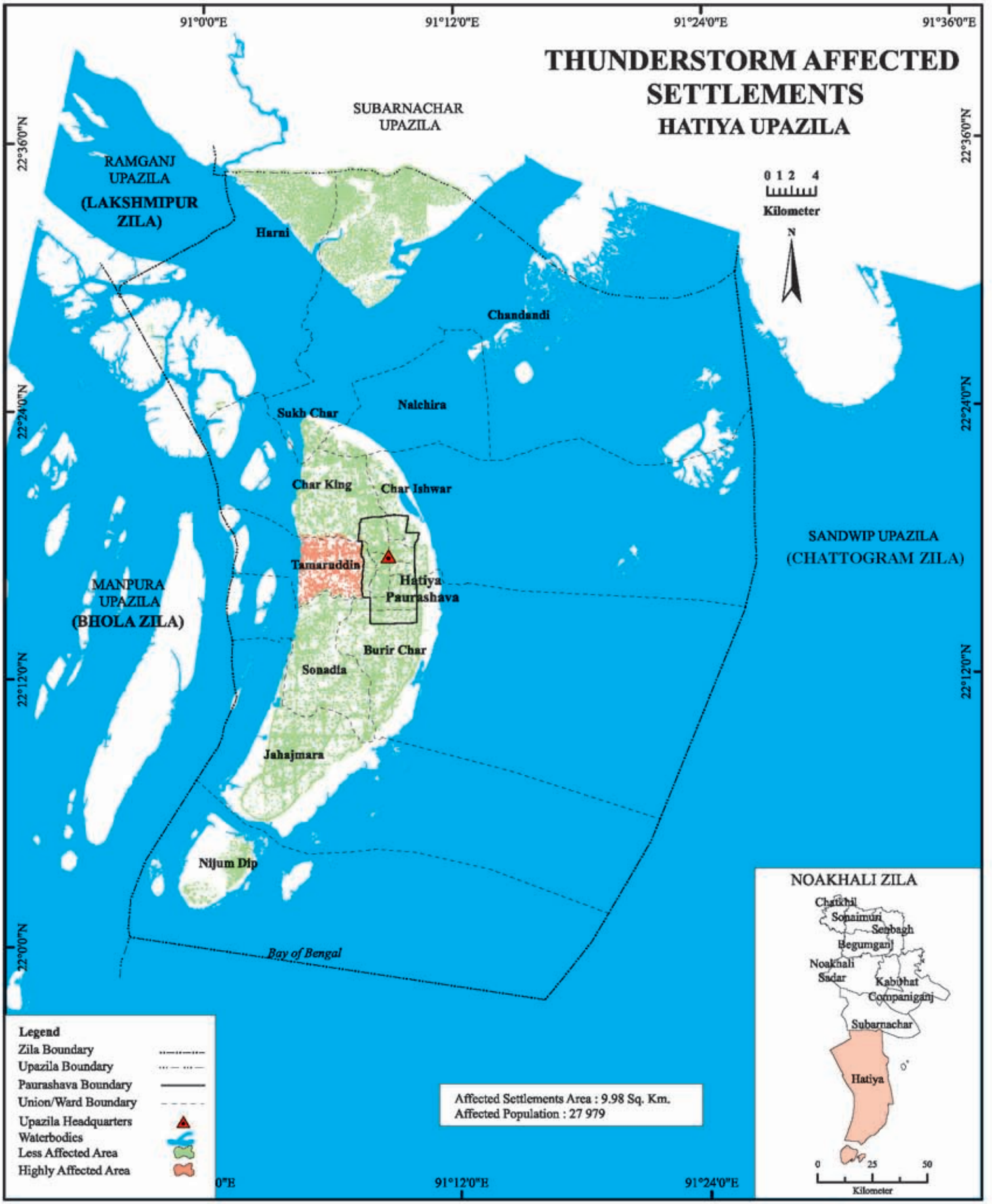

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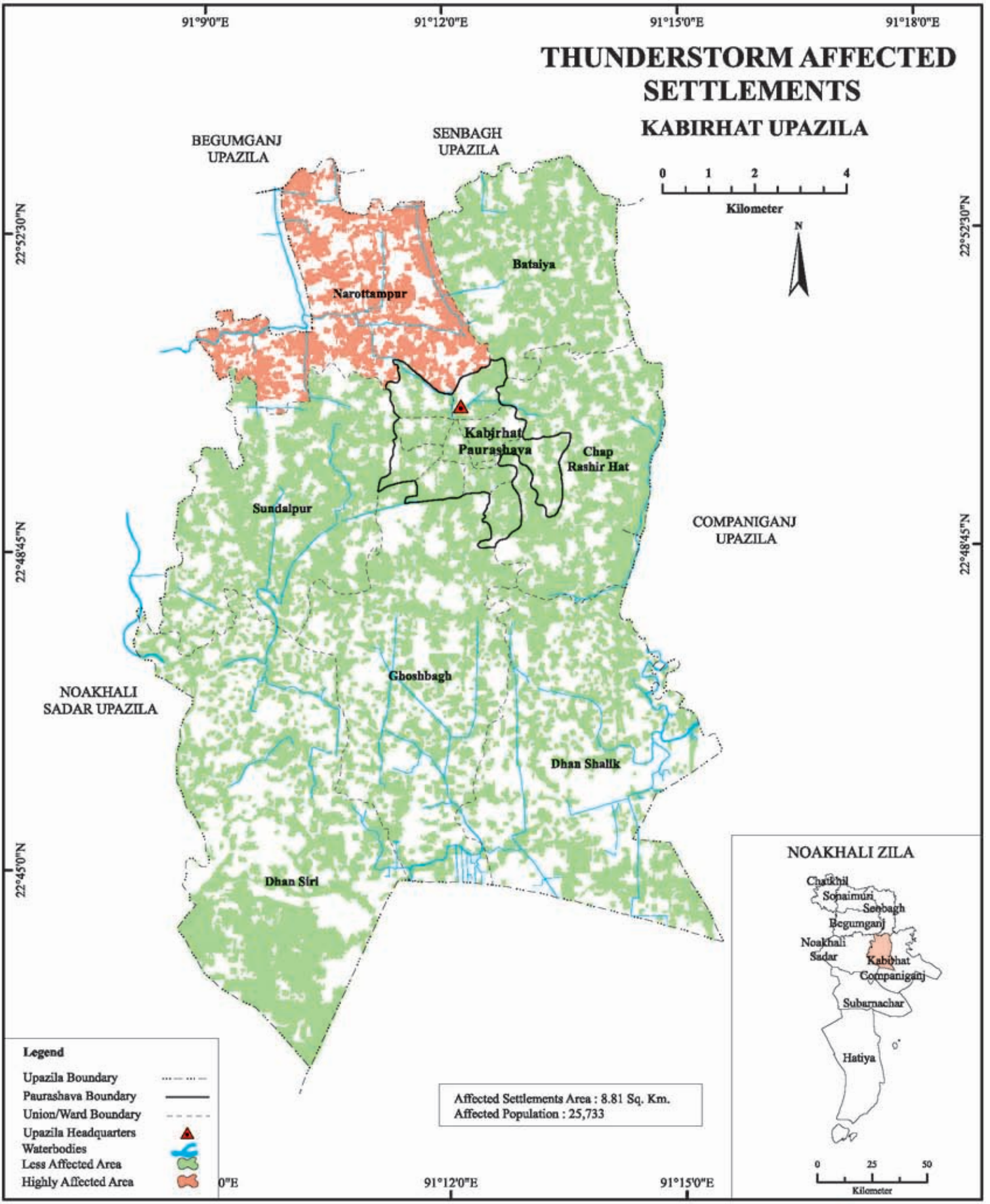

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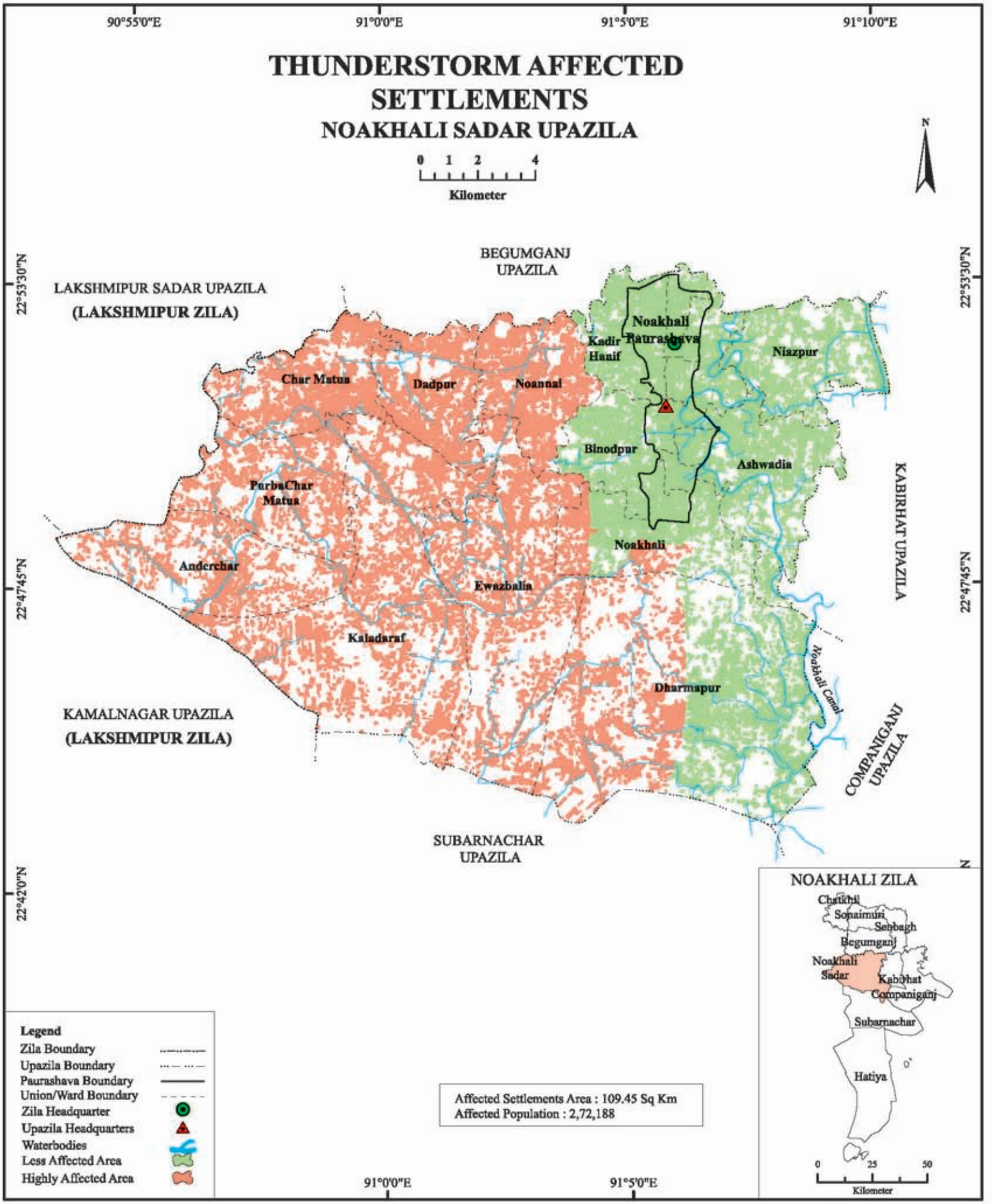

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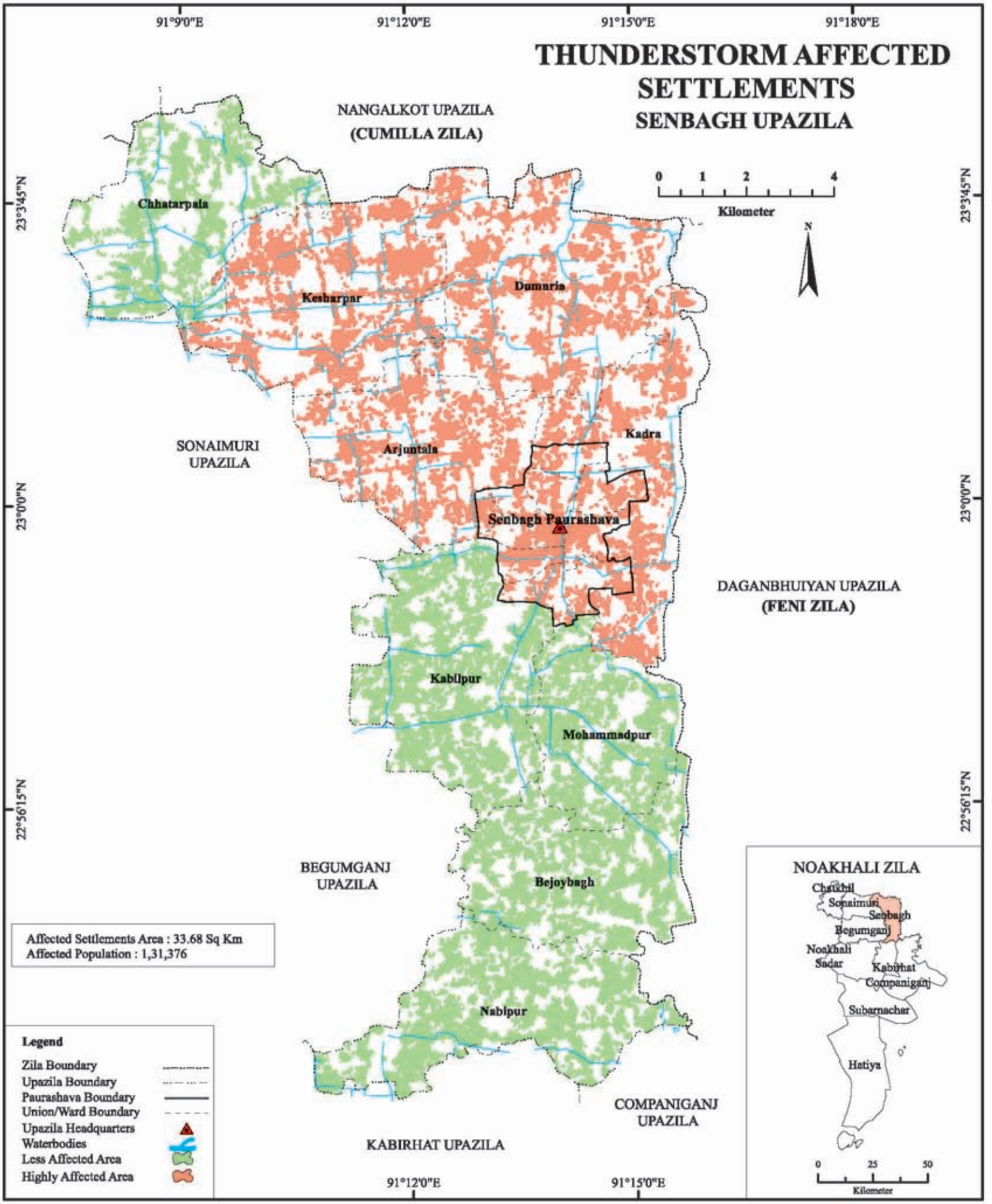

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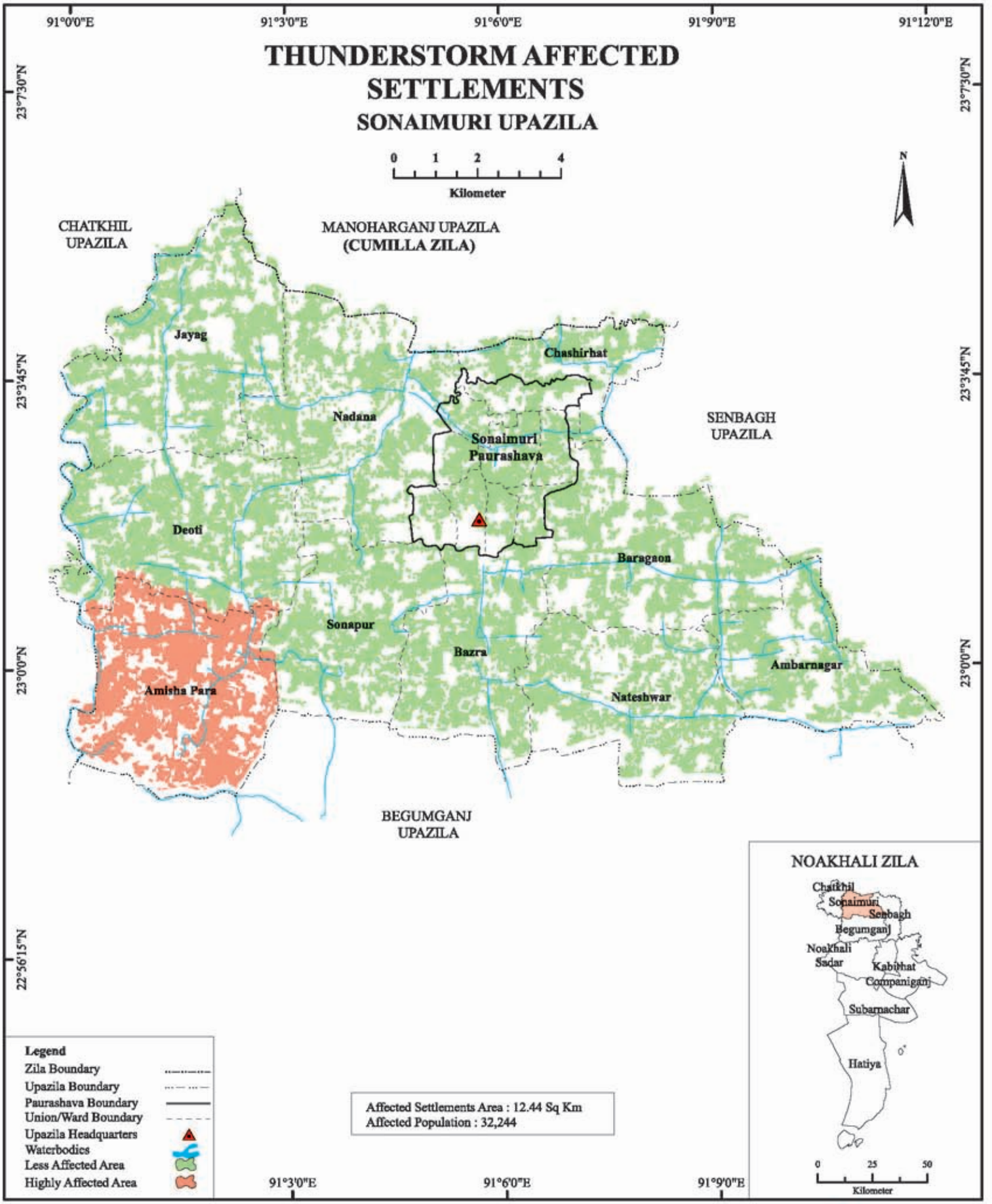

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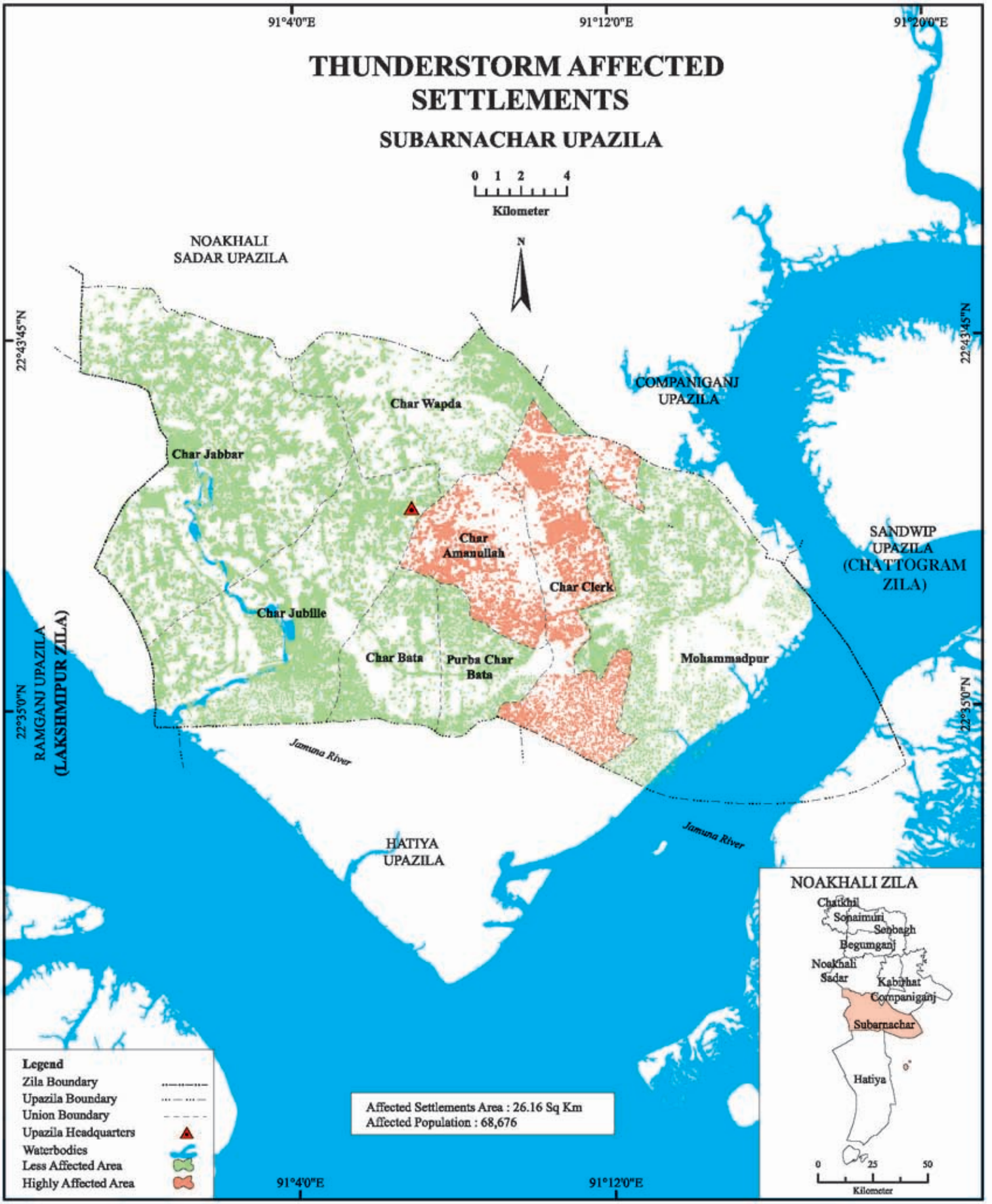
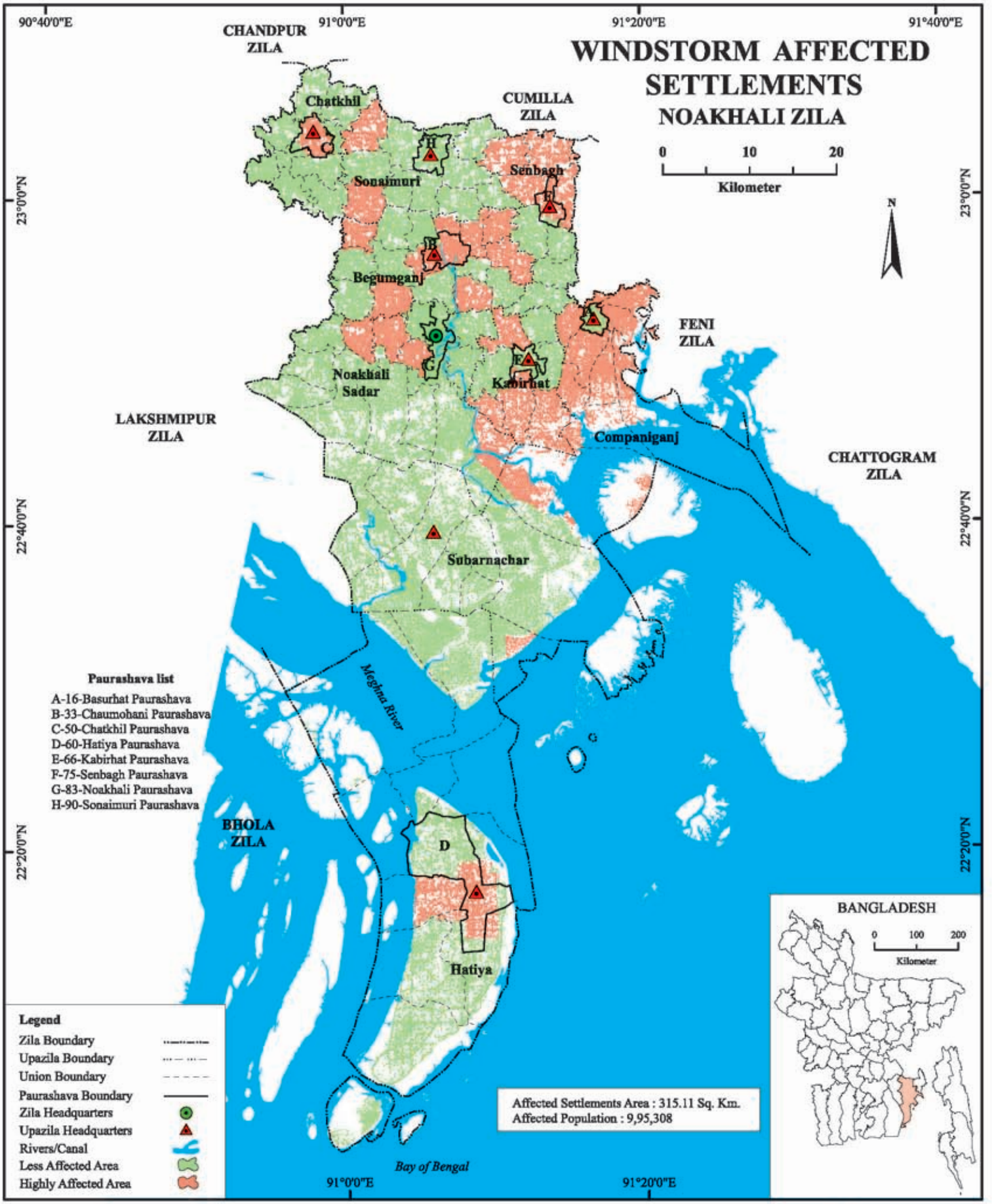


Stat4Dev Project, 2020

Windstorm Affected Area Map



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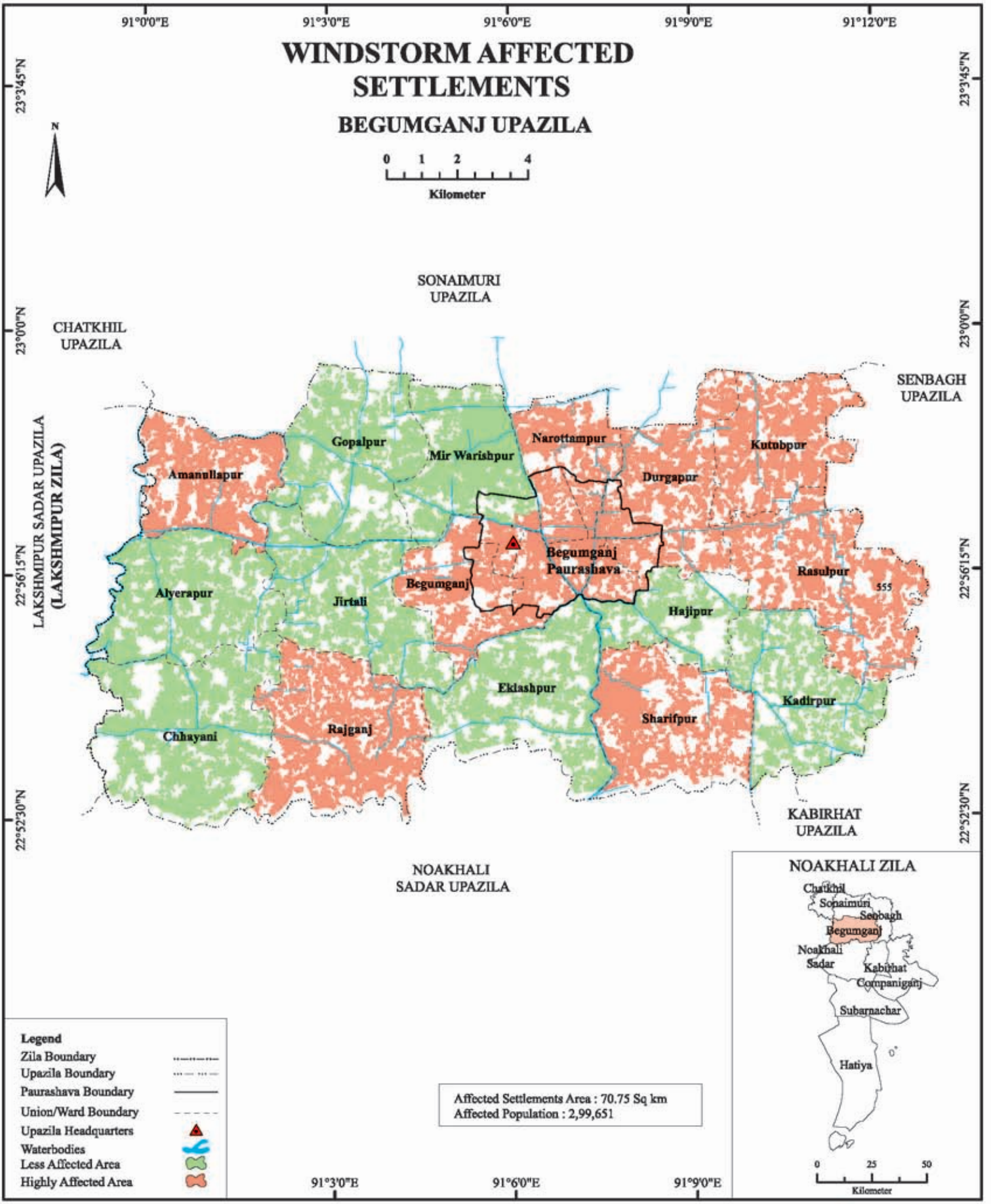

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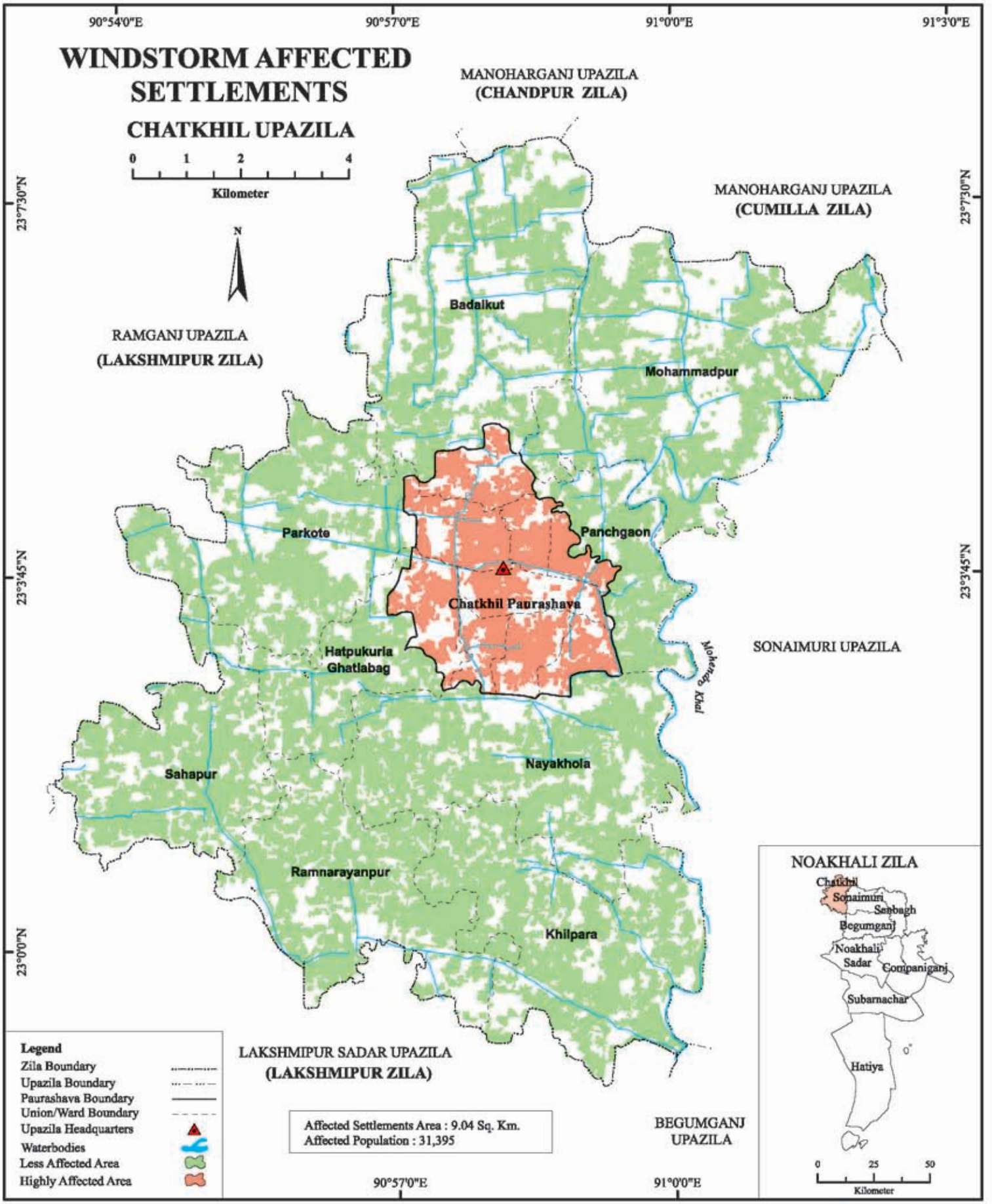

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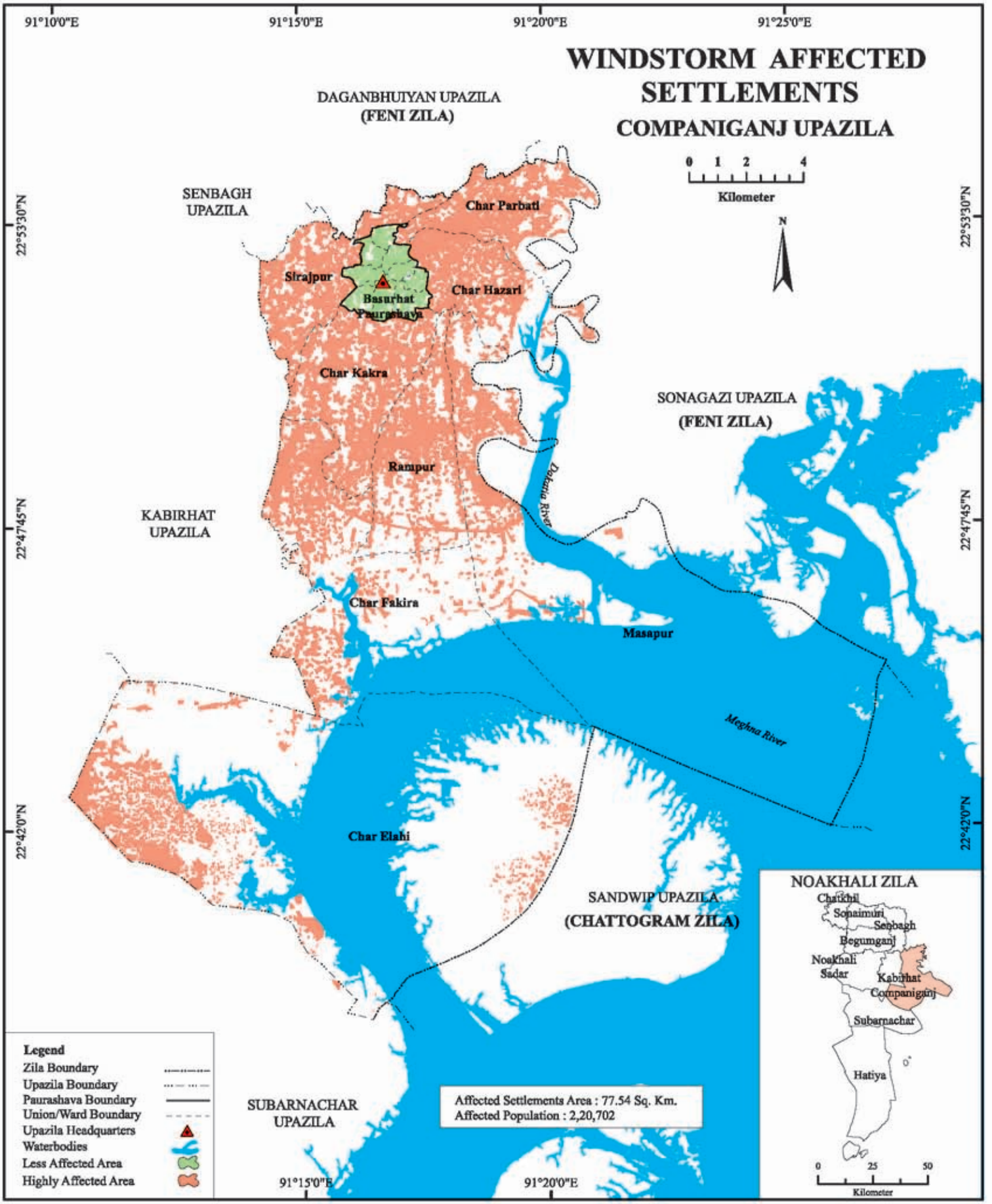
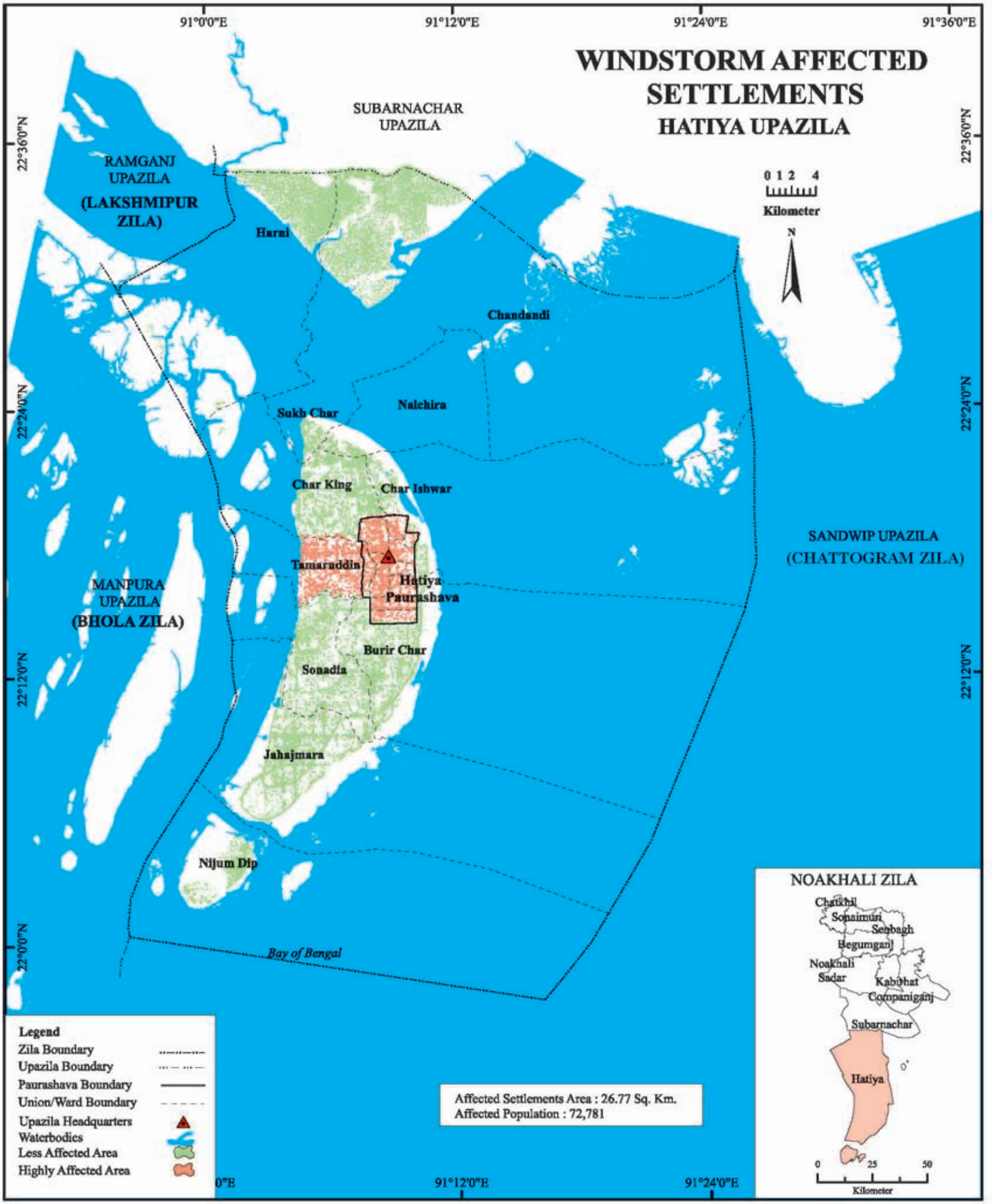

WINDSTORM AFFECTED SETTLEMENTS
COMPANIGANJ UPAZILA
91°10'0"E
91°15'0"E
91°20'0"E
91°25'0"E
22°53'30"N
22°47'45"N
22°42'0"N
0 1 2 4
Kilometer
N
DAGANBHUIYAN UPAZILA (FENI ZILA)
SENBAGH UPAZILA
KABIRHAT UPAZILA
SONAGAZI UPAZILA (FENI ZILA)
SUBARNACHAR UPAZILA
SANDWIP UPAZILA (CHATTOGRAM ZILA)
Char Parbati
Sirajpur
Basurhat Paurashava
Char Hazari
Char Kakra
Rampur
Char Fakira
Masapur
Char Elahi
Dakatia River
Meghna River
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union/Ward Boundary
Upazila Headquarters
Waterbodies
Less Affected Area
Highly Affected Area
Affected Settlements Area : 77.54 Sq. Km.
Affected Population : 2,20,702
NOAKHALI ZILA
Chatkhil
Sonaimuri
Senbagh
Begumganj
Noakhali Sadar
Kabirhat
Companiganj
Subarnachar
Hatiya
0 25 50
Kilometer



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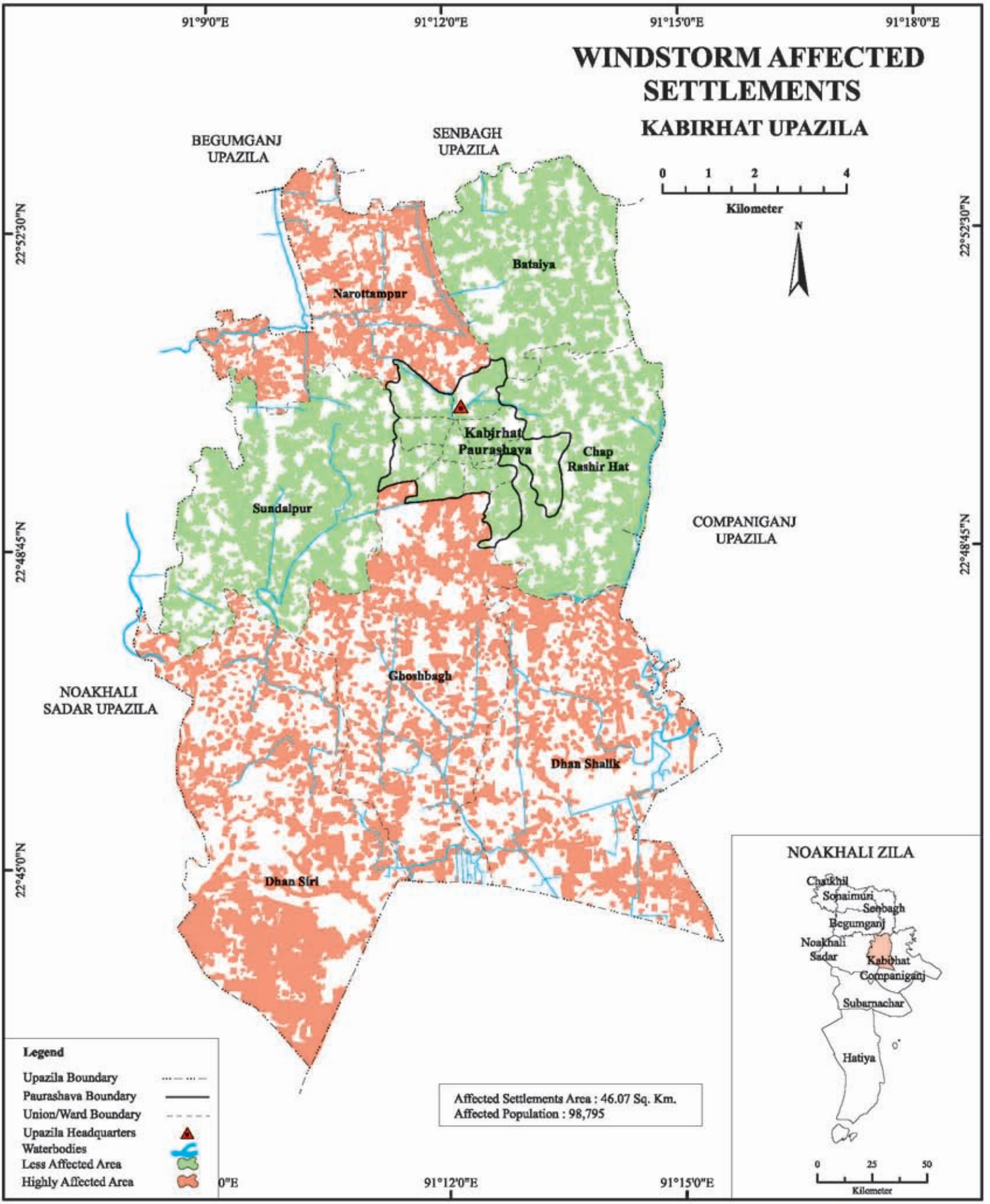
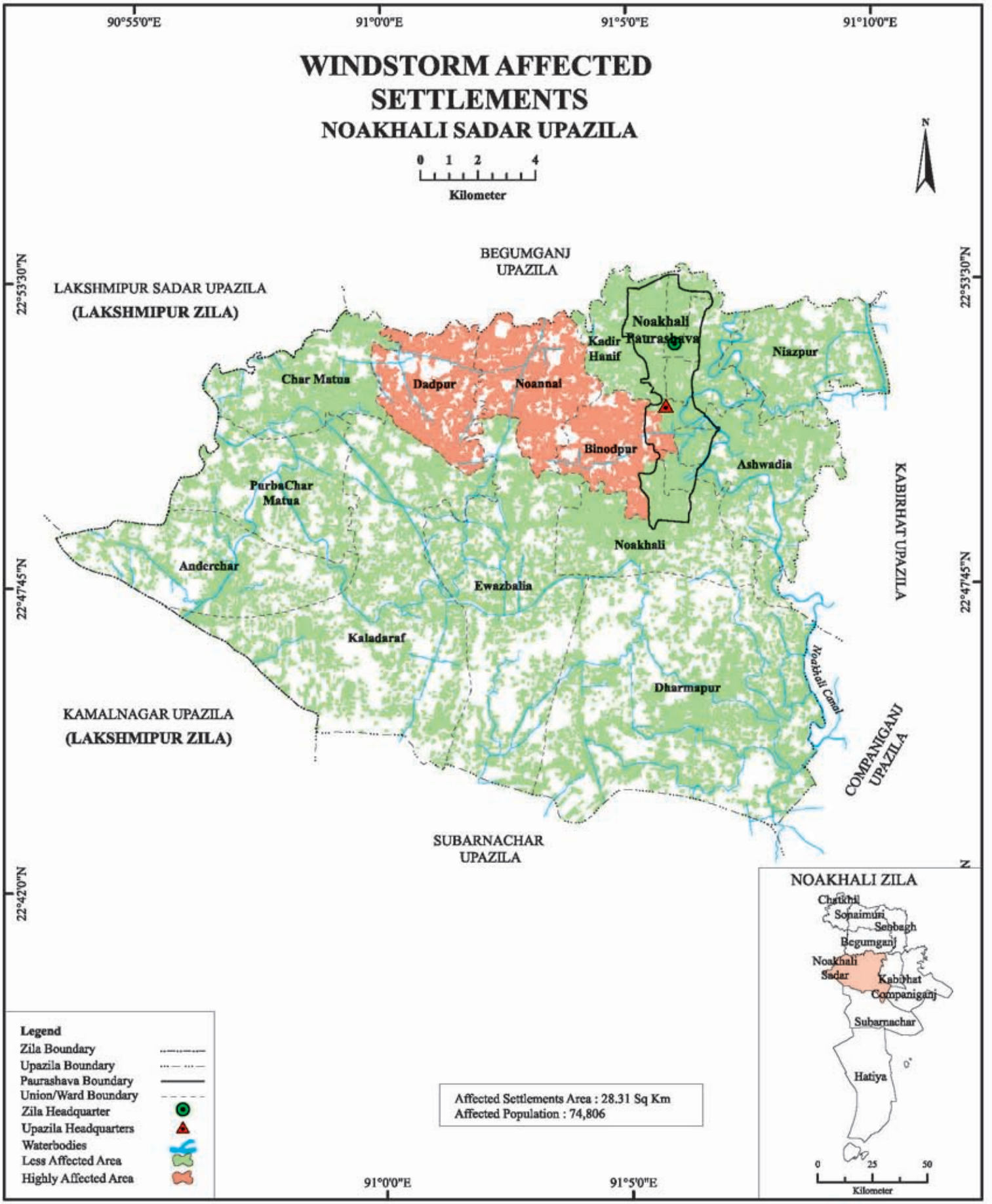
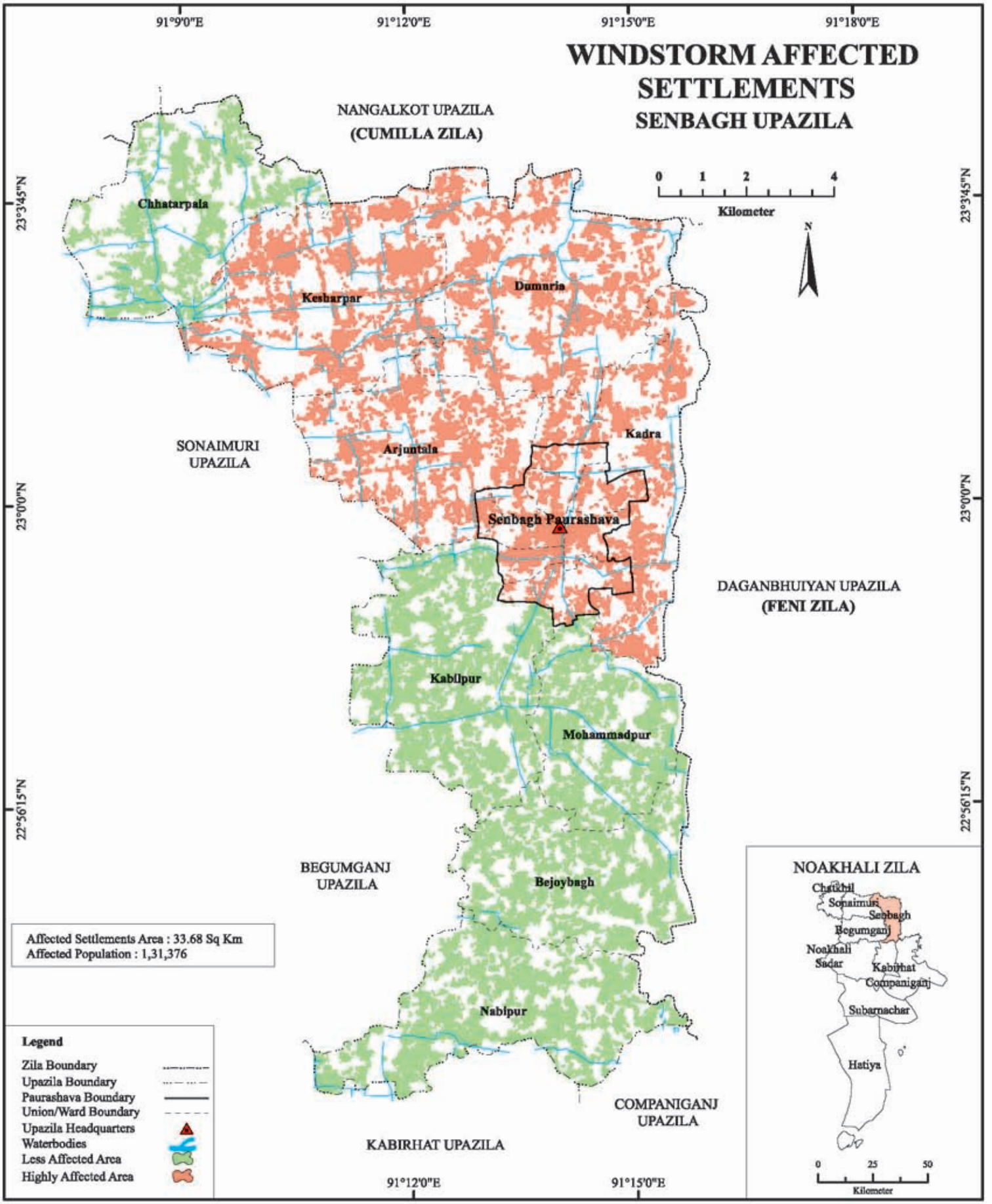


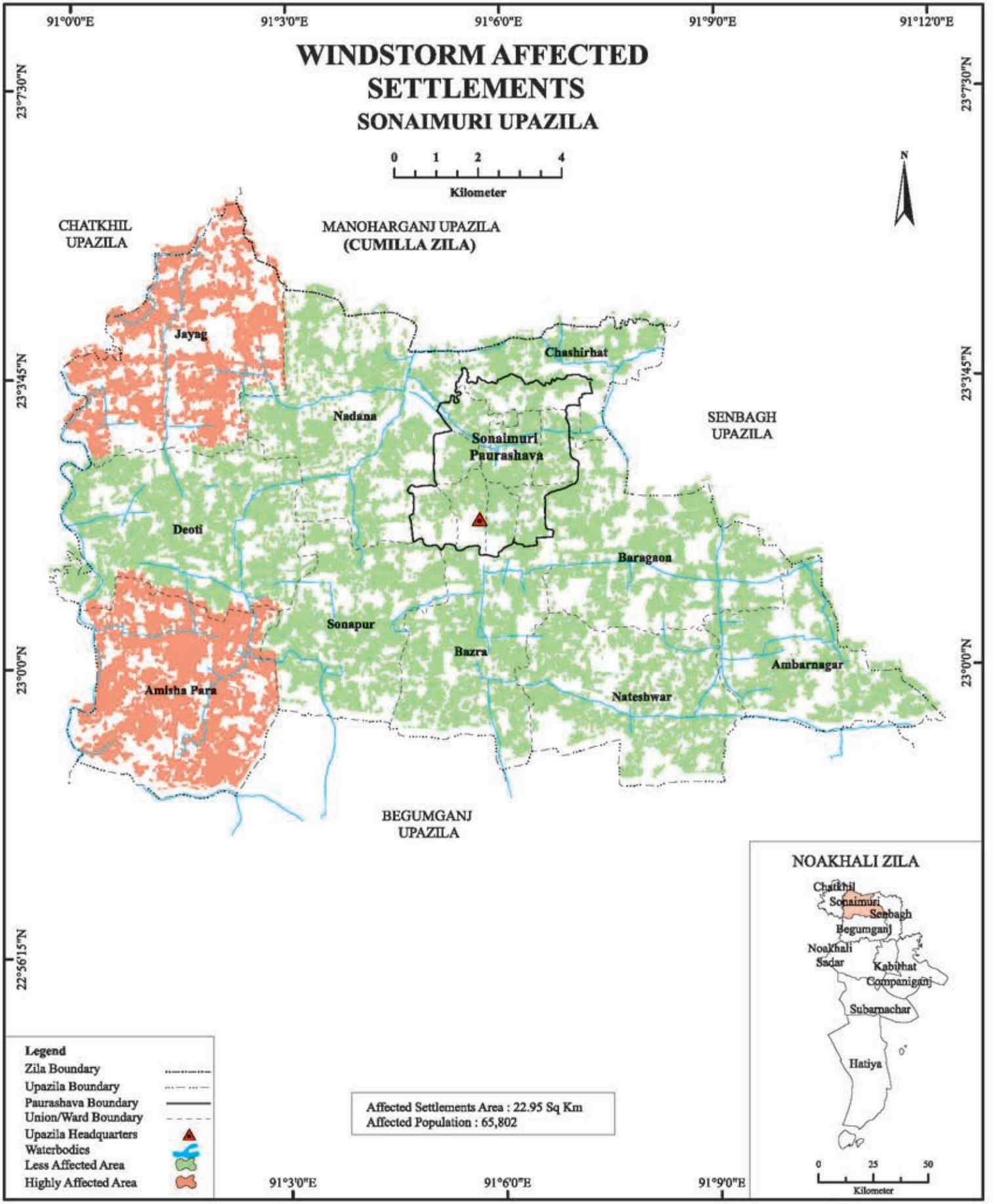
Stat4Dev Project, 2020



Stat4Dev Project, 2020



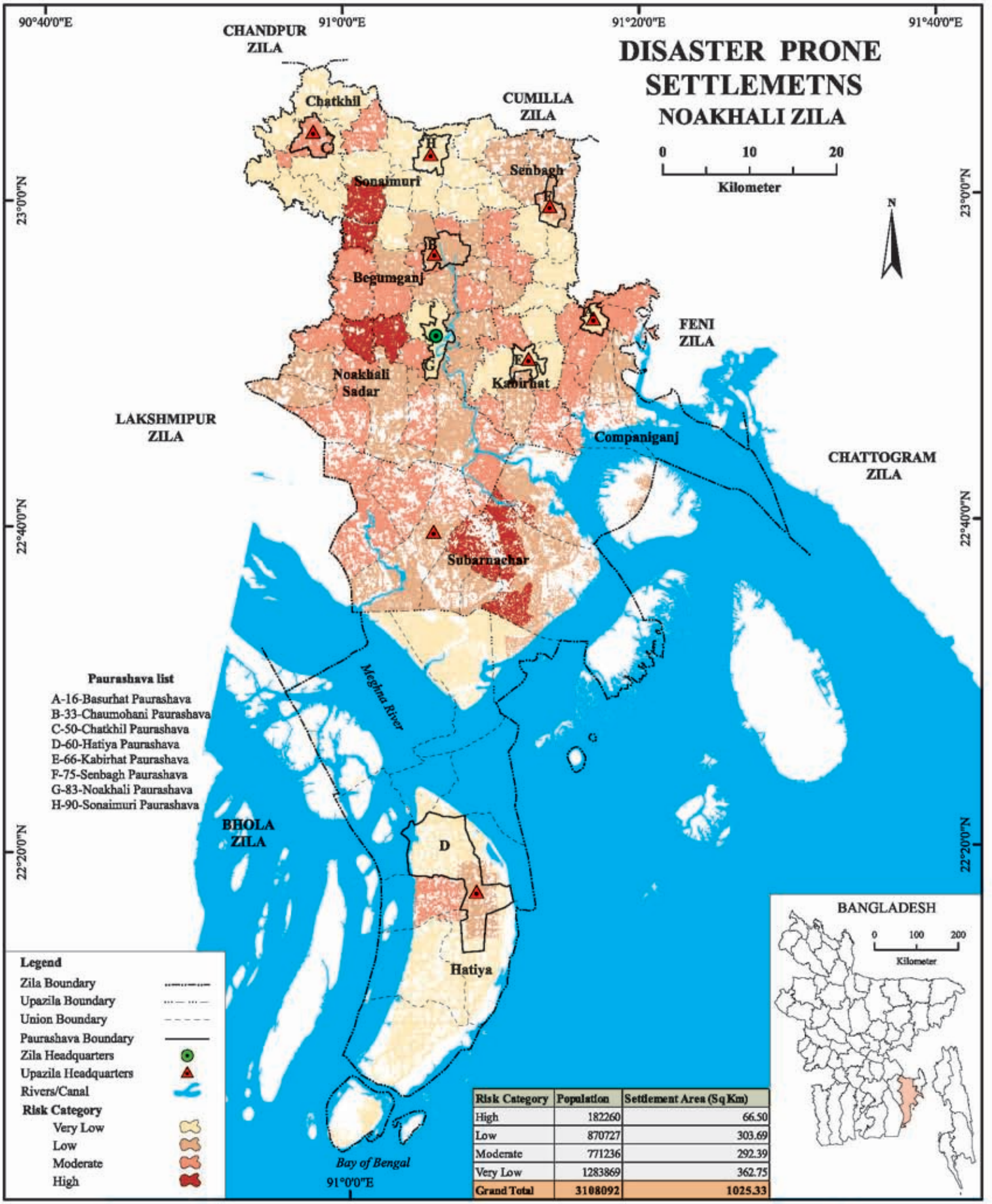
Stat4Dev Project, 2020



Stat4Dev Project, 2020

Stat4Dev Project, 2020

Disaster Prone Area Map

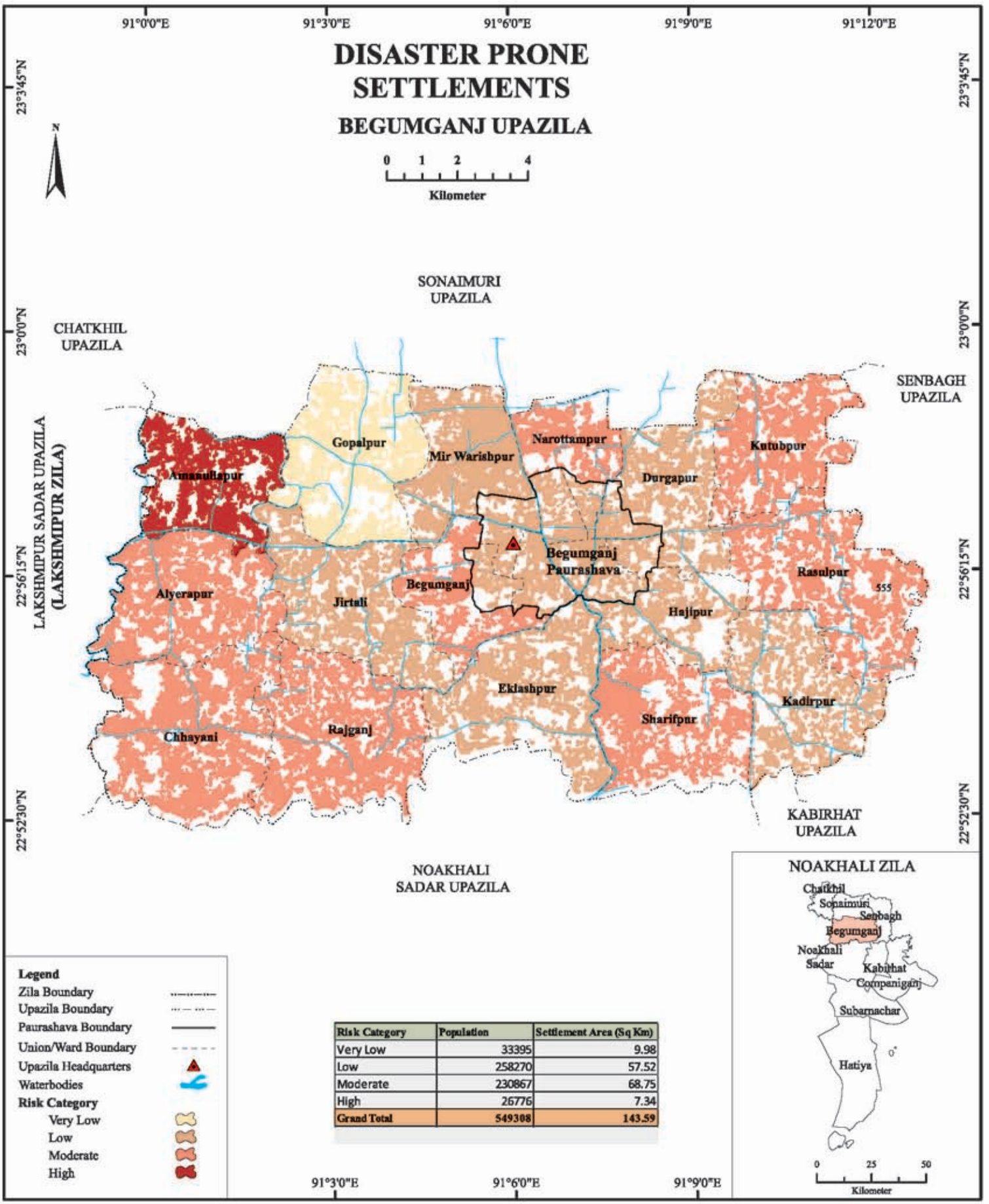


Risk Category	Population	Settlement Area (Sq Km)
High	182260	66.50
Low	870727	303.69
Moderate	771236	292.39
Very Low	1283869	362.75
Grand Total	**3108092**	**1025.33**

Stat4Dev Project, 2020

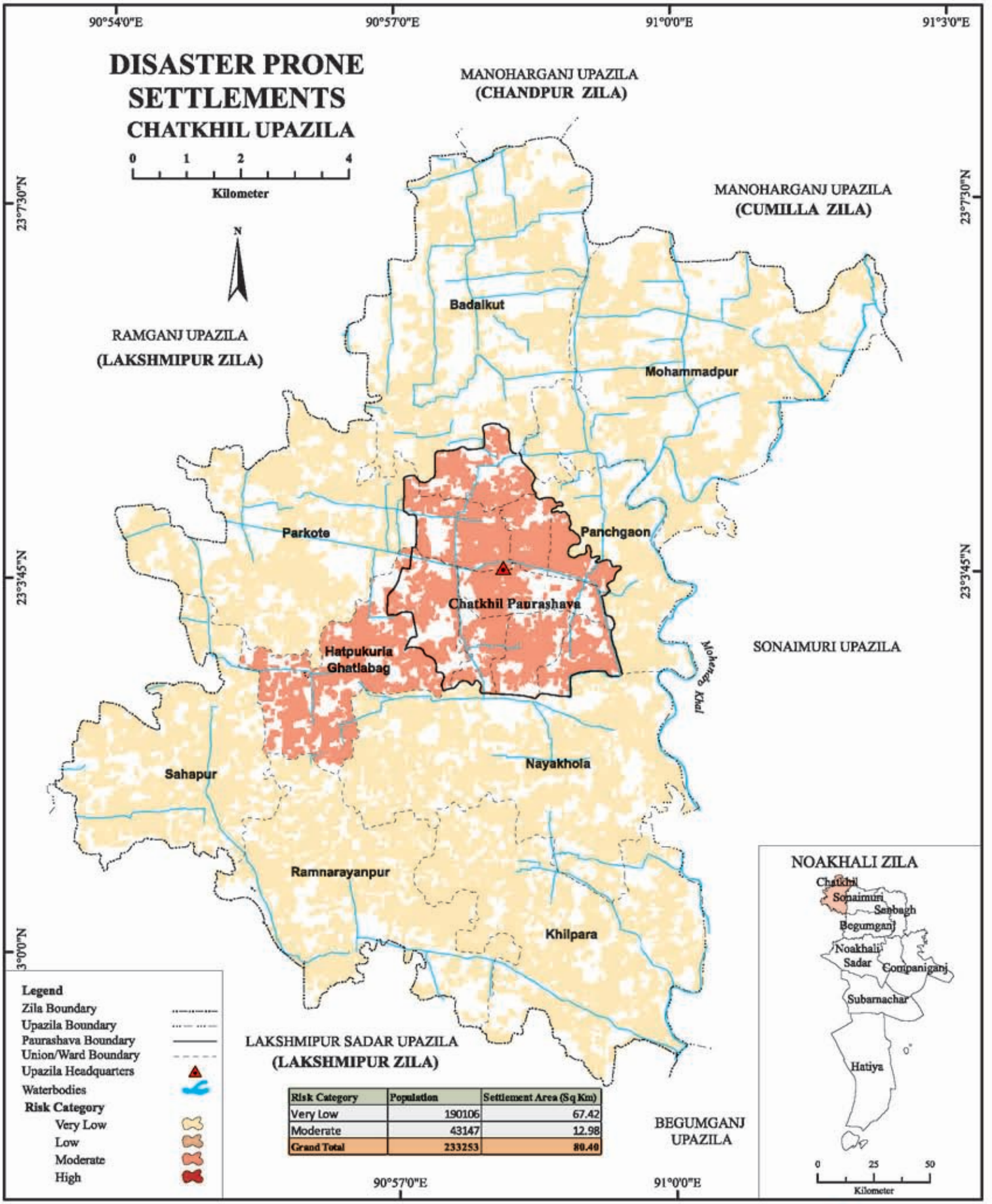
DISASTER PRONE SETTLEMENTS

BEGUMGANJ UPAZILA



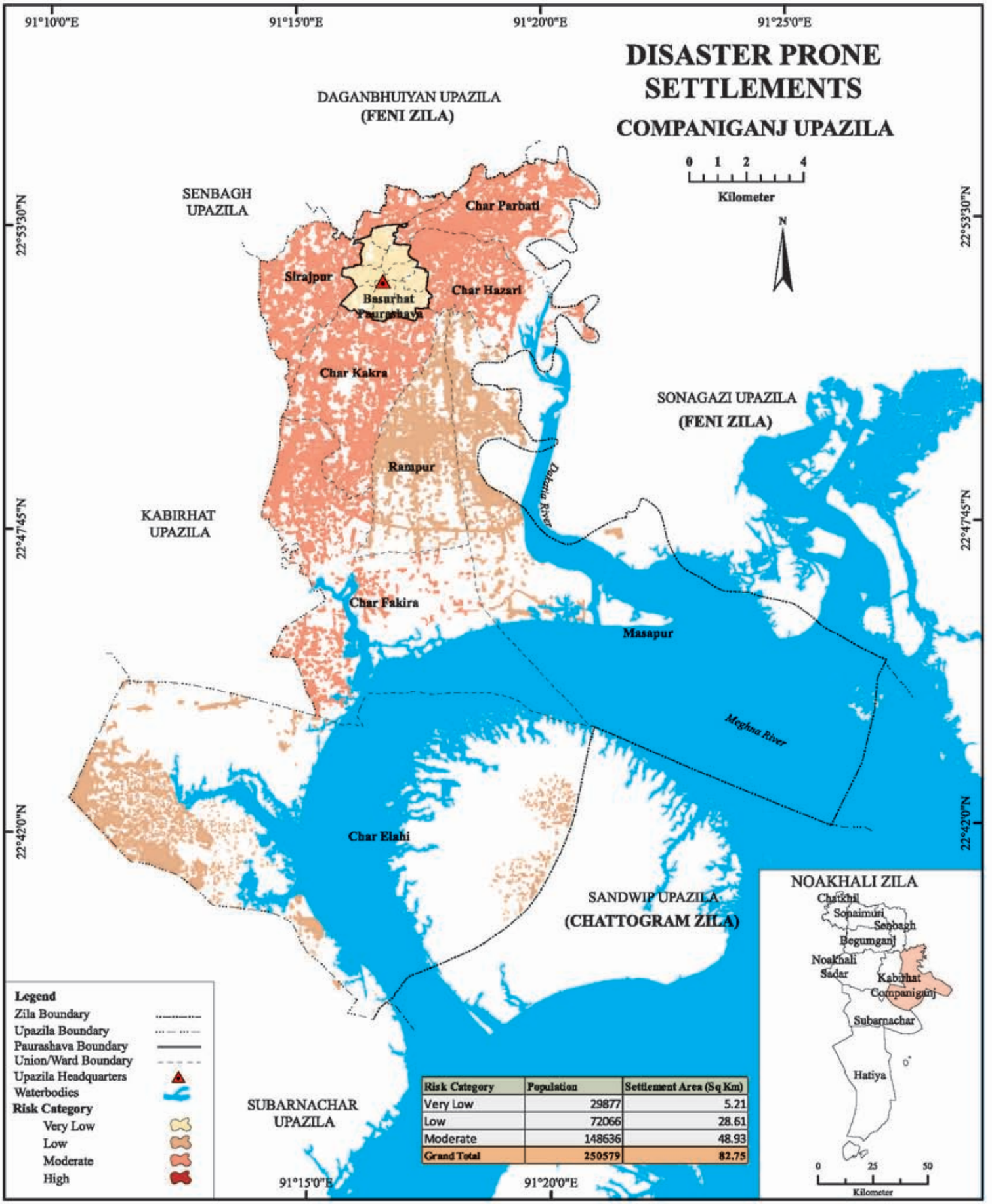
Risk Category	Population	Settlement Area (Sq Km)
Very Low	33395	9.98
Low	258270	57.52
Moderate	230867	68.75
High	26776	7.34
Grand Total	**549308**	**143.59**

Stat4Dev Project, 2020



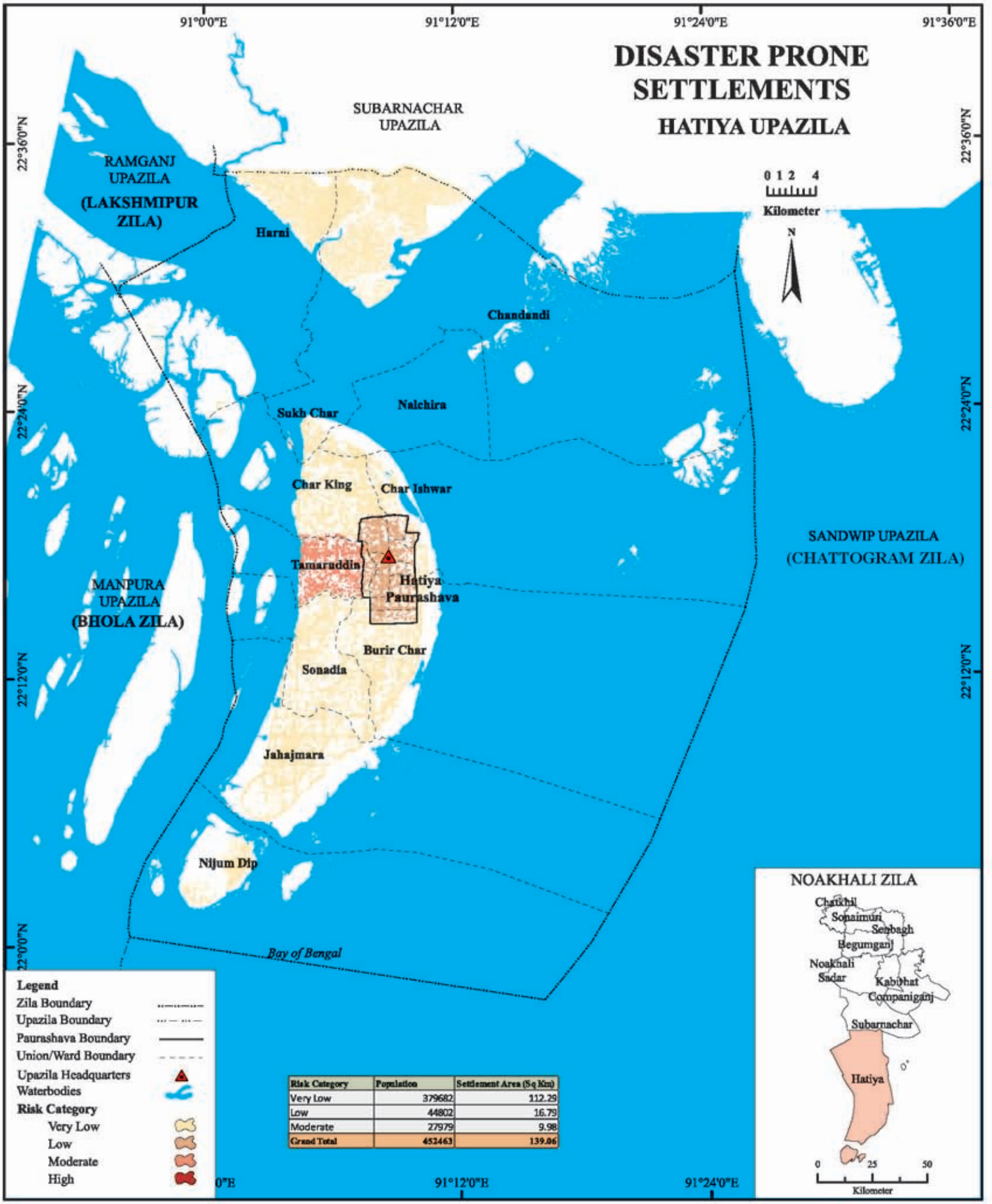
Risk Category	Population	Settlement Area (Sq Km)
Very Low	190106	67.42
Moderate	43147	12.98
Grand Total	233253	80.40

Stat4Dev Project, 2020



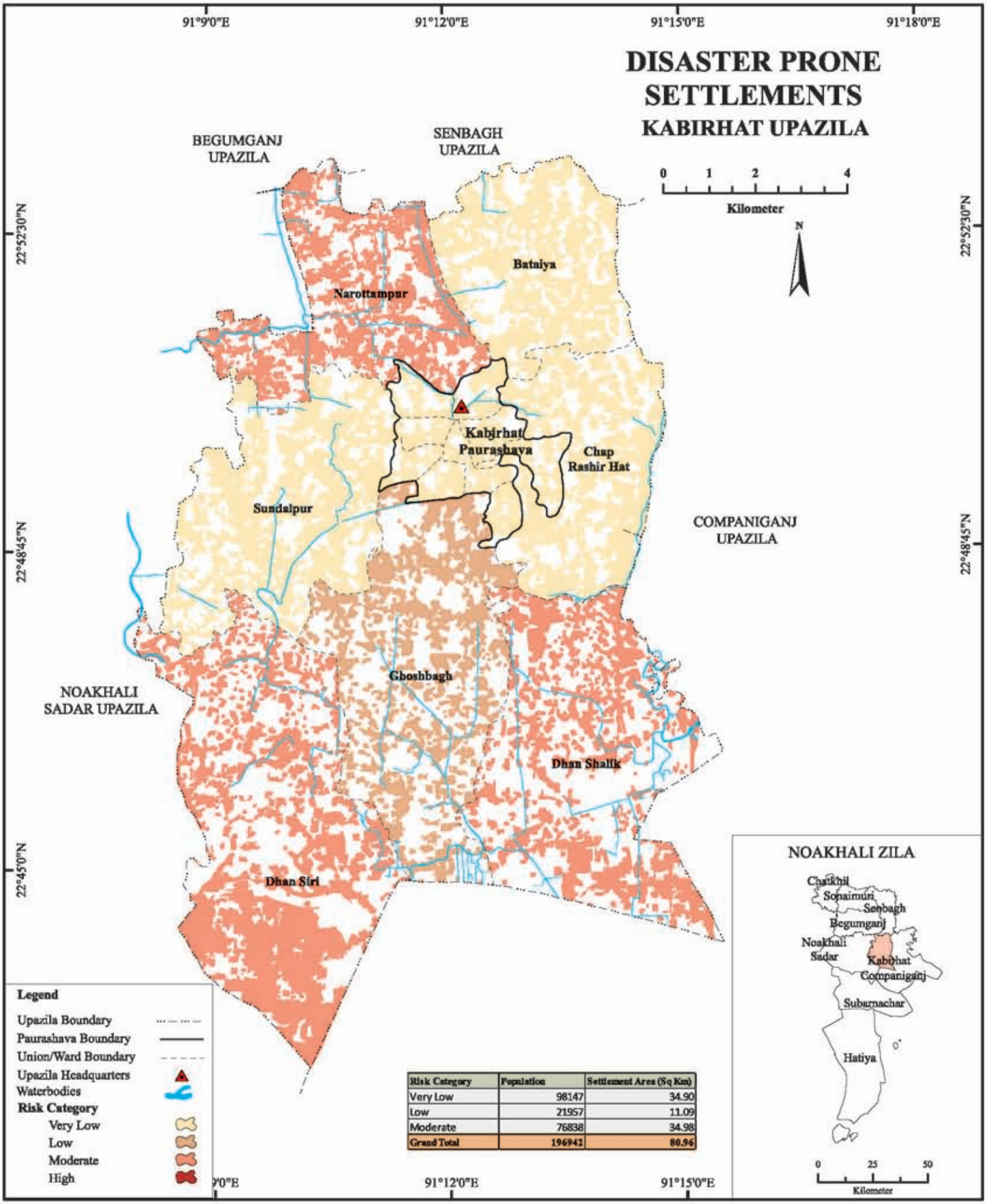
Risk Category	Population	Settlement Area (Sq Km)
Very Low	29877	5.21
Low	72066	28.61
Moderate	148636	48.93
Grand Total	**250579**	**82.75**

Stat4Dev Project, 2020



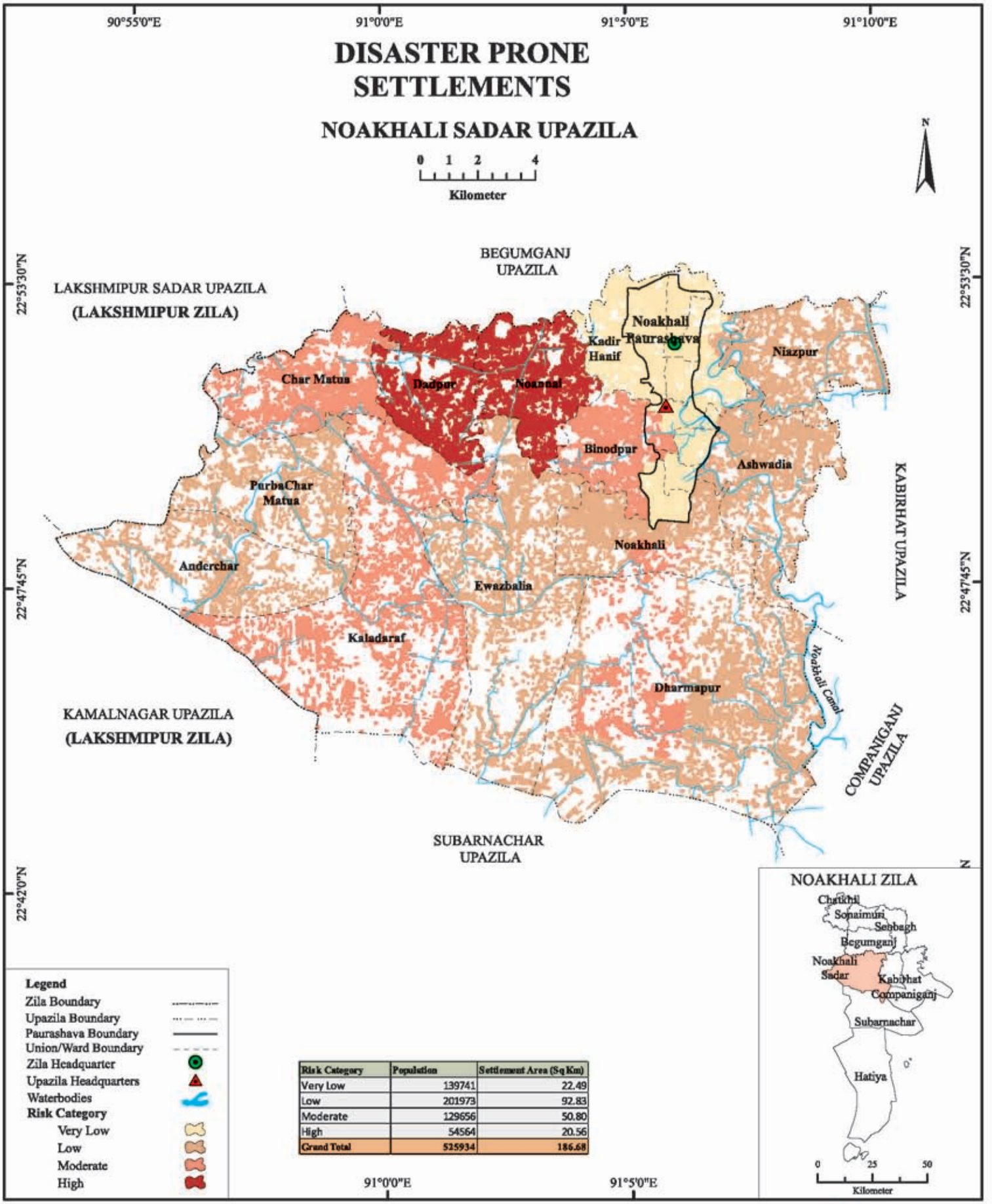
Risk Category	Population	Settlement Area (Sq Km)
Very Low	379682	112.29
Low	44802	16.79
Moderate	27979	9.98
Grand Total	452463	139.06

Stat4Dev Project, 2020



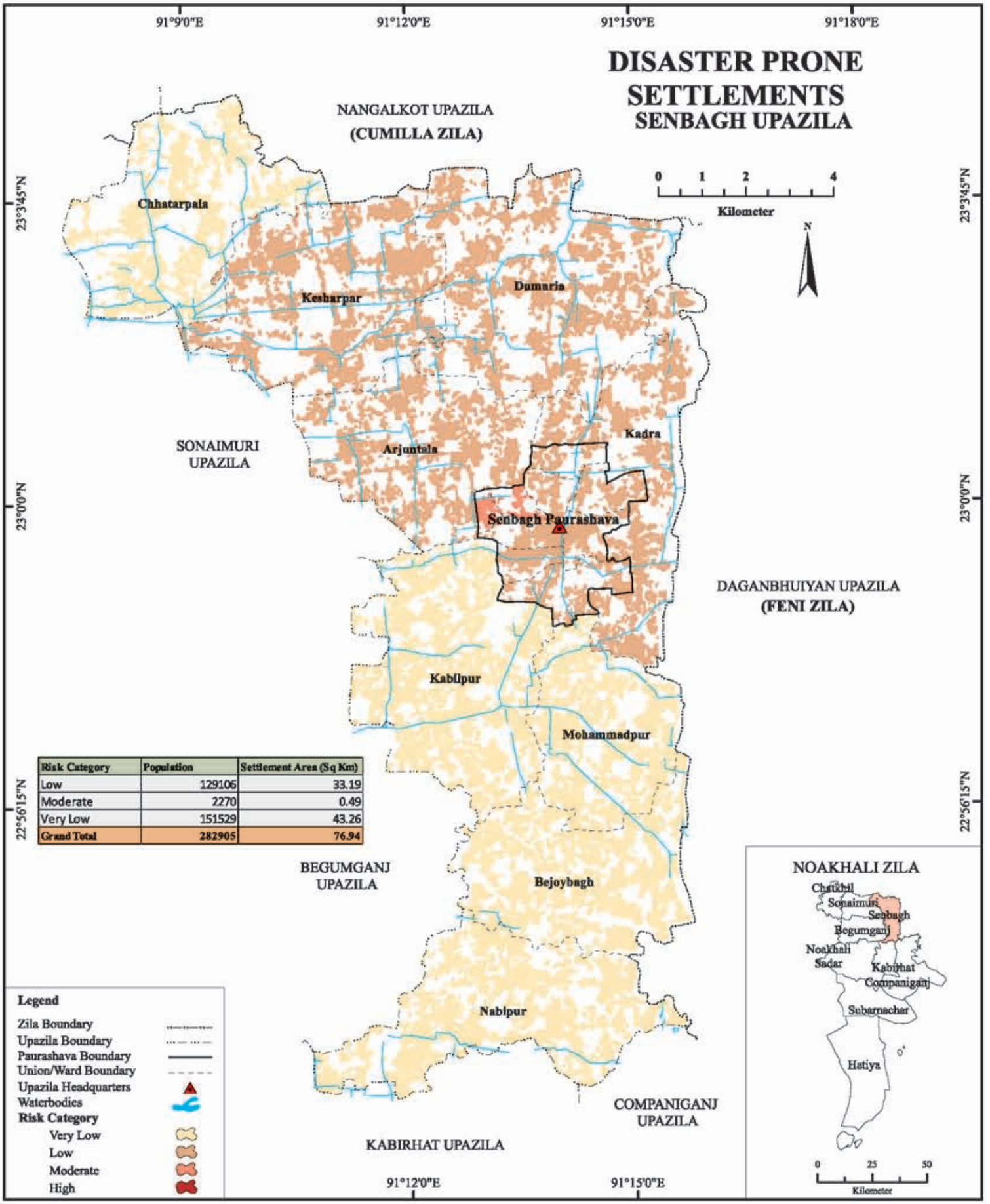
Risk Category	Population	Settlement Area (Sq Km)
Very Low	98147	34.90
Low	21957	11.09
Moderate	76838	34.98
Grand Total	196942	80.96

Stat4Dev Project, 2020



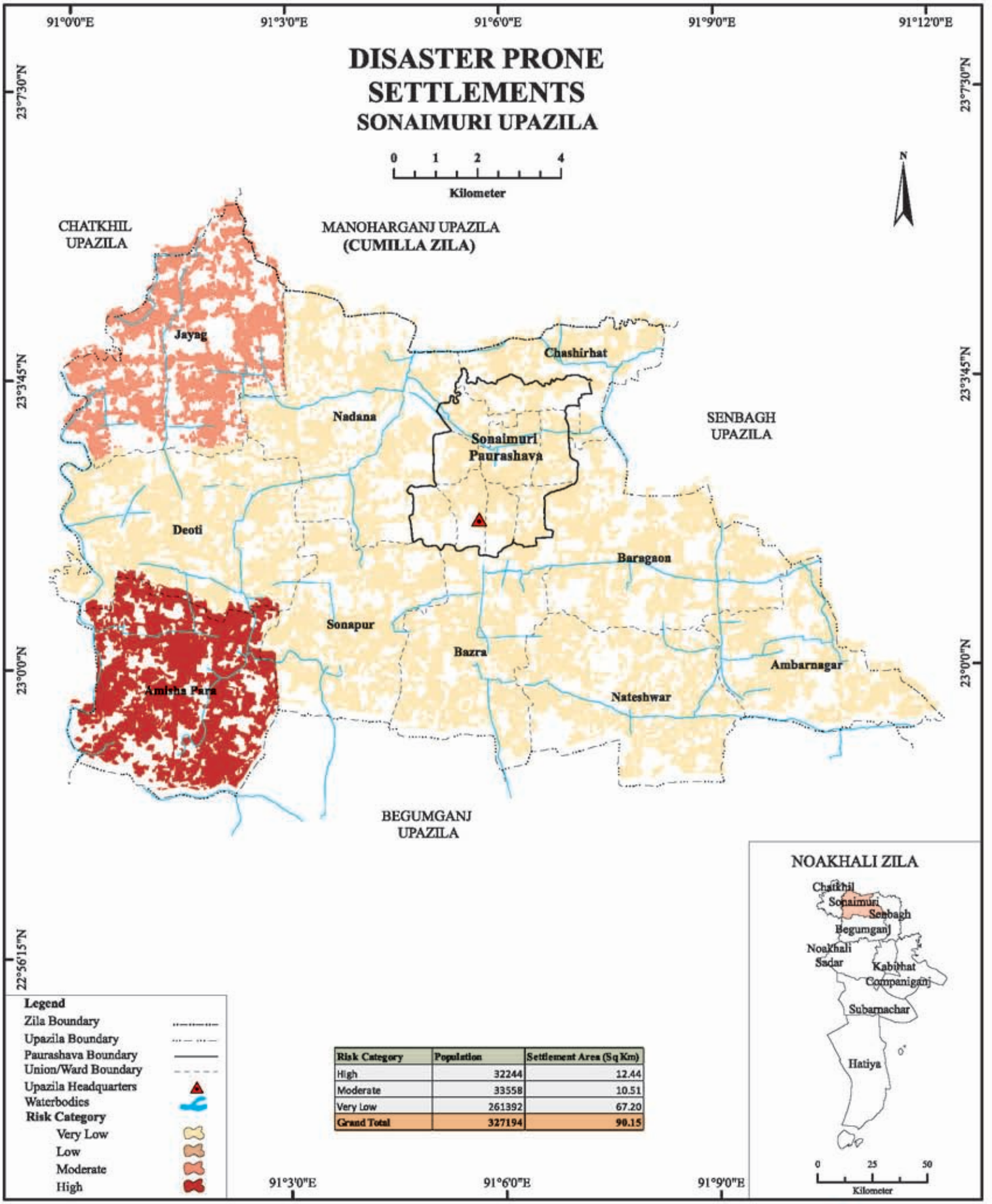
Risk Category	Population	Settlement Area (Sq Km)
Very Low	139741	22.49
Low	201973	92.83
Moderate	129656	50.80
High	54564	20.56
Grand Total	**525934**	**186.68**

Stat4Dev Project, 2020



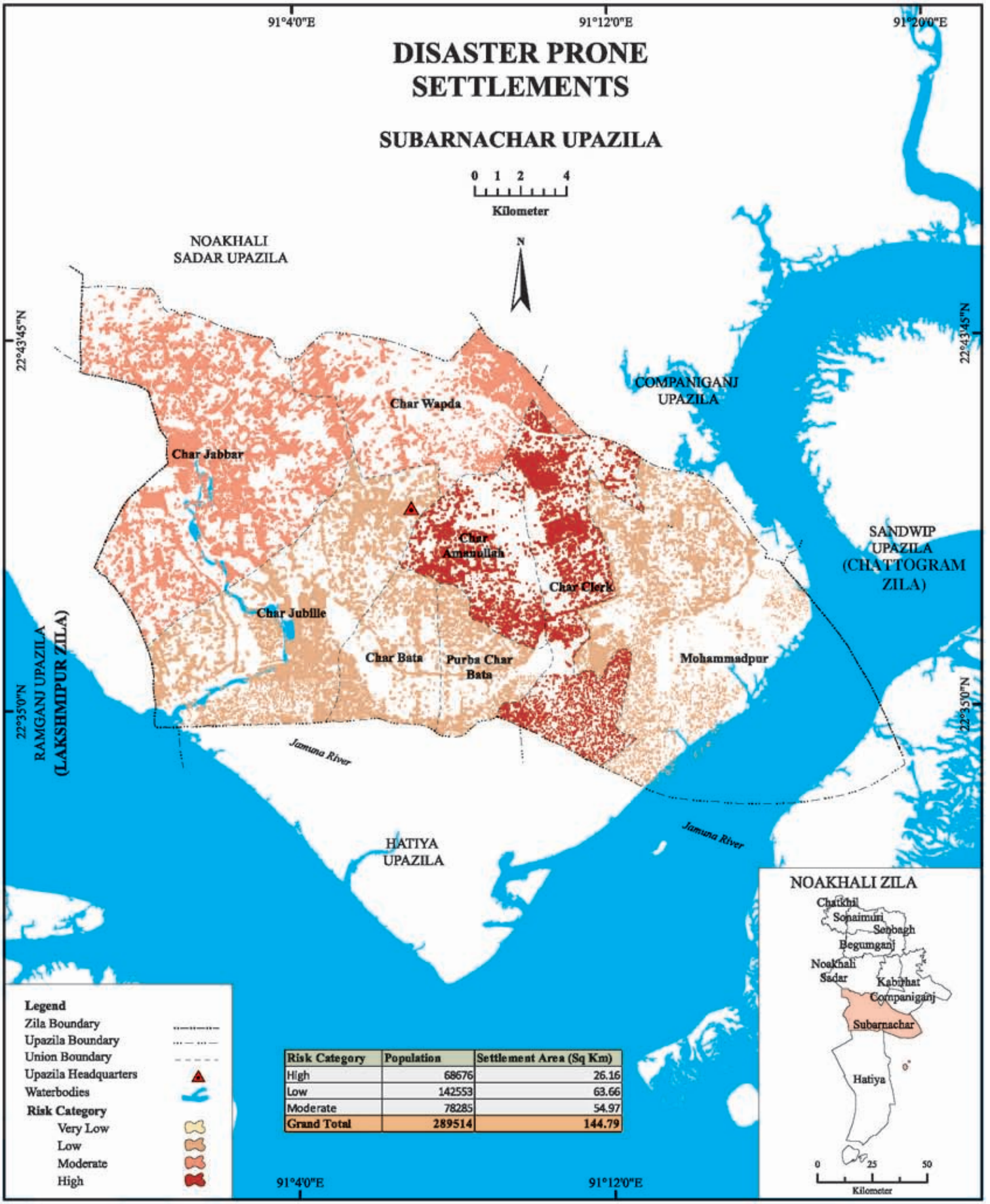
Risk Category	Population	Settlement Area (Sq Km)
Low	129106	33.19
Moderate	2270	0.49
Very Low	151529	43.26
Grand Total	**282905**	**76.94**

Stat4Dev Project, 2020



Risk Category	Population	Settlement Area (Sq Km)
High	32244	12.44
Moderate	33558	10.51
Very Low	261392	67.20
Grand Total	**327194**	**90.15**

Stat4Dev Project, 2020



Risk Category	Population	Settlement Area (Sq Km)
High	68676	26.16
Low	142553	63.66
Moderate	78285	54.97
Grand Total	**289514**	**144.79**

Stat4Dev Project, 2020

Appendix A

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁ, ঢাকা১২০৭

দুর্যোগ প্রবণ এলাকা এটলাস (Disaster Prone Area Atlas) তৈরির জন্য তথ্য সংগ্রহ ফরম

জেলার নামঃ কোডঃ ☐☐	সিটি কর্পোরেশনের নামঃ কোডঃ ☐☐	উপজেলার নামঃ কোডঃ ☐☐	পৌরসভার নামঃ কোডঃ ☐☐
ইউনিয়নের নামঃ কোডঃ ☐☐	ওয়ার্ডের নামঃ কোডঃ ☐☐	গ্রামের নামঃ কোডঃ ☐☐☐	মহল্লার নামঃ কোডঃ ☐☐☐

১. অবকাঠামো / স্থাপনার নামঃ			
২. অবকাঠামো / স্থাপনার অবস্থানঃ	অক্ষাংশ (Y):	দ্রাঘিমাংশ (X):	
৩. স্থাপনার প্রতিষ্ঠাকালঃ	☐☐☐☐	৪.স্থাপনাটি কত তলাবিশিষ্টঃ ☐☐ তলা	
৫. স্থাপনার ধরন (অবকাঠামো):	**(নিচের নোট অনুযায়ী লিখুন)	পাকা ☐1	.আধা পাকা ☐2
৬. মোট কামরার সংখ্যাঃ	☐☐	৭. মোট আয়তন (বর্গফুট): ☐☐☐☐☐ বর্গফুট	
৮. জেলার সংগে যোগাযোগের মাধ্যমঃ ৯. উপজেলার সংগে যোগাযোগের মাধ্যমঃ	ক. সড়কপথঃ কাঁচা / পাকা ..... কি.মি. ক. সড়কপথঃ কাঁচা / পাকা ..... কি.মি.	খ. জলপথ: ..... কি.মি. খ. জলপথ: .....কি.মি.	গ. রেলপথ: ..... কি.মি. গ. রেলপথ: ..... কি.মি.
১০. খোলা মাঠআছে কি?	হ্যাঁ ☐1 না ☐2	হ্যাঁ হলে,আয়তন (বর্গফুট): ☐☐☐☐☐☐ বর্গফুট	
১১.বিদ্যুৎসুবিধা আছে কি?	হ্যাঁ ☐1 না ☐2	১২. টেলিভিশন আছে কি? হ্যাঁ ☐1 না ☐2	
১৩. সংঘঠিত দুর্যোগের বিবরণঃ			

দূর্যোগের ধরণ (কোডসহ)	কারণ (কোডসহ)	সময়কাল (কোডসহ) (কোন মাসে)	উৎস(কোডসহ) (প্রাকৃতিক/ মানবসৃষ্ট)	স্থায়িত্ব (দিন/মাস)	ব্যাপ্তি (মৌজা /গ্রামের নাম)	কত দিন পর পর সংঘঠিত হয়	গত ৫ বছরে কতবার সংঘঠিত হয়েছে

**** যে সমস্ত তথ্য সংগ্রহ করতে হবে:** 1. শিক্ষাপ্রতিষ্ঠান (প্রাথমিক /নিম্নমাধ্যমিক/উচ্চ মাধ্যমিক বিদ্যালয়, মাদ্রাসা, কলেজ/বিশ্ববিদ্যালয়) 2. সাইক্লোনসেল্টার 3.হাসপাতাল/ক্লিনিক 4.ব্যক্তি মালিকানাধীন বহুতল ভবন 5.বাস/রেলস্টেশন 6.হেলিপ্যাড 7. স্টিমার/লঞ্চঘাট 8. বিমানবন্দর

দুর্যোগ কালীন সময়ে লোকজনদের আশ্রয়স্থল, অসুস্থ লোকজনদের জরুরি চিকিৎসার জন্য ফিল্ড হাসপাতাল স্থাপনের জায়গা, জরুরী ত্রাণ সহায়তা প্রদান ইত্যাদির জন্য অবকাঠামোর নাম, দুর্যোগকালীন সহায়তা, উদ্ধার ইত্যাদির জন্য যোগাযোগ ব্যবস্থার পূর্ণাঙ্গ বর্ণনা ম্যাপে প্রদর্শন এবং প্রদত্ত ফরমে সঠিক তথ্য সংগ্রহ করা আবশ্যক। জিপিএস রিডিংয়ের জন্য স্থাপনার নিকট গিয়ে রিডিং নিতে হবে।

তথ্য প্রদানকারীর নামঃ পিতার নামঃ মাতার নামঃ বয়সঃ পেশাঃ মোবাইল নম্বরঃ	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁ, ঢাকা১২০৭

Paurashava/Union Wise Disaster Calendar for Coastal Area of Bangladesh

জেলার নামঃ কোডঃ	সিটি কর্পো: নামঃ কোডঃ	উপজেলার নামঃ কোডঃ	পৌরসভার নামঃ কোডঃ	ইউনিয়নের নামঃ কোডঃ	ওয়ার্ডের নামঃ কোডঃ

DISASTER	Jan পৌষ/মাঘ	Feb মাঘ/ফাল্গুন	Mar ফাল্গুন/চৈত্র	Apr চৈত্র/বৈশাখ	May বৈশাখ/জ্যৈষ্ঠ	Jun জ্যৈষ্ঠ/আষাঢ়	Jul আষাঢ়/শ্রাবণ	Aug শ্রাবণ/ভাদ্র	Sep ভাদ্র/আশ্বিন	Oct আশ্বিন/কার্তিক	Nov কার্তিক/অগ্রহায়ণ	Dec অগ্রহায়ণ/পৌষ	RANK

তথ্য প্রদানকারীর নামঃ পিতার নামঃ মাতার নামঃ বয়সঃ পেশাঃ মোবাইল নম্বরঃ	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

Statistics for DEVELOPMENT

Strengthening Statistical Capacity of BBS for Collecting Data on Population and Development Project

Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning

Parishankhyan Bhaban (Level-9, Block-B)
E-27/A,Agargaon, Dhaka-1207
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