Digitization of Master Plan Map and Preparation of Different Thematic Maps of Gorakhpur City using Geospatial Techniques

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ABSTRACT- *The master plan map of any city is a blue print planning of spatial data based on large and comprehensive land use maps, planning and zoning standards. Master Plan Map is a tentative arrangement report which utilizes the current information or possibly past information for future projections. For better and effective use of Master Plan Map in digital environment it is required to be digitised using ArcGIS Software..*

Digitisation of Master plan map is done using high resolution google earth image as base map with GPS points as ground truth data. Digitization is done for easy handling, storing, transferring, manipulation, integration, updation and analysis of data. With the help of satellite image using Remote Sensing we can analyze the study area and with the help of GIS we prepare different thematic layers namely-Land use / Land cover, Surface Water body, Base/Transport Network, Slope, Contour. These vector layers are then converted into raster layer to produce different thematic maps.

Key Words: Master Plan, Digitisation, Thematic Map, Remote Sensing, GIS, Georeferencing, Urban Planning, Geospatial Technique.

1. INTRODUCTION

Digitization refers to the conversion of physical maps into digital form. It is performed through some kind of digital platform, typically a computer system with Graphical User Interface (GUI). In this paper ArcGIS software is used as digital environment. A thematic map is the representation of the spatial distribution of distinct data themes for the specific geographic areas. Thematic map is the representation of the data in such a way that gives greater understanding of the relationships between locations and the revelation of spatial patterns in the area that we are exploring. Remote sensing is understanding or sensing remotely that comprehends as getting information about the surface of Earth from a distance without actually being in contact with it. This process is basically done by sensing of energies reflected, emitted back from earth by processing, analyzing and applying the data for practical work. With the help of satellite image using Remote Sensing we can analyze the study area and with the help of GIS we prepare different thematic layers which are further converted into maps.

1.1 Research Objectives

The broad objective of this study is to prepare thematic maps of the study area.

The details of objective are as follows-

- Georeferencing/Digitisation of Master Plan map of study area.
- Preparation of Thematic Layers-Land use/Land cover map, Drainage map, Base /Transport map, Slope map, Contour map, Lithology map.

2. STUDY AREA

Gorakhpur is a city along the banks of the Rapti stream in the north-eastern piece of the Indian territory of Uttar Pradesh. It is close to the Nepal fringe, 273 kilometres east of the state capital Lucknow. It is the regulatory base camp of Gorakhpur locale and Gorakhpur division. The city is home to the Gorakhnath Math, a Gorakhnath sanctuary. The geographic directions of Gorakhpur city is 26.7606° N, 83.3732° E.
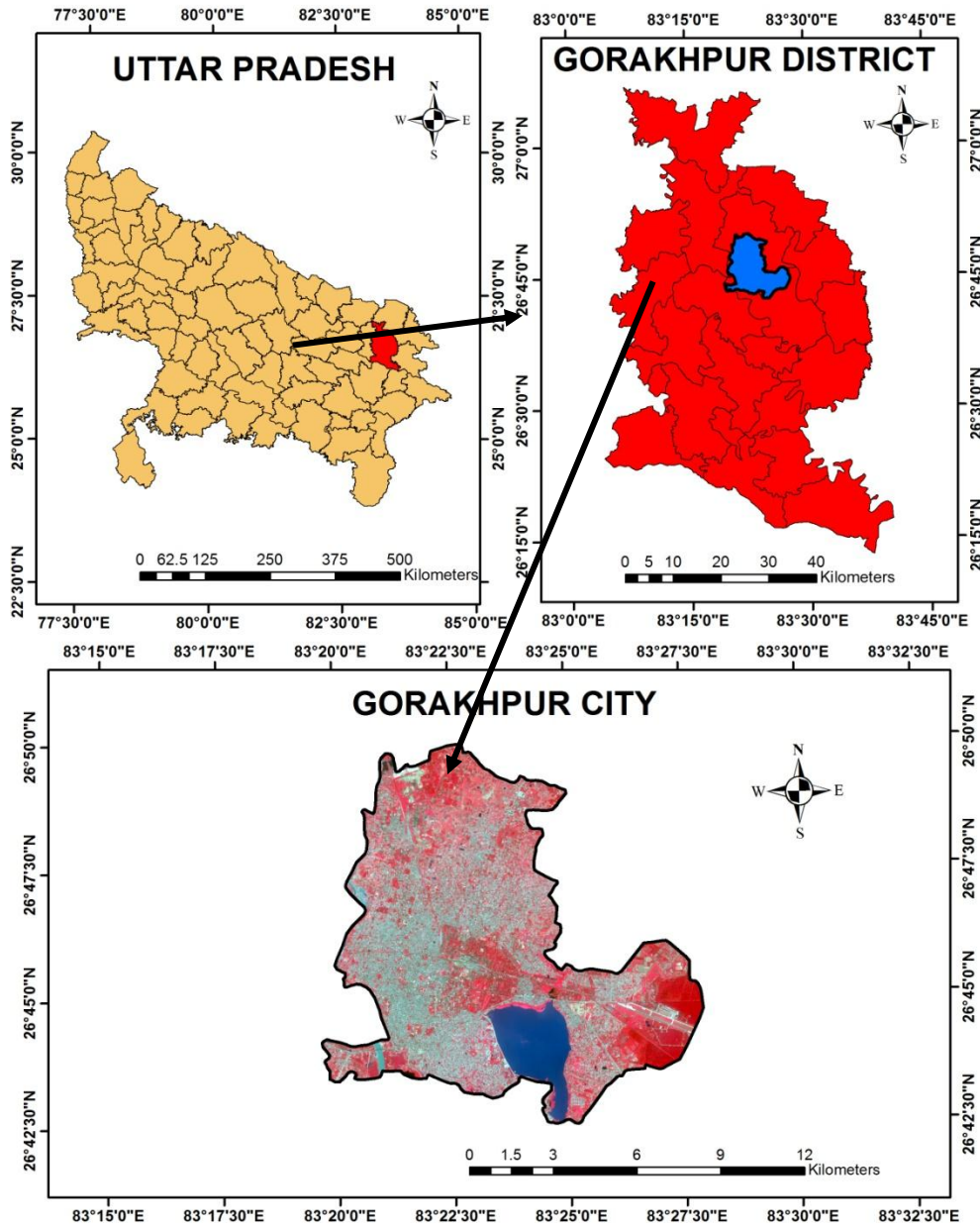
Fig-1: Study Area Location Map

3. DATA AND SOFTWARES USED

3.1 Data Used

- Sentinel 2B data is downloaded from United State Geological
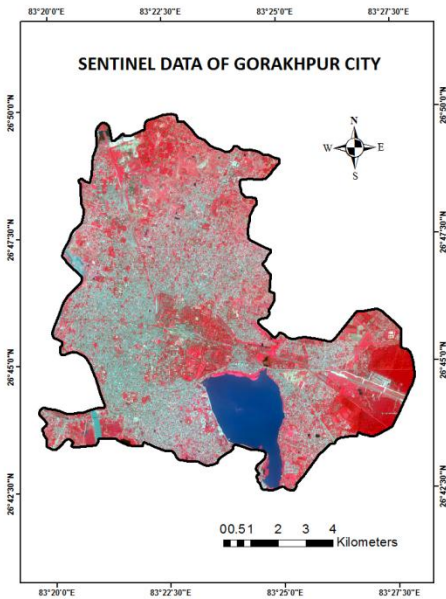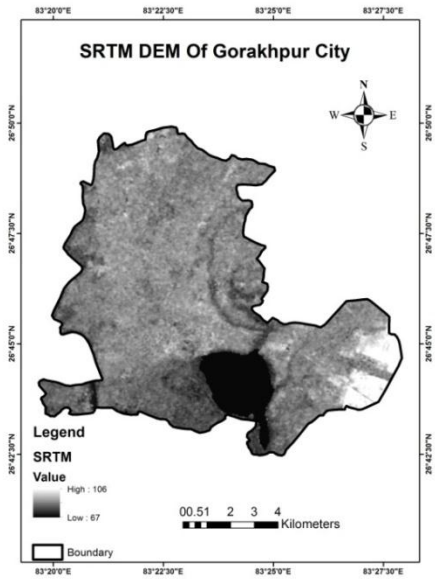- Survey website https://www.usgs.gov

Fig-2: Sentinel Data of Gorakhpur City

Fig-3: SRTM DEM of Gorakhpur City

- The SRTM data used in this study is downloaded from Open Topography website https://opentopography.org

- This Master Plan map is downloaded from official website of Gorakhpur Development Authority (GDA) https://www.gdagkp.org
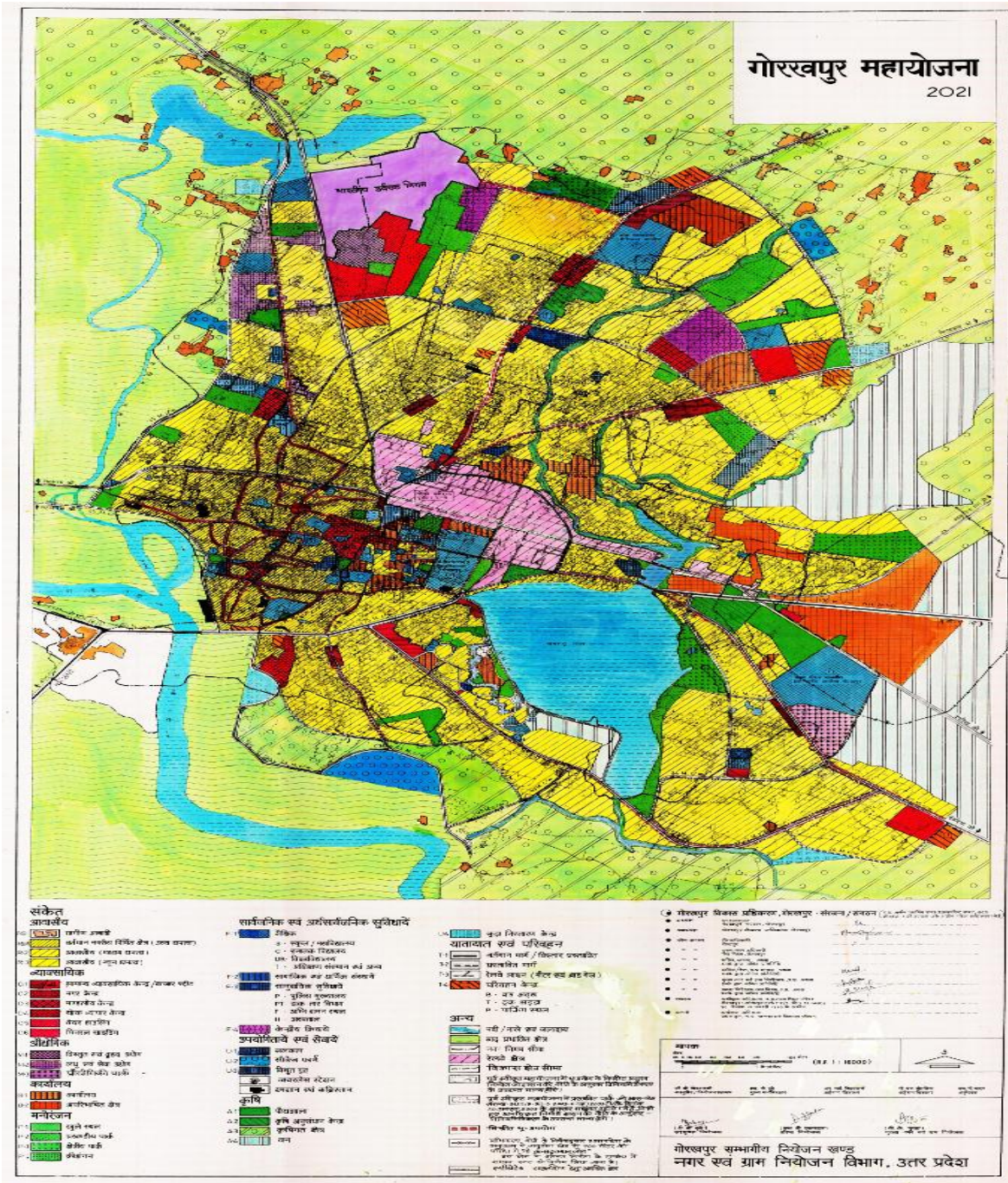
Fig-4: Master Plan map (2021) of Gorakhpur City

3.2 Software Used

- ❖ ArcGIS 10.2
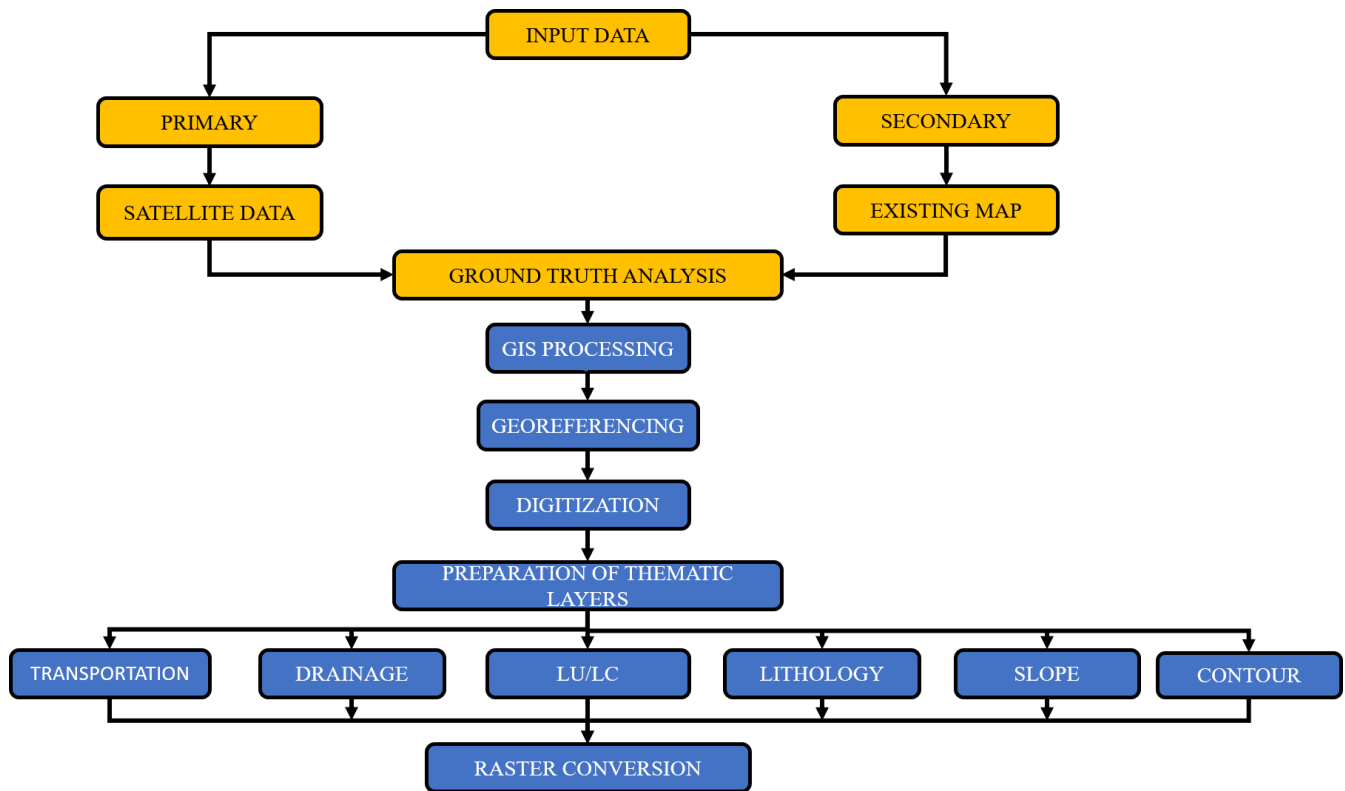- ❖ ArcHydro Tool
- ❖ ERDAS Imagine
- ❖ Microsoft Package

4. METHODOLOGY

Fig-5: Flow Chart for obtaining the Objective

4.1 Georeferencing and Digitization of Master Plan Map

The Master Plan Map of the study area is georeferenced using ArcGIS 10.2 Software with Google Earth Image as base map. After the georeferencing of Master Plan Map it is digitised using the same platform to create vector layer and the output is saved in raster format.
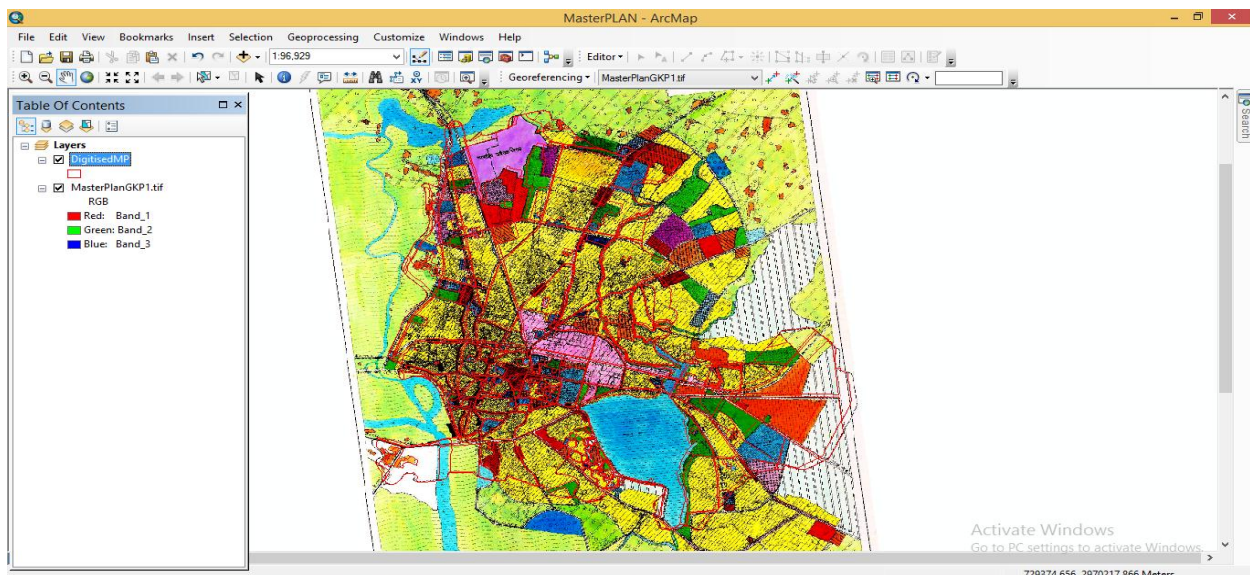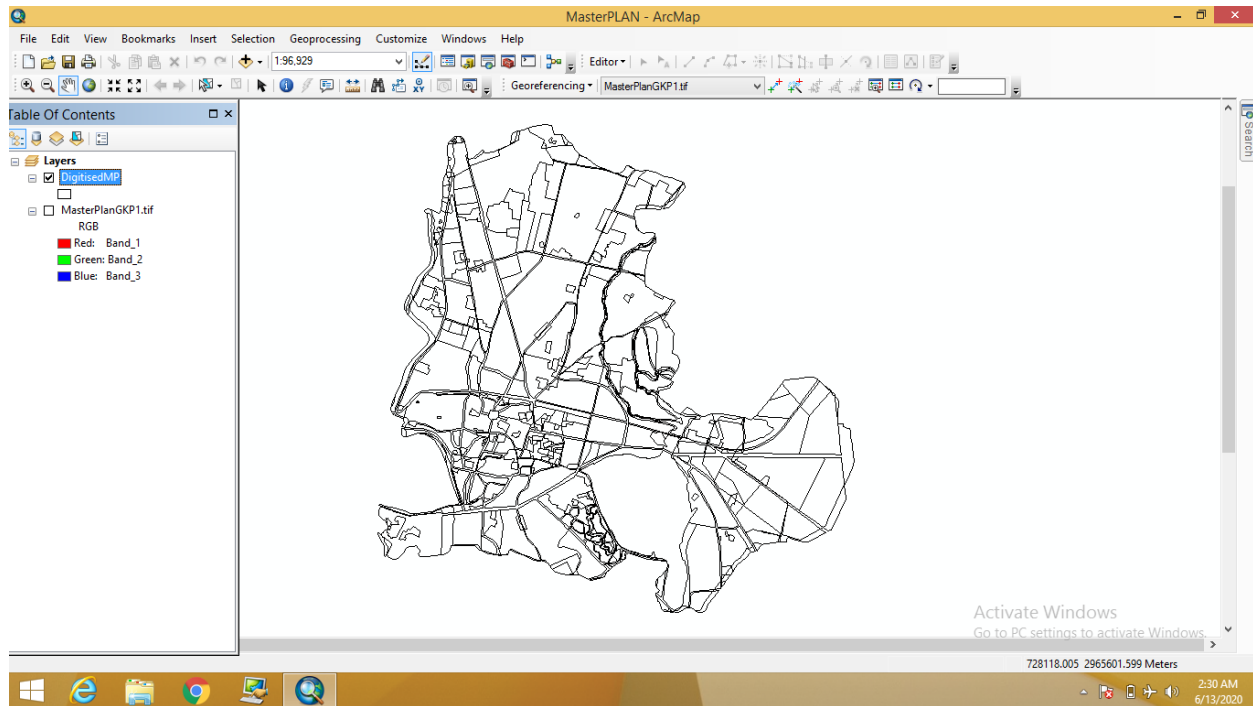
4.2 Preparation of Thematic Layers

Thematic maps viz. Base/Transport Map, Drainage, Land Use/Land Cover, Lithology , Contour, Slope have been prepared for the study area using Remote Sensing data ,Geospatial techniques. These thematic maps prepared using SENTINEL satellite data, SRTM-DEM, Google Earth Image and other secondary data. Arc GIS software is used during the whole course of work.

Base/Transport Network Map

Base Map of the study area includes Transportation layer i.e. Road & Rail Network. Base Map is prepared using high resolution imagery Google Earth Data and Sentinel Data. Figure 5 shows the base map of Gorakhpur City.

Drainage Map

Drainage Network map has been prepared from Digital Elevation Model (DEM) using ArcHydro Tool in ArcGIS. For the purpose of extracting drainage network Terrain Processing and Spatial Analyst Tools are used. Drainage map is shown in Figure 6.

Land Use/Land Cover Map

Land Use/Land Cover map is prepared using Google Earth image as base map through ArcGIS online. LULC map (Figure 7) contains geographical and man made features such as built up area, agriculture area, forest, waterbody, waste land and wetlands.

Lithology

Lithology refers to geochemical, physical and mineralogical behaviour of rocks. Lithology map of the study area has been prepared by digitising geological map (1:250000) of India obtained from Geological Survey of India (GSI). Figure 8 shows lithology map.

Slope Map

Slope is the measure of steepness or the degree of inclination of the feature relative to the horizontal plain. Slope map has been prepared from contour lines in a topographic map. It is represented by percentage, an angle or a ratio. In ArcGIS slope is extracted from contour lines using spatial analyst tools. Slope map is shown in Figure 9.

Contour Map

Contour is defined as the hypothetical lines obtained from connecting points of equal elevation. In cartography, contour map is prepared using DEM data through interpolation with the help of spatial analyst tools. Figure 10 shows contour map of Gorakhpur city.
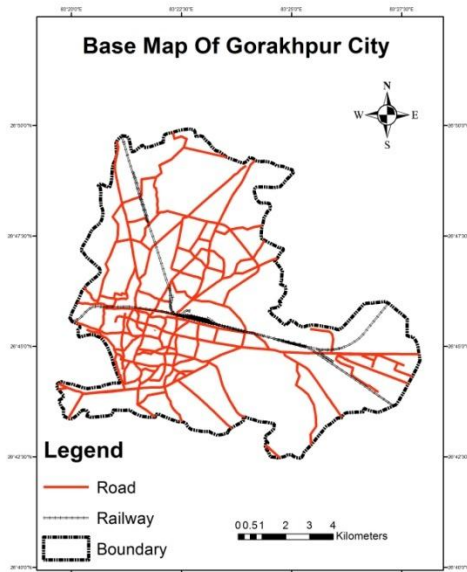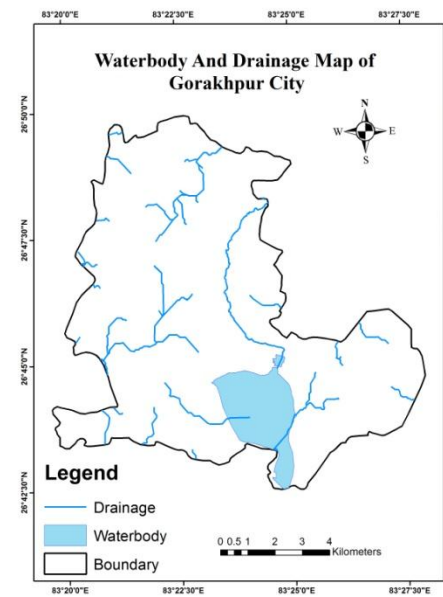
5. RESULTS

Fig-5: Base Map of Gorakhpur City

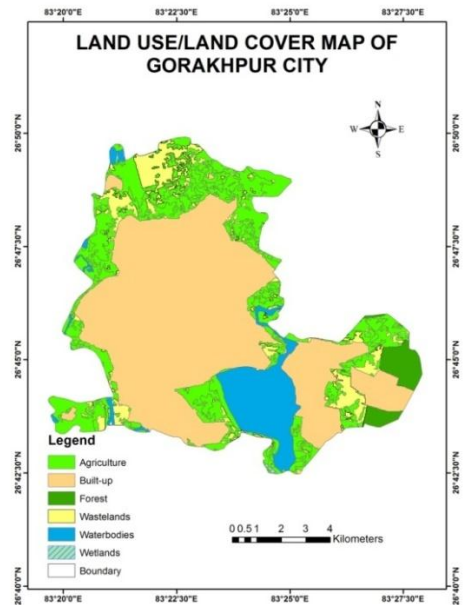**Fig-7:** LU/LC Map of Gorakhpur City

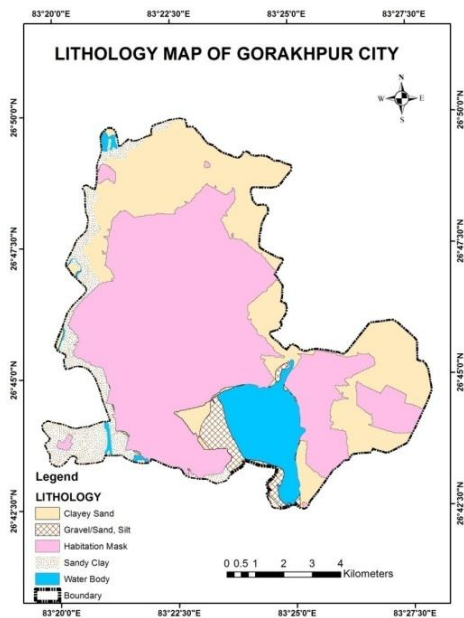**Fig-6:** Drainage Network Map of Gorakhpur City

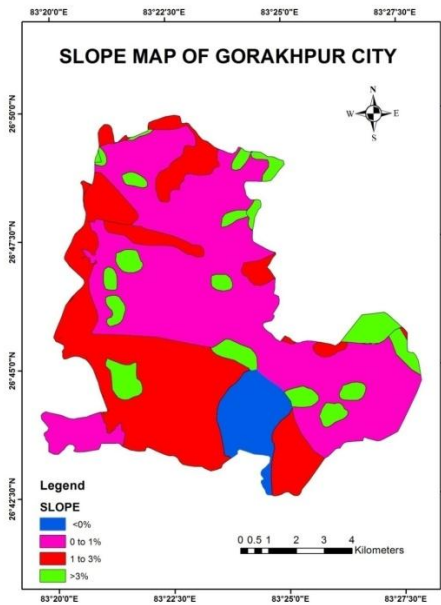**Fig-8:** Lithology Map of Gorakhpur City

Fig-9: Slope Map of Gorakhpur City
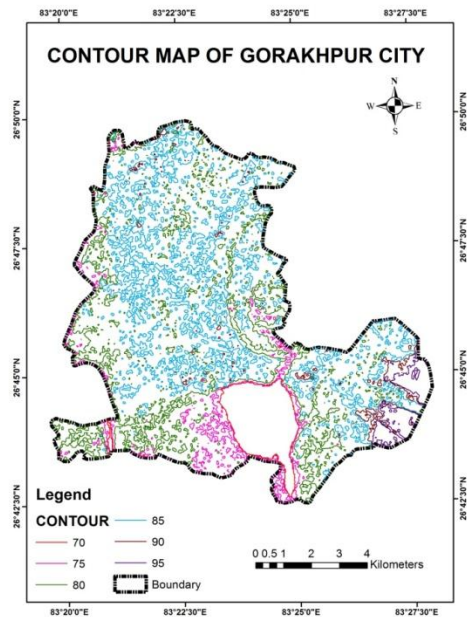

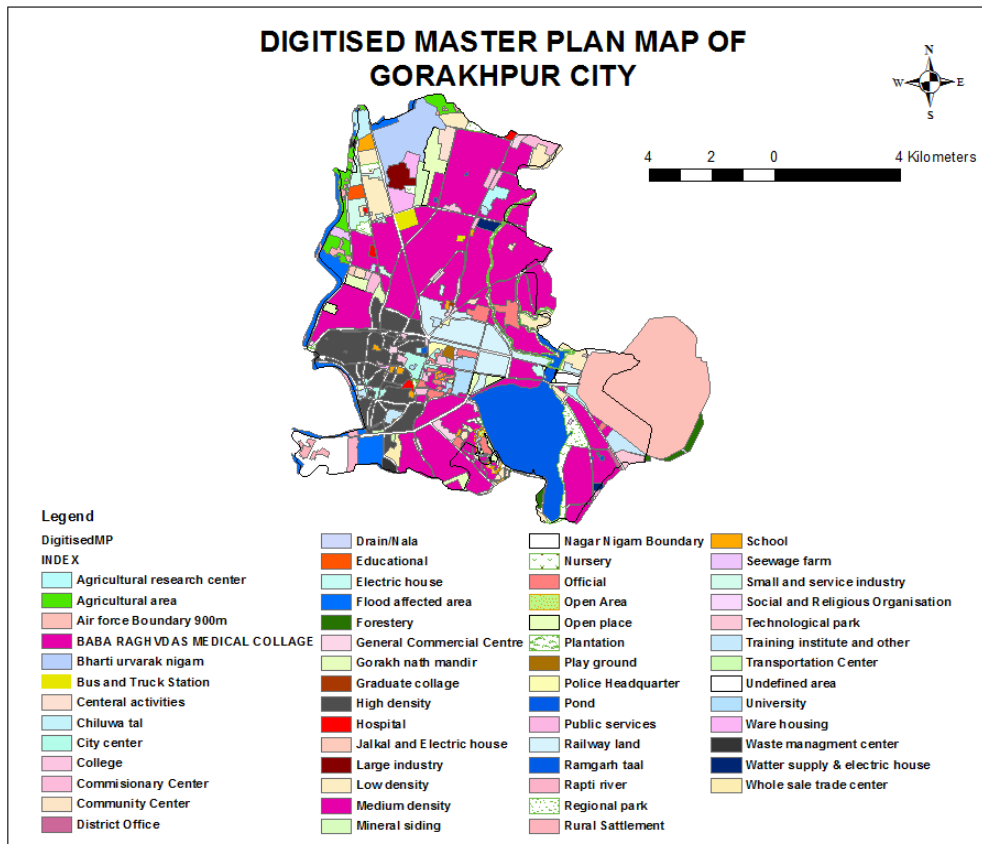**Fig-10:** Contour Map of Gorakhpur City

Fig-11: Digitised Master Plan Map of Gorakhpur City

6. CONCLUSION

The master plan map of Gorakhpur city has been georeferenced & digitised and various thematic maps eg. Base map, Drainage map, Land Use/Land Cover map, Lithology map, Slope map and Contour map. These maps can be stored and utilised for the various purposes in future. These maps can also be integrated to obtain a comprehensive result that can be further used in different areas for example urban planning, water resources application, soil analysis etc.

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